City of Tacoma

Right-of-Way Design Manual

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Prepared by
City of Tacoma

DEFINITIONS

Billable Work Order – funding to be provided by a Permittee for Work for which a Permit is required under Tacoma Municipal Code 10.22.080 to cover the City's actual costs, including, but not limited to, design review and approval, administration, and inspection of the privately designed plans for the construction of City-owned infrastructure in the public Right-of-Way.

Record Drawings – drawings based upon as-built conditions of all construction items.

City Engineer – the City of Tacoma City Engineer or their duly authorized representative. The City Engineer ensures all City projects comply with engineering standards.

Common Utility Trench – also known as a joint utility trench is a single trench where multiple utilities are installed.

Contractor – a contractor licensed and bonded in the City of Tacoma.

Cul-de-sac – a residential street characterized by a single ingress and egress.

Curb Ramp – an acceptable access ramp for the transition from the sidewalk to the street surface conforming to the current Americans with Disability Act (ADA) standards.

Development Conditions – the requirements for development of a site set forth by the City of Tacoma.

Easement – legal right to use a described piece of land for a particular purpose. It does not include fee ownership, but may restrict the owner's use of the land.

Erosion – the wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. Also, detachment and movement of soil or rock fragments by water, wind, ice, or gravity.

Excavation – the mechanical removal of earth material.

Frontage Improvements – includes, but not limited to, the construction of street, sidewalk, curb and gutter, landscaping, street trees, and wastewater or stormwater facilities on all adjacent City of Tacoma right-of-way.

Fill – a deposit of earth material placed by artificial means.

Grading – any excavating or filling or combination thereof.

Green Stormwater Infrastructure - A set of distributed stormwater best management practices that seek to mimic natural systems and deliver multiple community benefits in addition to stormwater management. Green stormwater infrastructure can be used at a wide range of landscape scales in place of more traditional stormwater control elements to support the principles of Low Impact Development.

Improvement – Streets (with or without curbs or gutters), sidewalks, crosswalks, parking lots, water mains, wastewater and storm sewers, stormwater facilities, street trees and other appropriate items.

Land Use Action – action taken by the City of Tacoma when a variance, special use permit, rezone, plat, etc. is requested by the applicant typically resulting in a set of conditions for approval.

Land Use Administrator – the City of Tacoma Land Use Administrator or their duly authorized representative.

Low Impact Development (LID) – a stormwater and land use management strategy that strives to mimic predisturbance hydrologic processes of infiltration, filtration, storage, evaporation and transpiration by emphasizing conservation, use of onsite natural features, site planning, and distributed stormwater management practices that are integrated into a project design.

Performance Bond – a surety instrument in which the faithful performance of a contractor is guaranteed up to the face value of the bond.

Permit – a document issued by Planning and Development Services Division allowing construction as identified by said document in accordance with all applicable approved drawings and specifications.

Planting Strip – that portion of the street section between the sidewalk and the concrete curb and gutter. The dimension of the planter strip is defined from the face of curb to the front of walk.

Private Accessway – any access serving two or more lots located in a private easement, which is owned and maintained by a private owner, group of private owners or neighborhood association.

Project – the proposed action to construct improvements.

Deficiency List – a list developed at the time of substantial completion that itemizes all remaining work tasks that must be performed before a project reaches final acceptance.

Right-of-way – land reserved and secured to the public for the purpose of public improvements to the City of Tacoma infrastructure.

Wastewater Sewer, Public – those portions of the Municipal Sewer System which are designated by the Director to carry, treat, or dispose of wastewater not constituting storm or surface water permitted by or under Tacoma Municipal Code 12.08 to enter the Municipal Sewer System. Wastewater sewers are also referred to and have the same definition as sanitary sewers.

Side Sewer, private – the sewage conveyance pipe owned by the property owner that extends from approximately two feet outside of a building or structure to the connection point at the public sanitary sewer main. In most circumstances, a portion of the private side sewer extends into public streets or alleys connecting to the public sewer main.

Street – an arterial or residential street located in public right-of-way owned and maintained by the City of Tacoma.

Streetlighting – illumination of the traveled way designed and constructed in accordance with current Illuminating Engineering Society of North America (IES) standards.

Surveyor – a professional land surveyor, licensed in the State of Washington.

ABBREVIATIONS / ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ADAAG	Americans with Disabilities Act Accessibility Guidelines
ANSI	American National Standards Institute
APWA	Washington State Chapter of the American Public Works Association
CAD	Computer Aided Drafting
City	City of Tacoma
CPTED	Crime Prevention through Environmental Design
CSTC	Crushed Surfacing Top Course
CSBC	Crushed Surfacing Base Course
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
GIS	Geographic Information Systems
GSI	Green Stormwater Infrastructure
HDPE	High Density Polyethylene
HMA	Hot Mix Asphalt
IBC	International Building Code
IFC	International Fire Code
IES	Illuminating Engineering Society
ITE	Institute of Transportation Engineers
LID	Local Improvement District
LID	Low Impact Development
Manual	City of Tacoma Right-of-Way Design Manual
MoMaP	Mobility Master Plan
MUTCD	Manual on Uniform Traffic Control Devices
PE	Professional Engineer
PLS	Professional Land Surveyor
PVC	Polyvinyl Chloride
NAD	North American Datum
NGVD	National Geodetic Vertical Datum
PROWAG	Public Rights-of-Way Guidelines
RCW	Revised Code of Washington
ROW	Right-of-way
SEPA	State Environmental Policy Act
Side Sewer Manual	City of Tacoma Side Sewer and Sanitary Sewer Availability Manual
SWMM	Stormwater Management Manual
SWPPP	Stormwater Pollution Prevention Plan
TMC	Tacoma Municipal Code
TPU	Tacoma Public Utilities
TRB	Transportation Research Board
UFM	Urban Forest Manual
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation

CHAPTER 1
INTRODUCTION AND GENERAL REQUIREMENTS

INTRODUCTION

The City of Tacoma (City) Right-of-Way Design Manual (Manual) shall apply to the construction of all street and right-of-way (ROW) improvements including stormwater and wastewater construction, streetlighting, traffic signalization, landscaping, ADA requirements, and channelization. The Manual provides the minimum technical standards required to construct improvements within the City ROW. This Manual is designed to be used in conjunction with other local, state, and federal rules, regulations, and design guidance as applicable to a given project. See Appendix G for a list of the most commonly referenced additional documents that will be necessary for design within the ROW.

Tacoma Municipal Code Section 10.22 provides the authority to require that this Manual be required for certain projects.

The City has developed this Manual to outline design criteria for City-owned streets and utilities as well as private access ways. The minimum technical standards described in this Manual help ensure public infrastructure that is effective, efficient, economical, and sustainable. City staff, private developers, and any other entity proposing construction within the public ROW or proposing construction of City-owned facilities shall use this Manual. Deviations from the standards within this Manual shall be based upon sound engineering practices and shall be reviewed and approved by appropriate City staff.

This Manual should be used by the engineer as a tool prior to submitting plans for review. It should be considered a "living document" and is subject to updates and revisions. The Manual and any updates are available at www.govme.org under City Information.

SECTION 1 Plans, References, and Specifications

1.1 References

References and portions of text from documents, ordinances, standards, and codes have been provided for convenience based on the current publication date of each reference. All references contained herein shall be superseded by the latest adopted or published respective reference.

1.2 Standard 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); the City of Tacoma General Special Provisions; general or site specific notes referenced on the plan set; other City design manuals or policies; or the project engineer's site specific edits.

The WSDOT Standard Specifications are available at:
http://www.wsdot.wa.gov/publications/manuals/m41-10.htm

The City of Tacoma General Special Provisions are available at:
www.cityoftacoma.org/government/city_departments/punlib_works/designmanual

Permeable pavement specifications are available at:
www.cityoftacoma.org/permeablepavement

1.3 Standard Plans

City Standard Plans are not included in this document as they are updated on an as needed basis. Applicants shall reference and use the most recent version of the City Standard Plans when applicable for the work proposed.

If a City Standard Plan does not exist, applicants shall use the most recent version of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of the APWA; standard plans contained in other City design manuals or policies; standard details shown on the plan set; or the project engineer's site specific details.

The City Standard Plans are available at:
http://www.govme.org/govME/EVault/Inter/StandardPlans/StandardPlans.aspx

The WSDOT Standard Plans are available at:
http://www.wsdot.wa.gov/Design/Standards

1.4 Project Plans

Prior to any construction within the ROW, the extension of any public utility, or construction of improvements that will be owned and/or operated by the City a complete plan set with associated technical reports shall be prepared by a professional engineer licensed in the State of Washington. Plans and reports shall be submitted to the City for review and approval. Improvements proposed by the public are required to obtain all appropriate City permits and may be required to obtain additional state, federal, or other local jurisdiction permits depending upon project scope. Plans and specifications submitted shall be in conformance with this Manual and other applicable City standards.

The applicant or City project engineer is responsible for identifying and complying with all applicable local, state and federal regulatory requirements.

The Governor's Office for Regulatory Innovation and Assistance website is a useful tool for determining additional permitting requirements that may apply to a project:
www.oria.wa.gov

The City permitting website is a good tool for determining additional regulations that may be imposed by other City departments: http://tacomapermits.org

2 CHAPTER 2
WORK ORDERS AND LOCAL IMPROVEMENT DISTRICTS

INTRODUCTION

This chapter of the Manual focuses on the City permitting process. An alternative to the permitting process is to form a Local Improvement District (LID). A description of the LID process can be found in Chapter 9.

Applicable Permits

A Right-of-Way (ROW) Construction Permit and a Site Development Permit are mechanisms used by the City for the review, approval, and inspection of privately designed plans for the construction of infrastructure, both private and City owned. City-owned infrastructure includes, but is not limited to, construction or repair of wastewater and stormwater sewers, paving, street lighting, traffic signalizations, and other traffic control devices and associated appurtenances. Privately owned infrastructure includes, but is not limited to, construction or repair of wastewater side sewers, stormwater systems, paving, private access ways (such as sidewalks and driveways) and associated appurtenances.

Division of Permitting

The City separates the construction of the facilities and infrastructure listed above into two separate categories: public improvements; and private improvements. In general, projects include a public and private improvement component; therefore, a Site Development Permit and a ROW Construction Permit will be required. See Tip Sheets for additional detailed information regarding applicable permits.

SECTION 1 Authority and Permits

1.1 Enforcement

The Director of Public Works, Director of Environmental Services, Director of Planning and Development Services or their designated agents are hereby authorized, and it shall be their duty, to enforce all the provisions of Tacoma Municipal Code. Such duties shall include, but are not be limited to, the approval of plans and specifications for all ROW Construction and Site Development Permits for the construction or alteration of any privately or publicly owned infrastructure.

1.2 Permit required

No person, firm or corporation shall grade, pave, level, alter, construct, repair, remove or excavate any pavement, sidewalk, crosswalk, curb, driveway, gutter, public wastewater or stormwater sewer, water main, conduit, fuel tank, vault, streetlight, traffic signal, or any other structure or improvement located over, under, or upon any street, public easement, alley or other public place; or place any structure, building materials, earth, gravel, rock, garbage, debris or any other material or thing tending to obstruct, damage, disturb or interfere with the free use thereof or any improvement situate therein; or cause a dangerous condition thereon, without first obtaining a permit in writing from the Director of Public Works, Director of Environmental Services, Director of Planning and Development Services or their designated agents to do so. (TMC 10.22.020)

Some of the work covered under this Manual may require multiple City permits, reviews, and approvals. Several types of permits and approvals require prior approval from the applicable City authority before a building or other permit can be issued. Any questions

regarding permits, approvals, and agreements shall be directed to Planning and Development Services (www.tacomapermits.org or 253-591-5030).

1.3 Provisions for permit

The person, firm or corporation to whom the permit is issued shall conform to the City's general specifications in effect at the time of issuance of permit and with additional conditions and provisions as may be prescribed by the Director of Public Works, Director of Environmental Services, Director of Planning and Development Services or their designated agents. (TMC 10.22.030)

SECTION 2 Initiation of a ROW Construction and Site Development Permit

A flowchart showing the Site Development Permit and the ROW Construction Permit process from the time of application, to the start of construction is provided at the end of this chapter.

2.1 Applying for a ROW Construction and Site Development Permit

To start the permitting process, an applicant shall provide the following to Planning and Development Services electronically through www.tacomapermits.org:

- A complete application. All correspondence will be sent to the individual listed as the contact person on the form.
- A detailed/engineering plan set as defined by Planning and Development Services Tip Sheets. This plan must be standalone and independently convey the scope of work without further explanation.
- A cost estimate for site work
- A copy of the conditions of improvement. This may be a Hearing Examiner's report, recorded plat, concomitant agreement, short plat report or recorded short plat, a letter from the City Site Development staff or a list of requirements placed on a commercial building permit application, as applicable.
- Payment of all applicable permit fees.
- Electronic copies of all required reports and associated documents, including, but not limited to Stormwater Site Plan, Stormwater Pollution Prevention Plan, and Geotechnical Report.

2.2 Descriptions of ROW Construction and Site Development Permits

The City reserves the right to designate the classification of the ROW Construction Permits.

2.2.1 Site Development Minor

The Site Development Minor Permit is intended to be used for a single family residential building lot. This permit will include all scopes of work for the building site including: grading, paving, other new impervious surfaces, stormwater and wastewater sewer facilities, and utilities. The Site Development Minor Permit is a fee based permit, and includes all review and inspections necessary to complete the project for both onsite and ROW. Depending on the scope of work, an engineered plan set may be necessary to obtain City approval. An engineered plan set is typically required if the offsite improvements require construction of

new curb and gutter or curb ramps. Additional services such as relocation of street lights will be an additional fee. A performance bond will be required for any ROW work valued over $15,000, as determined by the City.

2.2.2 Site Development Major

The Site Development Major Permit is intended to be used for all commercial, industrial, and plat site work. This permit will include all scopes of work for the building site including: grading, paving, other new impervious surfaces, stormwater and wastewater sewer facilities, and utilities. The Site Development Major Permit is a variable fee based or actual cost based permit depending on the scale/complexity of the project and established by the fee code. Engineered plans are required for all levels of the Site Development Major permit. As with the Site Development Minor Permit, all additional services shall be billed at an at cost basis. A performance bond will be required for all ROW work.

2.2.3 ROW Construction Permit

The ROW Construction Permit is intended to be used for all ROW work not associated with a new development or redevelopment project, or as a related permit to the Site Development Permit The cost for the ROW construction is based on the scope of work and may be a flat fee, or if deemed necessary by the City may be billed to the applicant at an at cost basis. Engineered plans may be required at the discretion of the Site Development Group. A performance bond will be required for all ROW work completed under a ROW Construction permit in conjunction with the Site Development Permit.

2.2.4 Bonding

The applicant may be required to post a bond, provide an assignment of funds or otherwise allocate funds for the construction of required improvements. City staff will work with the applicant to determine the appropriate bond amount for a given project. The bond amount must provide adequate funds for the City to administer the contract if necessary. City of Tacoma Tip Sheet G-220 provides additional information regarding performance bonds for work within the right of way.

(1) Performance Bonds for Plat Approval

When applying for final plat/short plat approval prior to constructing the required improvements, the City will require a performance bond for the construction of the remaining required improvements per TMC 13.04.090 or 13.04.100.

(2) Bonding for Previously Platted Property

Lots on previously platted property will require a bond for the required improvements prior to approval of the work order plans.

SECTION 3 The Review Process

3.1 Coaching or Intake Meeting

Prior to submitting the first set of plans, the applicant or project engineer may elect to schedule a Coaching or Intake meeting with City staff.

3.2 Plan Review and Resubmittals

Upon submittal, the plans will be reviewed for conformance with applicable city, 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.

3.3 Prior to Permit Approval

Upon first review, the applicant shall be informed if any additional forms are required including the in lieu of assessment release form, covenant and easement agreement and private property permanent or temporary easements as applicable. Prior to approval of the plans, the applicant must complete all applicable forms. During the course of project review, changes made by the applicant may affect which forms and easements are required. The applicant shall be informed of the need for additional items after the first review.

SECTION 4 The Approval Process

4.1 Approval of the Site Plan Set

Once the City has determined the plans are satisfactory, the City will request the engineer or applicant submit the plans with any final changes made for City approval.

4.2 Distribution of Plans

A reproducible set will be transmitted to the engineer or applicant with written direction as to the remaining permit and preconstruction process. In addition, a copy of the approved plans will be transmitted to the various utilities. If ROW work is included, the plans will be uploaded to the City website.

4.3 Revisions

Any change to the approved plans shall be submitted for approval to the City Site Development staff prior to implementation in the field. Some minor changes may be verbally approved in the field by the City Construction Inspector and the change in design noted on the record drawing plans submitted at the conclusion of the project.

In order to revise an approved plan, the engineer shall make the changes and identify the revision as such in the title block of an approved plan set. The revision number, description and date shall be identified within the revision block located in the title block.

SECTION 5 Contractor Responsibilities

5.1 Pre-Construction Meeting

Prior to permit issuance and the start of work, the applicant shall contact the City Site Development staff at (253) 591-5760 to coordinate and schedule a preconstruction meeting.

5.2 Obtaining a Permit for Construction

Upon approval of the plans and paying all permitting fees, and after the pre-construction meeting is held, a contractor satisfying the following criteria may use the approved plans to obtain the ROW Construction or Site Development Permit. The contractor shall:

- be licensed and bonded in the State of Washington;
- possess a City of Tacoma Business License;
- provide approved traffic control plans for street and pedestrian accessible routes;
- provide copy of notification to impacted properties letter; and
- Obtain a ROW Bond as outlined in Section 6.1.

5.3 Applicant Responsibilities

- List responsibilities of the Applicant
- Obtain a performance bond for the value of work.

SECTION 6 Bonding Requirements

6.1 ROW Bond

The contractor shall deliver to the City, prior to the issuance of the permit, a street obstruction bond in the sum of no less than $15,000, in a form to be approved by the City Attorney and with surety approved by the Director of Finance. (TMC 10.22.030-E)

6.2 Performance Bond

The applicant or contractor shall deliver a separate bond to the City, prior to the issuance of a ROW Construction permit, in the sum equal to the value of the work to be performed, but, in any event, not less than $15,000, in a form to be approved by the City Attorney and with surety approved by the Director of Finance.

SECTION 7 Construction and Inspection

If, in the judgment of the Director of Public Works, Director of Environmental Services, Director of Planning and Development Services or their designated agents, the nature of the work requires inspection and/or engineering on behalf of the City, during and/or after the completion of the work, designated Environmental Services staff may inspect and/or design or survey and establish reasonable charges in accordance with the average costs of like work. If the provisions of are not performed to the satisfaction of the Director of Public Works, Director of Environmental Services, Director of Planning and Development Services or their designated agents, then said Director of Public Works, Director of Environmental Services, Director of Planning and Development Services or their designated agents may cause the necessary work to be done to comply with the provisions of this chapter at the expense of the person doing such work. (TMC 10.22.060)

7.1 Work Authorized Under the Permit(s)

After the pre-construction meeting has been held and the applicable permit(s) has been issued, the contractor may begin construction. The contractor, developer, or their agents must have an approved set of plans onsite at all times during construction. Work outside of the scope dictated by the approved plan set will require a revision to the plan set or may be constructed under separate permit(s).

It is the responsibility of the permitee to ensure that all necessary inspections are called for in advance and approved by a City Construction Inspector.

All specific inspections, test measurements or actions required for all work and materials are set forth in other chapters of this Manual; the City Standard Plans; Work Order General Notes; WSDOT Standard Specifications for Road, Bridge, and Municipal Construction; and SWMM. Material and performance tests (i.e. compaction, compression tests for concrete, soil reports, etc.) shall be performed at no cost to the City.

Failure to comply with the provisions of this Manual or the approved plans may result in a stop work order, requirements for removal and replacement of unacceptable work, or other penalties as established by ordinance. This results in unnecessary cost overruns.

SECTION 8 Closure of the ROW Construction and Site Development Permit

8.1 Construction Deficiency List Items

Prior to final acceptance, the City's Construction Inspector shall provide the contractor with a construction deficiency list. The deficiency list will contain a complete list of required work to be performed to grant final acceptance.

8.2 Record Drawings

Prior to permit closure, record drawings shall be provided to the City Site Development staff. The criteria for creating the record drawings are outlined in the Record Drawing Criteria or the SWMM.

8.3 Permit Closeout

Upon completion, the City will initiate closure and will release any holds on assignment of funds or performance bonds. Conversely, if the account contains an outstanding balance, the City will bill the applicant for the funds necessary to cover the expenses already incurred by the City.

8.4 Permit Expiration

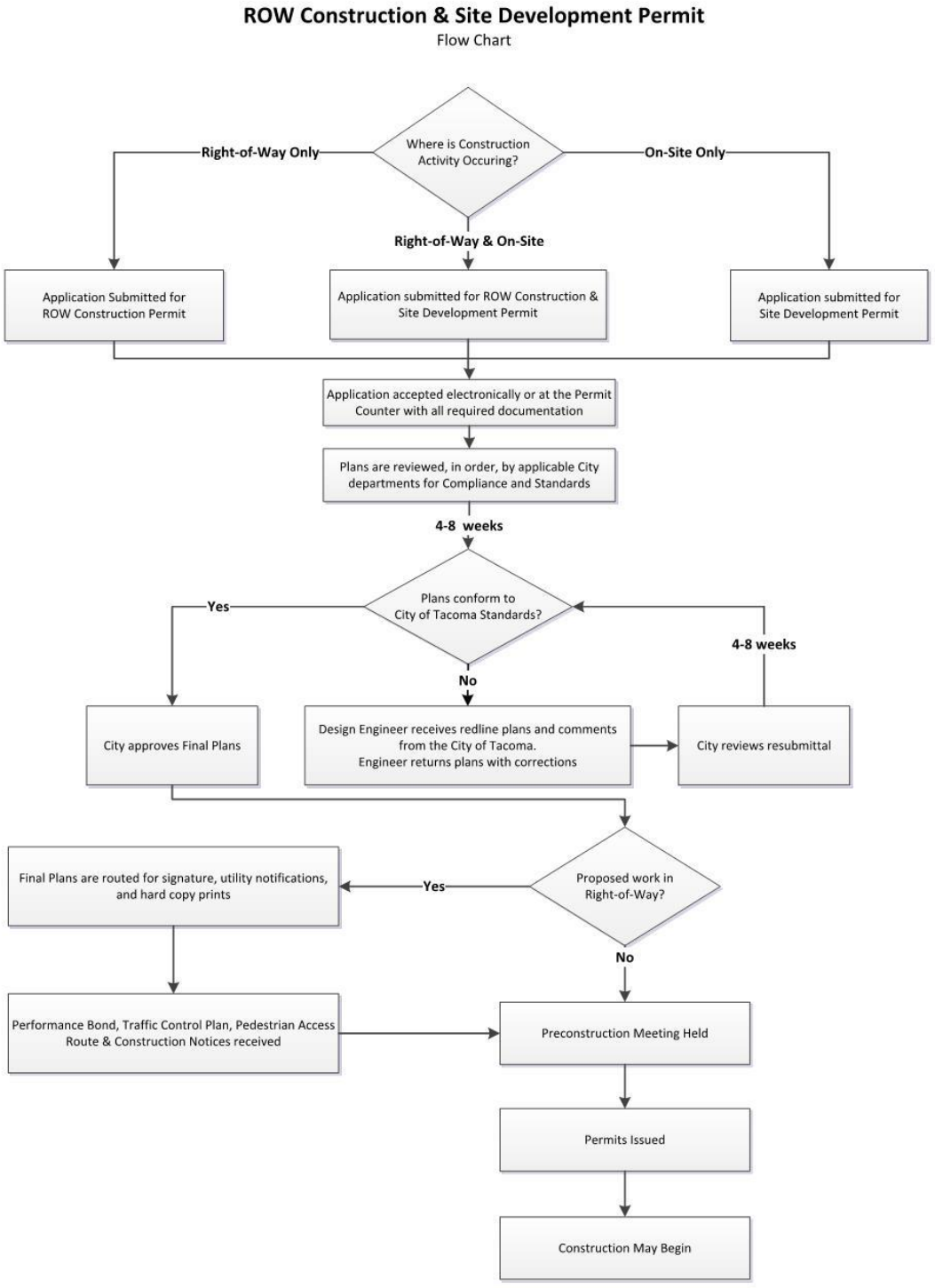
The City will consider a ROW construction project abandoned if 24 months of time has expired without any action. The ROW construction permit shall be closed and the account settled accordingly.

8.5 Miscellaneous Information

The following information may be found on the subsequent sheets:

- Flow Chart
- Planning and Development Services Tip Sheet

Figure 2-1: ROW Construction and Site Development Permit Flow Chart



SECTION 9 Local Improvement Districts

One alternative to the work order process is to form a Local Improvement District. There are benefits of using either the work order process or the Local Improvement District process to construct the improvements. The developer should carefully research both processes to determine the best solution for their situation. The following is a summary of the Local Improvement District process and provides answers to some common questions. Further questions surrounding the Local Improvement District process contact the LID Administrator in the Department of Public Works at (253) 591-5522.

9.1 Local Improvement District Definition

A Local Improvement District provides a process for public financing of public infrastructure projects where property owners share the cost of street and alley paving, wastewater sewer extensions, street lighting, water mains, sidewalks and/or underground wiring. Costs to the owners are deferred until the project is completed. A Local Improvement District requires support from 50% or more of the abutting properties willing to sign an advisory survey. Upon receipt by Public Works of a valid survey, the City will consider the formation of a Local Improvement District when the benefits from the improvements outweigh the total cost of the improvements. Each property owner pays an amount proportional to the benefits that they receive for each property they own.

9.2 Starting an Local Improvement District

An individual interested in a Local Improvement District should contact either the LID Administrator at (253) 591-5522 or an LID Representative at (252) 591-5338 and request an Local Improvement District advisory survey packet. City staff will prepare an estimate for the requested improvement(s) and provide a Local Improvement District packet which includes an advisory survey for circulation within the neighborhood. The requestor is responsible for circulating the advisory survey to gage support from the property owners within the proposed improvement area. Owners in favor of the proposed improvement would indicate their support by signing the advisory survey.

9.3 Advisory Survey

The advisory survey is a non-binding request to the City Council where property owners representing at least 50% of the properties within the proposed Local Improvement District show their support of the proposed improvement. Upon receipt of an adequate advisory survey, a public hearing is scheduled to verify the level of support.

9.4 Formation Hearing and the Initiation of Construction

The formation hearing allows property owners within the boundaries to ask questions about the proposed improvement and to question what impacts, if any, the proposed project would have to their property. Upon formation hearing completion the Hearing Examiner will issue a decision with a recommendation to the City Council. Generally if a majority of the property owners continue to support the project the City Council will create the Local Improvement District. After the City Council approves the formation, the City will commence with the design. Upon design completion, the City will award the project to a contractor, based on bids, and construction will commence. The actual construction of the improvements begins approximately 12 months after the organizer has returned the petition of support to the City.

9.5 Costs/Methods of Payment

The cost of a Local Improvement District is dependent upon the requested improvements. The cost estimate for the improvement prepared by the City and provided with the packet provides the cost per frontage foot. This estimate should be noted on the advisory survey.

Local Improvement Districts allow for payments for the improvements over a number of years with low-cost financing. After the contractor completes the work, the City will schedule a hearing before the Hearing Examiner for the purpose of confirming the final assessment(s) for each property. Following the hearing, the City Council will consider the recommendation of the Hearing Examiner, confirm the assessment and roll final project expenses through the adoption of an ordinance. Once the ordinance has been adopted, the City will invoice the property owners for their payment. The property owners may then utilize one of the following methods for payment:

1. Pay off the assessment in full during a 30-day interest-free window and receive a reduction in administrative fees and costs.
2. Pay off part of the assessment during the interest-free window and pay the balance owed over a defined number of years..

9.6 Financial Assistance

Financial assistance may be available for property owners on a fixed or limited income who occupy their residence. Owners qualifying for the program would have their base assessment paid for by the City. For further information on the Local Improvement District assistance program, contact Ralph Rodriguez at (253) 591-5522 or Michael Garrison at (252) 591-5338 of the Department of Public Works.

3 CHAPTER 3
SITE DEVELOPMENT PERMIT AND RIGHT-OF-WAY CONSTRUCTION PLAN FORMAT

INTRODUCTION

This chapter does not address design criteria and is strictly dedicated to provide the engineer with guidance and minimum requirements in the development of the construction plans. Design criteria can be found in other applicable chapters of this Manual.

Design criteria focusing on the construction of street improvements and related appurtenances can be found in Chapter 4. Criteria concerning the design of wastewater sewer systems and stormwater extensions and related appurtenances are located in Chapter 5.

The engineer should also reference the City's Site Development Permit and ROW Construction Sample Plan. The Sample Plan has been developed to provide the design engineer with a representative plan showing the depth of detail required for submitting a set of work order plans to the City for review. The sample work order plans are at the end of this chapter.

SECTION 1 General Requirements

The City standard template as described in this chapter shall be used for the plan format for all Site Development and ROW Construction permits that require an engineered plan set. This chapter is to be used in conjunction with the checklist provided in Appendix B as a guideline for the minimum acceptable standards by which a set of drawings shall be submitted. Under no circumstances should this chapter, the checklist, or this Manual substitute for good engineering practice.

SECTION 2 Plans for Site Development and ROW Construction Permits

The City's goal is to provide the contractor, inspector, and other various agencies with a stand-alone plan set. An individual should be able to locate and construct the designed improvements from the approved permit plan set. Therefore, all site specific notes and details shall be included on the plans.

2.1 Capital Delivery Projects

Typically, City of Tacoma capital delivery projects do not follow the Site Development and ROW Construction Permits process. Capital Delivery projects shall follow the permit process specific to the City Department that is responsible for the project.

SECTION 3 General Format

3.1 Sheet Size, Scale, and Basic Format

Sheet size shall be 22 inches by 34 inches. The plans shall be shown and labeled as a 1 inch to 20 feet horizontal scale and a 1 inch to 5 feet vertical scale unless otherwise approved prior to submittal. Architect's scale will not be accepted.

The plans shall contain a plan and profile view with the street names clearly labeled in both. The stationing in the plan view should line up with the stationing in the profile. Stationing shall be shown from left to right. Where a "match line" is required, it should be clearly identified on the plan and profile as such with the station noted and a reference to the sheet showing the continuation.

A vicinity map, together with a north designation arrow, shall be provided. The project shall be situated on the plan sheet such that north is either up or to the right. A legend shall be provided with all shading and symbols conforming to City standards.

3.2 Title Block

All plans shall bear a City standard title block; available on the City's govME website, www.govme.org. To access from the link listed above, click on document information, then click on standard plans. The title block must contain the signed and dated seal of the professional engineer. A revision block shall also be included to be used by the City only after a set of plans has been signed off by the City as approved.

3.3 Professional Land Surveyor (PLS) required

The design engineer shall submit Site Development and ROW Construction drawings based upon a preliminary survey prepared by a professional surveyor licensed in Washington State. Projects involving City streets and street infrastructure or projects involving City sewers shall consider the possibility of future extensions, which may require survey ahead of and beyond the project limits.

3.3.1 ROW Construction Permit Preliminary Survey

The preliminary survey for ROW Construction Permits shall be an accurate survey showing all existing topography which might be affected by the project work. They should include sufficient cross section elevations to prepare the drawings and provide sufficient information to the reviewing City engineer.

3.4 Monumentation and Horizontal Control

All existing structures and new improvements shall be tied into the City's monumentation system. There shall be stationing on the construction centerline and an offset to the monument line if the construction centerline is not coincident with the monument line. Horizontal control shall be tied to two monuments, including necessary bearings, and the stationing of all monuments. All monuments must be labeled with a description of the monument (i.e. "surface brass mon.", "mon. in case", etc.).

The City encourages that state plane coordinates identify at least one of the monuments. Where coordinates are provided, the plans shall identify the current City horizontal datum: North American Datum – 83/91.

New monuments to be constructed shall be shown and identified on the plans. The type and station of each monument shall be identified.

3.5 Vertical Control and Datum

All elevations shown on the drawings shall be on the current City vertical datum as described below. The plans shall identify the current City vertical datum: National Geodetic Vertical Datum – 1929.

A City benchmark must be used and a description of the benchmark shall be shown and labeled on the plans. A temporary benchmark may be shown on the plans in conjunction with an existing City benchmark. However, the engineer must verify that the temporary benchmark is on the correct datum.

3.6 Additional Items to be Identified

- All ROW, easements, and property lines shall be shown and labeled on the plans.
- All easements shall be dimensioned and labeled as public or private, and the purpose for the easement noted.
- All wetland boundaries and buffers in the project vicinity must be labeled on the plans.
- All existing improvements shall be shown and labeled on the plans including, but not limited to; surfacing, vegetation, access, utilities, walls, steps, existing and proposed building footprints, driveways, curb ramps, walkways, streetlights, and traffic control devices.
- All proposed improvements shall be shown, labeled, and dimensioned on the plans including, but not limited to; grading, paving, driveways, sidewalks, curb ramps, and drainage.
- The plans shall note when matching existing features and utilities.
- Include property addresses for all parcels shown on the plans.

3.7 Drawing Clutter

Providing plans with as much detail as possible is helpful to the City plan reviewer. When providing increasing drawing detail it should be accompanied by the appropriate use of line weight and font size. To make drawings easier to interpret the work order related construction items should be highlighted using heavier line weights and larger fonts. Non-work order related work should be de-emphasized by using lighter line weights and smaller fonts. Examples of non-work order related details include existing improvements, property lines, existing contour lines, existing and proposed private utilities.

SECTION 4 Street Plans

4.1 Plan View

The plan view shall clearly show the street work to be constructed under the ROW Construction Permit. Proposed and existing driveways shall be shown together with centerline stations and driveway widths.

All horizontal curve information shall be shown on the plan. The plan shall show and label the beginning and end point of the horizontal curve, point of intersection, length, radius, delta angle, and degree. All horizontal angle points shall also be identified.

Pavement tapers shown on the plan shall be identified by the beginning station and offset, the taper length, together with the ending station and offset.

4.2 Profile

The City no longer uses curb elevations on plans. Gutter (flowline) elevations shall be shown on the street, access way, and alley profiles. The existing centerline profile shall be shown and identified. In areas where the right and left gutter profiles diverge, the plan shall clearly identify each gutter profile. Flowline elevations may be broken at the end of the radius for the curb return at street intersections. Separate intersection detail

"go-rounds" are to be provided on the plans which show pavement elevations within intersections (see Section 6.3, Intersection Details). Street, alley, access way and sewer profiles should be shown using the standard "three view, plan and profile grid," available at the City's govME website, www.govme.org.

The profile view shall show and label each grade, vertical curve, point of vertical curvature, point of vertical intersection, point of vertical tangency (PVT), grade break, and top of curb/gutter elevations. The gutter elevations, left and right, should be spaced at 50 feet on straight grades and 25 feet through vertical and horizontal curves.

Where connecting to an existing grade, the profile of the existing pavement shall be shown a minimum of 50 feet beyond the limits of improvement. The existing profile grade shall be shown in conjunction with any existing grade breaks and vertical curve information. Refer to Chapter 4 for additional information.

In some instances it may be necessary to extend the limits of the design, or show additional information, to ensure that the proposed improvements will not inhibit future construction.

4.3 Cut and Fills

Cut and fill catch points shall be shown for all cuts or fills over approximately 1 foot in depth or where the catch point will encroach on private property. Prior to approval, all applicable temporary construction easements shall be provided to the City. Refer to the end of this chapter for an informational sketch showing the definition of a cut and fill "catch point."

4.4 Private Access Ways

Private access ways, although not owned and maintained by the City, are reviewed and inspected by the City as part of the Site Development and ROW Construction Permits for conformance with the development conditions. The format for identifying private access ways shall be consistent with Section 1.030.F.

4.5 Illumination

See Chapter 6, Illumination for plan requirements.

4.6 Traffic Signalization

See Chapter 7, Traffic Signalization for plan requirements.

4.7 Channelization and Signing

Reference Chapter 8, Channelization and Signing for particular plan requirements with respect to designing channelization and signing for roadways. Should there be any conflicting directions with respect to the plan formatting or general content, then the guidance in this Chapter shall prevail in order to ensure general consistency of plan formatting. This exception does not pertain to potentially more detailed information discussed and required within Chapter 8, Channelization and Signing.

SECTION 5 Stormwater and Wastewater Sewer Plans

5.1 Mainlines, Manholes and Catch Basins

The plans shall clearly identify the pipe diameter, length, slope, and pipe material. The distance of each main from the monument line or construction centerline shall be identified in the plan view. The plans shall show all structures and clearly identify the size and type of structure, station, offset, rim elevation, and all invert elevations (existing and proposed). All utility crossings shall also be shown and identified in the plan and profile.

5.2 Wastewater Sewer Laterals (Side Sewers)

The location of all proposed wastewater sewer laterals and tees shall be clearly shown on the plan (station location of each end of the lateral). When extending a City wastewater sewer main, tees shall be constructed for all properties that could be served by the wastewater sewer extension.

Laterals shall be constructed 5 feet beyond the ROW limits, the easement limits, or the common utility trench where applicable. The proposed connection to the building should not be shown on the work order plans. Private connections to the wastewater sewer lateral require separate side sewer connection permits.

5.3 Private Utilities

Private utilities shall be shown on the plans. Private utilities shown on the plan (such as private stormwater systems) shall be de-emphasized and denoted as private. Private connections to public utilities require separate permits (for example, a stormwater connection permit is required before connecting private stormwater systems to the City receiving waters). The dimension of each utility from the monline or construction centerline should be identified in the plan view and where applicable in the profile.

5.4 Stormwater and Wastewater Facilities

Stormwater and wastewater facilities shall be shown and denoted as public on the drawings for Site Development and ROW Construction Permits if they will be publicly maintained. The City of Tacoma Stormwater Management Manual (SWMM) provides design criteria for stormwater facilities. The SWMM is available at www.cityoftacoma.org/stormwatermanual.

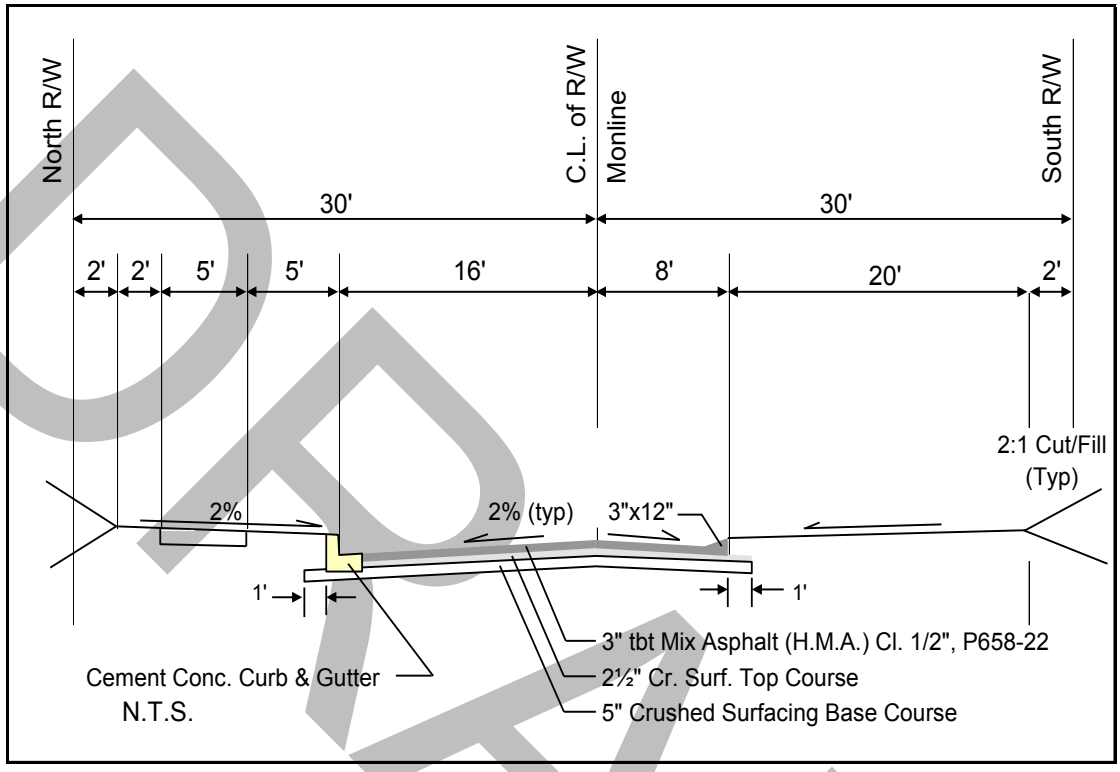
SECTION 6 Details

6.1 Typical Sections

A typical roadway section shall be included on the plans for each unique cross section of roadway and/or at the beginning and end of a transition section. Corresponding street names and stations shall be shown for each section. The section shall include improvements to be constructed within the ROW or public easement?. The centerline of the ROW and/or monument line shall be shown and labeled and the relationship to the construction center line shall be shown if not coincident. The typical roadway section shall also include: the street section, the type and/or dimensions of the curb, the cross-slope or a relationship from the crown to the gutter, the dimensions of sidewalk, the dimensions of the planter strip, the relationship to the top of the cut or the toe of the fill, the slope of the planter strip and sidewalk, and any other existing or proposed improvements that reoccur and is paramount to the design.

A typical half street section is shown in Figure 3-1 based on a future 32 feet street section. Additional street sections can be found in Chapter 4, Street Design.

Figure 3-1: Typical Half Street Section



6.2 Cross Sections

Cross sections at regular intervals may be required in areas where street widening is proposed to verify that the meet line is adequately designed. Cross sections are an aid in the design review and may either be shown on the plan or submitted separately. Cross sections should be shown with the corresponding station every 25-50 feet. For each cross section, the elevation and offset of the centerline and/or crown, the meet line, both gutter lines, and the existing front of walks shall be identified where applicable. In addition, corresponding cross slope grades for each change in grade shall be shown.

6.3 Intersection Details

Intersection details shall be included for each intersection affected by the project. They shall include, at a minimum, elevations at: centerline of pavement, gutter, gutter-gutter intersects, half delta on radius, and the end of radius (labeled as such). A three-line profile shall be completed for each roadway and additional gutter line profiles shall be completed for each radius (extend profile lines beyond end of radius for determination of entering/exiting grade). Refer to City Standard Plan DR-07 for a sample of a typical intersection detail.

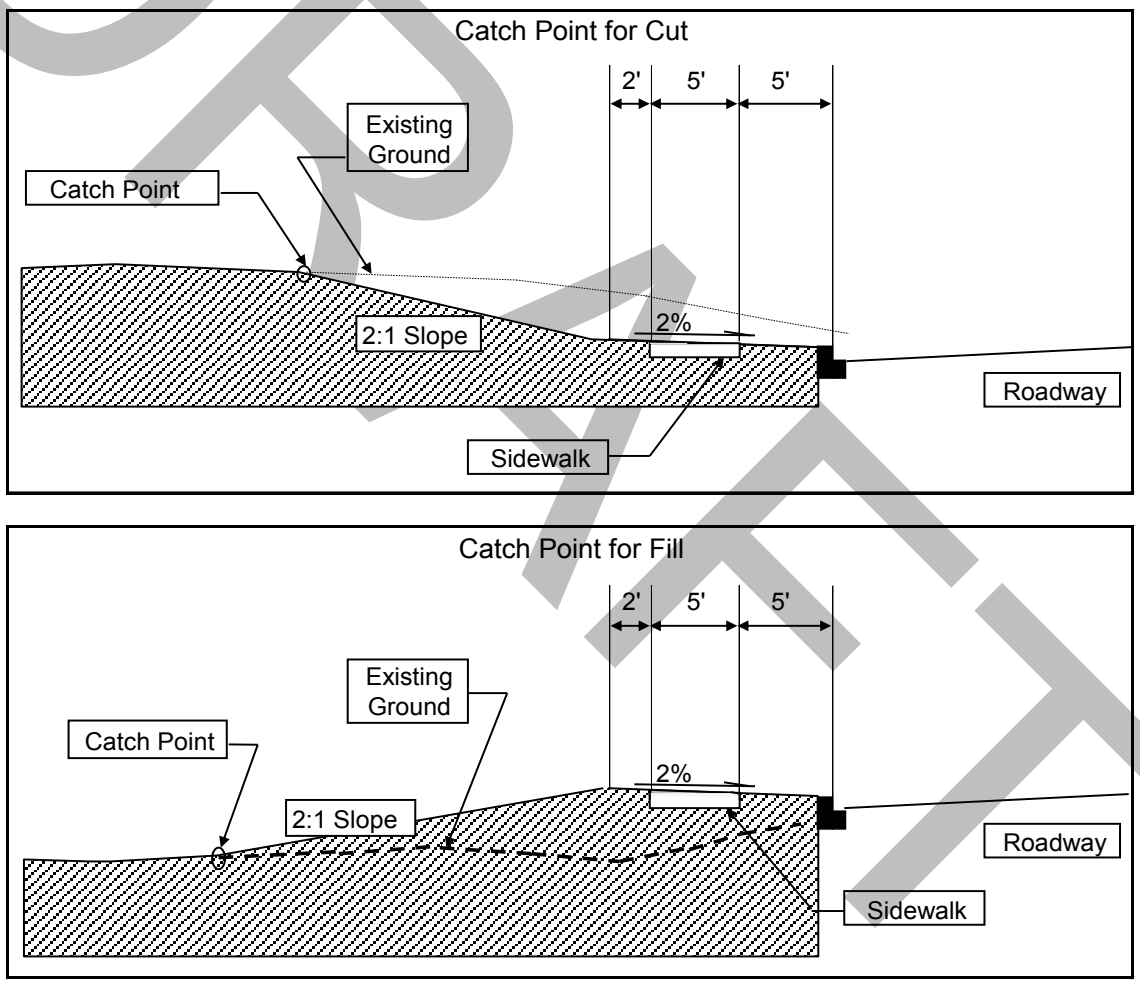
Ramps to be provided in separate detail. See Chapter 4 Street Design for requirements.

6.4 Additional Notes and Details for the Site Development and ROW Construction Permit Plans

All necessary notes and details must be included within the plans. As a minimum, the standard specifications, the record drawing criteria, and the staking notes and detail shall be included. The work order standard specifications, record drawing criteria, and the staking notes are included in the City Standard Plans.

If a separate Site Development Permit is not required or if required grading, excavation, and erosion control plan does not address work to be performed within the ROW, erosion control best management practices (as required by the SWMM) and the erosion control notes shall be included. Additional details may be required as dictated by the season, site, and proposed improvements. Typical erosion control notes and checklist are provided at the end of this chapter. Please see Chapter 9 for additional comments regarding grading, excavation, and erosion control.

Figure 3-2: Portion of Typical Cross Section Illustrating Cut and Fill Catch Points (Info Only)



4 CHAPTER 4
STREET DESIGN

INTRODUCTION

The City strives to create a transportation system that promotes Complete Streets, transportation choices, and environmental sustainability; serves and supports economic development; and equitably and efficiently serves all neighborhoods of the City. In support of these goals, this chapter covers design criteria and guidelines on the geometric design elements that must be considered in the location and the design of the various types of roadways, which includes all elements in the right-of-way.

SECTION 1 Street Typologies

1.1 Identifying the Street Classification and/or Street Type

The following information is important in identifying the classification of the street and/or type of street so that the appropriate and necessary elements of the street's design are considered.

	Information Needed	Resources
1	Is the street an arterial? If so, what type?	govME; City of Tacoma Comprehensive Plan, Transportation Element
2	Is the street a truck, transit, pedestrian, bicycle, multi-use or boulevard classification?	City of Tacoma Comprehensive Plan, Transportation Element
3	What is the speed limit on the street?	govME
4	Is my project located on a transit route? Are there transit facilities nearby?	govME, Pierce Transit Website, Sound Transit Website
5	Is the street a designated or primary pedestrian street?	Tacoma Municipal Code 13.06 and 13.06A
6	Is my project located on a corridor with adopted design guidelines?	See Section 1.2, below

1.2 Design Guidelines and Resources

Tacoma's roadway design citywide is guided by the City of Tacoma Comprehensive Plan's strong overarching policy direction calling for Complete Streets, transportation choices, Greenroads™, and environmental sustainability. Through multiple policy actions, the City Council has adopted design guidelines for specific streets, areas of the City, and/or types of facilities. The City Council has directed that this body of guidance be implemented, as applicable, through the design of roadways, bicycle and pedestrian features, amenity areas and other improvements within the ROW.

These guidelines range in detail from specific design guidance to broader statements of policy intent. They are intended to be used in conjunction with the standard design guidance contained in this Manual, along with other professional guidance, laws, code and standards. In case of inconsistency or conflicting design direction, City staff will work with the designer to resolve any differences. See also other pertinent chapters of this Manual.

All new road construction and ROW reconstruction projects will strive to achieve Greenroads™ certification, excluding alleys. Refer to Chapter 1 for information on the City's Greenroads™ Program and Policy.

1.2.1 Citywide Design Guidance Documents

The following table provides a list of design guidelines, studies, and resources that will guide street design specific to the project location. These guidelines are available at www.cityoftacoma.org.

- Comprehensive Plan, Transportation Element: The Transportation Element of the Comprehensive Plan houses the City's arterial classification, levels of service, vehicular and active transportation system plans. These guidelines may affect design for projects along the designated routes. The active transportation system is divided into the following facilities:
  - Bike Lanes
  - Bicycle Boulevard
  - Cycle Track
  - Shared Lane Marking
  - Unpaved Pedestrian Path
  - Trail (Shared Use Paths)
- Mobility Master Plan, Pedestrian and Bicycle Guidelines: These guidelines provide Citywide design guidance for pedestrian and bicycle features. Also see Shared-Use Paths Chapter of this Design Manual.
- Transportation Master Plan: This document will provide both high level policy and implementation direction on transportation issues throughout the City, pertaining to all travel modes. The plan gives a high level vision of major corridors and backbone networks for all travel modes, and explains improvements to the network needed to support the City's long-range growth strategy.

1.2.2 Area-Specific Design Guidelines

- Complete Streets Residential Design Guidelines: The City Council has directed that the City implement these design guidelines pertaining to Tacoma's residential streets (per Resolution #37916).
- Complete Streets Mixed-Use Centers Design Guidelines: The City Council has directed that the City implement these design guidelines pertaining to streets within Tacoma's designated Mixed-Use Centers (per Resolution #37916). The appropriate street typology is determined by the design intent and specific conditions of the site/corridor. Types include:
  - Mainstreet
  - Avenue
  - Transit priority
  - Urban residential
- Comprehensive Plan – Downtown Element: These guidelines consist of a system of street typologies applicable to streets within Downtown Tacoma.

The Downtown Element of the Comprehensive Plan designates streets according to the following system of street typologies:

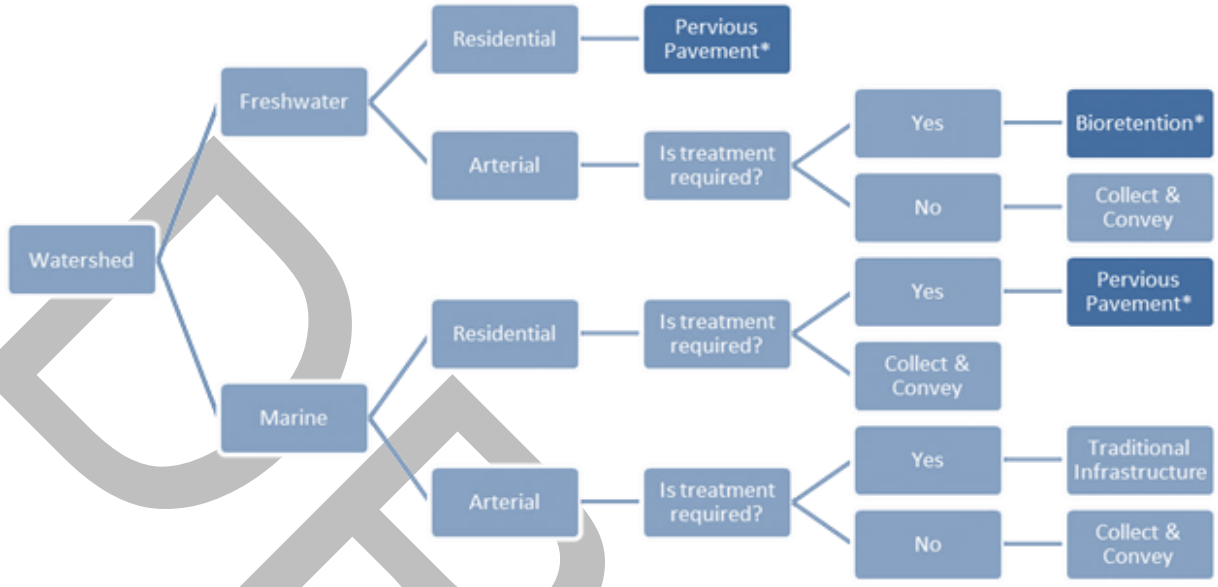
- Pedestrian/retail streets
- Planning for transit priority
- Connectors
- Cycling boulevard
- Urban residential
- Green streets
- Yakima avenue
- Warehouse district

- Mixed-Use Centers and Downtown Designated Pedestrian/Primary Pedestrian/Core Pedestrian Streets: This hierarchy is integrated in the zoning code of Tacoma Municipal Code 13.06 and 13.06A. While it pertains primarily to development standards for private property, it may also influence street design.
- South Downtown, Hilltop, and North Downtown Subarea Plans: These policy documents provide direction for roadway design throughout the Downtown Tacoma Regional Growth Center.
- Downtown Tacoma Streetscape Study and Design Concepts: This design study provides input on street design within downtown Tacoma.
- Sixth Avenue Design Plan, South 38th Street Design Plan, Martin Luther King Jr. Way Design Plan: These policy documents provide relevant policy input for street design in the applicable areas.
- Tacoma Shoreline Design Guidelines: These guidelines provide high level design guidance for projects throughout Tacoma's Shoreline Districts.

1.3 Green Stormwater Infrastructure

Green Stormwater Infrastructure (GSI) has been proven to be a valuable cost effective tool for managing stormwater and meeting the infrastructure needs of our community. The first step is to determine if GSI is feasible based on the guidance provided in the SWMM. It is important that maintenance is evaluated at the feasibility stage, so we are building infrastructure that can be maintained long-term.

Figure 4-1: Preferred Green Stormwater Infrastructure Guide



This guide shall be considered when evaluating the elements of the roadway. The preferred infrastructure identified in this guide still requires a feasibility analysis from the SWMM, and should complete a lifecycle cost analysis.

SECTION 2 Basis for Geometric Design

Geometric design of roadways shall conform to the requirements of American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets (AASHTO Policy). The AASHTO Policy contains general design parameters for highways and all roads; and specific design parameters for local roads and streets, collectors, arterials, and freeways. Designers shall apply the AASHTO Policy to their specific roadway conditions. It is essential that the engineer carefully research the AASHTO Policy to ensure that the recommendations are applicable to the project conditions.

Designers shall also apply specific design guidance from the City of Tacoma Street Design Guidelines Library (Street Design Guidelines) as applicable to each specific design project. The vision of the corridor as outlined in the Street Design Guidelines shall be reflected in the geometric design. The Street Design Guidelines includes Complete Streets Guidelines, Mobility Master Plan, Pedestrian and Bicycle Guidelines, and the Transportation Element of the City's Comprehensive Plan.

Federally classified roadways and roadways on the National Highway System shall meet the design standards required for those roadways. Any modification to those standards shall comply with the deviation process as established by the WSDOT Local Agency Guidelines Manual.

The National Association of City Transportation Officials (NACTO) Urban Street Design Guide has been endorsed by the Federal Highway Administration (FHWA) and the City. It provides an up to date source of urban street design best practices and guidelines.

All streets shall be designed to safely accommodate all modes and users, per the Street Design Guidelines. Multi-modal design features can relate to pedestrians, bicycles, mass transportation and high occupancy vehicle traffic, commercial traffic, and general automobile traffic.

2.1 Design Speed

The City considers the design speed of a facility to generally be determined as 5 mph above the "85th Percentile" speed of the prevailing traffic on the subject roadway. However, on new construction or reconstruction, which significantly alters the characteristics of the roadway, the design speed shall be considered as the posted, designated, or proposed speed limit plus 5 mph. Safety for all users and modes shall be considered when designing multi modal features, and the design speed shall be both evaluated and applied with the Street Design Guidelines.

The designated speed limit for Tacoma residential streets is 25 mph which corresponds to a 30 mph design speed. Alleys shall be designed using a 20 mph design speed. The designated speed for arterials in Tacoma varies. All streets should be designed for consistent and safe traffic speeds and for the safety of all users and travel modes. The engineer should contact the Traffic Engineering Section of the Engineering Division for determination of the design speed when the project scope of work includes significantly altering the design of a designated arterial. For non-arterials, in locations where conditions warrant, a reduced design speed may be considered on a case by case basis. Documentation must be provided to the Engineering Division of the Public Works Department justifying any and all deviations from the standard design speed.

2.2 Stopping Sight Distance

Stopping sight distance (SSD) is the sum of two distances: the distance traversed by the vehicle from the instant the driver sights an object necessitating a stop to the distance when the brakes are applied; and the distance required to stop the vehicle from the instant brake application begins. These are referred to as brake reaction distance and braking distance, respectively. The designer shall refer to the AASHTO Policy for SSD design values and vertical and horizontal curvature design.

2.3 Design Vehicle

Typical residential streets and alleys are to be designed to accommodate a single unit vehicle within the driving lane.

Typical arterial streets, as well as streets in industrial/commercial areas, are to be designed to accommodate a WB-40 (intermediate semi-trailer) design vehicle within the established and striped driving lanes.

The designer should investigate if special maneuverability requirements are warranted for the specific project location, for example specific transit and emergency response routes.

SECTION 3 Geometric Design

3.1 Temporary versus Permanent Improvements

The City generally classifies a permanent street section as consisting of concrete curb and gutter with sidewalk in combination with a standard residential or arterial street section (as defined in Section 5 of this chapter). The design of the permanent improvements or as a result of new development may mandate providing some temporary improvements for the approval of the City Engineer. The minimum pavement section for temporary improvements shall not be less than 2 inches hot mix asphalt (HMA) over 2 inches crushed surfacing top course. Improvements shall conform to the geometric guidelines outlined in this section.

3.1.1 Geometric Guidelines

Providing dust and erosion control measures to improve air and water quality, and safety enhancements are some of the primary objectives for providing temporary improvements.

In order of decreasing hierarchy, the designer shall comply with the following directives:

1. The geometric design of the permanent improvements shall conform to this chapter AND the design shall align with the alignment and elevation of any existing adjacent permanent improvements.
2. The geometric design of the permanent improvements shall conform to this chapter AND the design shall take into consideration any future improvements identified by the City Engineer which would tie into existing permanent improvements in the vicinity.
3. The geometric design of the permanent improvements shall conform to this chapter AND the design shall provide a best fit design which will adequately channelize traffic and connect to any existing temporary improvements.

Under no circumstances shall temporary street sections dictate the design of the permanent street improvements. A safe, smooth transition must be provided to any temporary improvements. Additional pavement removal and replacement may be required to provide an adequate transition or crown to the street. In some cases removal and replacement of the street may extend to the centerline or beyond the centerline, see the City's Right-of-Way Restoration Policy. Temporary street improvements are also required to meet all requirements of the SWMM.

All new City public road construction, ROW reconstruction projects will strive to achieve Greenroads™ certification, excluding alleys. Refer to Chapter 1 for information on the City's Greenroads™ Program and Policy.

3.2 Straight Grades

Through experience, the City has found that without providing a mechanism for controlling grade, such as through the use of concrete curb and gutter, asphalt cannot be placed at a grade less than 1% and maintain positive drainage. Therefore, where asphalt wedge curbs will be constructed, a 1% minimum longitudinal grade shall be provided or some mechanism for temporary grade control addressed in the design. When concrete curb and gutter is being installed the minimum longitudinal grade may be reduced to not less than 0.3%.

Due to the difference in minimum grades between temporary asphalt wedge curb, and the construction of permanent curb and gutter, the grades required in order to construct the temporary asphalt wedge curb may substantially control the design of a half street.

The engineer should refer to the AASHTO Policy for maximum grades for all road classifications as applicable to each specific road design project. Additionally, in commercial and industrial areas, grades shall not exceed 8%, although a 5% maximum is the desirable target. Improvements to existing roads and streets, and new roads that are severely constrained by steep existing topography (greater than 15% slopes) shall be designed to have the lowest feasible grades, and shall be reviewed on a case-by-case basis.

3.3 Horizontal Curves

The designer shall refer to the AASHTO Policy for a determination of minimum acceptable horizontal curves. The "vehicle speed" shall be the design speed as discussed in Section 1.1 of this chapter.

Non-arterial streets shall be designed with a standard pavement cross-section where feasible (reference Section 5). Generally, the allowable maximum cross-slope is 6%. Where necessary and justified, super elevation greater than the standard cross-slope will be considered.

Arterial streets with design speeds of 40 mph or less shall also be designed in conformance with this section. No arterial streets shall be designed for speeds of greater than 40 mph, unless it can be demonstrated that there is a unique circumstance dictating this approach, and that the design is in accordance with both the Street Design Guidelines and the AASHTO Policy.

3.4 Tapers and Transitions

All tapers shall be in conformance with the Manual on Uniform Traffic Control Devices (MUTCD) as referenced by AASHTO. The designer shall refer to the MUTCD, Part 3 Markings for guidance. According to the MUTCD, the minimum allowable taper shall conform to the following formula if the posted speed limit is 40 MPH or less:

$$L = WS^2/60$$

Where:

- L = the taper length in feet.
- W = the offset width of the taper or transition in feet
- S = the design speed in miles per hour.

3.5 Vertical Curves (Crest)

The engineer shall refer to the AASHTO Policy for requirements in the design of crest vertical curves. Designing for the greatest possible SSD is desirable.

3.6 Vertical Curves (Sag)

The engineer shall refer to the AASHTO Policy requirements in the design of sag vertical curves. Designing for the greatest possible SSD is desirable.

Where cost or topographic conditions justify a deviation from the above stated desirable practice, reduction in the length of a sag vertical curve may be considered in areas where adequate fixed source lighting (streetlighting) exists or is included as a part of the project (see Illumination Chapter of this Design Manual). Where approved, the sag vertical curve may be reduced to an absolute minimum as determined by the "comfort" criteria, in accordance with the AASHTO Policy.

3.7 Roadway Grade Breaks

The City allows for a 1% maximum grade break in place of a vertical curve (crest or sag). Grade breaks are not allowed at the beginning of vertical curvature (point of vertical curvature) or the end of vertical tangency (PVT) of a vertical curve, in close proximity to a vertical curve, or in close proximity to another grade break. The minimum separation from grade break to a vertical curve or another grade break can be calculated by inserting a vertical curve in place of the grade break.

Example:
If designing a crest vertical curve with a 35 mph design speed, the K-value, based on the AASHTO Policy, is 29. For ease of calculation and supposing a better crest curve fits, use a K-value of 30. Then, for a 1% grade break, the vertical curve equivalent would be 30 feet in length. Consider also that for a 30-foot vertical curve an equivalent 1% grade break would be centered in the horizontal direction, at 15 feet from the start of that vertical curve segment since vertical curves may not overlap each other. The minimum spacing between two 1% crest grade breaks is 30 feet. Likewise, a 1% crest grade break could not be located within 15 feet of the beginning or end of a vertical curve.

SECTION 4 Roadway Intersections

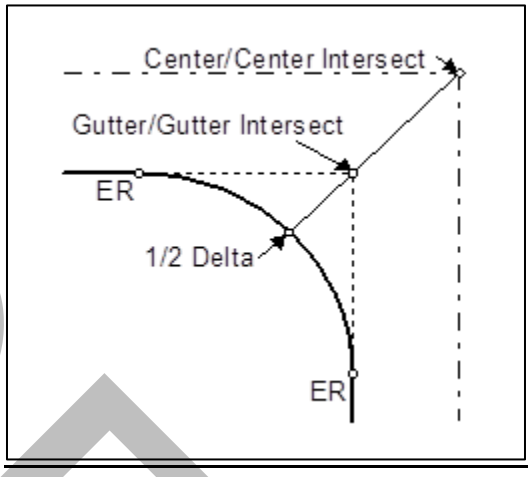
This section applies to intersections involving public roads and streets and excludes alleys, driveways, and private access ways, which are discussed in Section 5.

4.1 Intersection Profiles

Design of the intersections shall be conveyed through intersection details which are outlined in Chapter 3. Intersections shall be designed with the following criteria:

- All vehicle paths shall have a smooth transition through the intersection.
- Intersections shall safely and comfortably accommodate all users and modes per Street Design Guidelines and the AASHTO Policy.
- Intersection grades shall not exceed 6%, but where existing steep topography is a design constraint, larger grades may be evaluated on a case-by-case basis
- Minimum 1% slope around intersection corners.
- Intersections shall be designed to have positive drainage to gutters and catch basins, to prevent ponding and sheet flows across the intersection.
- The engineer should review the diagonal profile from the center/center intersect to the ½ delta point of the radius through the gutter/gutter intersect as shown in Figure 4-5. Taking into consideration the 1 inch lip of the gutter as shown in the detail for curb and gutter on City Standard Plan SU-03.

Figure 4-2: Diagonal Profile



4.2 Sight Distance for Intersections

Sight distance shall conform to the AASHTO Policy. The engineer shall evaluate the sight distance for each of the cases presented in the AASHTO Policy, including intersection and stopping sight distances. Generally, the intersections of two non-arterial streets are "uncontrolled" meaning they have no yield signs, stop signs or traffic signals. The operator of a vehicle approaching an uncontrolled intersection must be able to perceive a potential conflict with sufficient time to alter the vehicle's speed as necessary before reaching the intersection.

As presented in the AASHTO Policy, a controlled intersection has different sight distance criteria based on the specific traffic control in place. In some cases, such as roundabouts, the sight distance principles in the AASHTO Policy may be supplemented by guidance provided in other design guidelines, such as FHWA and WSDOT publications.

SECTION 5 Street Section

5.1 Street Width

The City standard minimum residential street width is 28 feet which typically provides for parking on both sides. The City Engineer or designee may consider different widths based on site specific considerations, the specific street design, Low Impact Development design alternatives, or existing improvements that may dictate the alignment of the curb. The engineer shall consider the existing improvements, including trees and landscaping, public art, historic features, and other pertinent features, in the area and may base the design of the street section accordingly.

5.2 Lane Widths

Table 4-1: Typical Channelization Combinations by Street Width[1]

Street Width	Outside Lane	Inside Lane	Turn Lane	Bike Lane[2]	Parallel Parking Lane[3]
56 feet	11 feet	11 feet	None	6 feet	None
56 feet	12 feet	11 feet	10 feet	None	None

56 feet	13 feet	None	None	5 feet, 2 foot buffer	8 feet (both sides)
56 feet	12 feet	None	10 feet	5 feet, 2 foot buffer	8 feet (one side)
56 feet	15 feet	None	10 feet	None	8 feet (both sides)
44 feet	11 feet	None	10 feet	6 feet	None
44 feet	11 feet	None	None	5 feet, 2 foot buffer	8 feet (one side)
44 feet	14 feet	None	None	None	8 feet (both sides)
40 feet	15 feet	None	10 feet	None	None
40 feet	14 feet	None	None	6 feet	None
40 feet	12 feet	None	None	None	8 feet (both sides)
32 feet	11 feet	None	None	5 feet	None
32 feet	12 feet	None	None	None	8 feet (one side)
30 feet	15 feet	None	None	None	None
30 feet	11 feet	None	None	None	8 feet (one side)
28 feet	14 feet	None	None	None	None

1 Other channelization solutions may be considered for review. Refer to Section 6 of this chapter for guidance on medians versus two-way turn lanes, parking, and bike-lanes.
2 Additional bike facilities, including sharrows, buffered bike lanes, advisory bike lanes, bike passing lanes, contraflow bike lanes, and cycle tracks are described in the City's Mobility Master Plan Pedestrian and Bicycle Design Guidelines. See also the Shared-Use Trails Chapter.
3 For additional consideration, note that angle parking may also be permitted in some cases.

5.3 Cross Sections

Please note that the following tables and accompanying text in this subsection are based on the design of a full street section. Design of a half street section shall take into account the future permanent improvements and adjust the cross section accordingly.

The City standard street section consists of a typical crown section with the elevations of the right and left gutters being equal. Where existing conditions dictate a variance from the standard, a full warp cross section may be considered. An offset crown is typically used to transition to the full warp section from a standard crown section.

Table 4-2 provides a guideline illustrating which section is most appropriate based on typical street widths and the difference in the gutter elevations.

Table 4-2: Type of Section

Street Width	Difference in Gutter Elevations	Type of Section
28 to 36 feet	0 to 0.4 feet	Typical crown
	0.4 to 0.75 feet	Offset crown
	0.75 to 2.0 feet	Full warp
40 to 44 feet	0 to 0.6 feet	Typical crown
	0.6 to 1.0 feet	Offset crown
	1.0 to 2.5 feet	Full warp
56 feet	0 to 0.8 feet	Typical crown
	0.8 to 1.2 feet	Offset crown
	1.2 to 3.0 feet	Full warp

A linear cross section should be used for streets equal to or less than 32 feet, and cross slopes should be designed from 2% to 1% minimum where feasible. Table 4-3 provides

a guideline for the design of a typical crown cross section. The centerline elevation is determined by averaging the gutter elevations and adding the centerline adjustment as shown in Table 4-3. The quarter point elevation is determined by subtracting the quarter point adjustment shown in the table from the previously determined centerline elevation.

Table 4-3: Adjustments to a Typical Crown Cross Section

Street Width	Section	Centerline Adjustment	Quarter Point Adjustment
Up to 32 feet	Linear	0.28 to 0.36 foot	None
From 32 to 36 feet	Parabolic	0.4 foot	0.1 foot
From 36 to 40 feet	Parabolic	0.4 to 0.5 foot	0.1 to 0.15 foot
From 40 to 44 feet	Parabolic	0.5 foot	0.15 foot
From 44 and 56 feet	Parabolic	0.5 to 0.6 foot	0.15 to 0.2 foot
56 feet	Parabolic	0.6 foot	0.2 foot

A centerline profile and an adequate number of cross sections shall be shown for streets providing a consistent typical crown section where the difference in gutter line elevations is zero or uniform. For streets where the absolute difference in gutter elevations varies, a two line profile (left and right) and an adequate number of cross sections shall be provided. Left and right profiles can be at the gutter line, top of curb, or at the edge of pavement line, as long as adequate cross sections are provided in the plans detailing the left and right profile offsets.

5.4 Subgrade Preparation

The above standard sections are designed to be placed upon a firm and unyielding subgrade according to WSDOT Standard Specifications for Road, Bridge, and Municipal Construction, Section 2-06. Verifying the condition of the subgrade by "proof rolling" is required.

5.4.1 Permeable Pavement Subgrade Preparation

For permeable pavements, the exposed subgrade shall maintain preconstruction infiltration rates and should be protected from over compaction. Traffic should be limited to emergency access. If traffic is allowed on the exposed subgrade, it shall be re-evaluated for infiltration and scarification may be required. The subgrade must be suitable, as determined by the engineer, prior to placement of geotextile fabric (if required) or permeable ballast base course. The subgrade shall be protected from siltation or over-compaction, including replacing all material that becomes unsuitable while the subgrade is exposed.

To prevent excessive subgrade compaction the following procedure shall be adhered to:

1. Excavation to final subgrade elevation shall occur immediately prior to placing pavement section materials and paving. If necessary, the contractor may excavate to an intermediate subgrade elevation established at 12 inches above the final subgrade elevation.
2. Grading to final subgrade elevation shall be completed by machinery operating on the intermediate subgrade level or the adjacent non-pervious pavement subgrade.
3. To prevent excessive compaction of subgrade during placement of pavement section material the follow these steps:

a. Excavate to subgrade elevation using method by which equipment, including trucks, are not operated on the final subgrade elevation.
b. Scarify the top 6 inches subgrade to a firm and unyielding condition.
c. Compact subgrade to density specified herein or as directed by the project engineer.
d. Install geotextile fabric (if required).
e. Back dump the material onto the subgrade from the edge of the installation and push it out onto the subgrade using low ground pressure equipment. Trucks then back dump subsequent loads on top of the previously dumped/pushed material as the installation progresses.

4. Avoid subgrade preparation during wet conditions.

Contractor shall phase the work so as to not compromise or excessively compact the subgrade. Should it be necessary for machinery or trucks to access the final subgrade in certain areas, the contractor shall protect said areas from over-compaction by placing steel sheets on the areas to diffuse point loading.

Infiltration tests shall be completed immediately following final subgrade preparation to verify that the subgrade is not over-compacted. The test shall be conducted using the small scale Pilot Infiltration Test (PIT) as outlined in the Low Impact Development Technical Guidance Manual for Puget Sound (Washington State University Extension/Puget Sound Partnership, December 2012). Except projects required to install permeable pavements per the Minimum Requirements of the SWMM shall follow acceptance requirements of the SWMM.

Tests shall be conducted at a rate of 1 test per 5000 square feet, or 1 test per 200 lineal feet of roadway, or one test per lot for residential sites. Subgrade infiltration tests shall be conducted at the discretion of the engineer.

Areas determined to be overly compacted, in the sole opinion of the engineer, shall be scarified by the contractor to a depth specified by the engineer and re-compacted.

5.5 Pavement Section

Pavement section standards, including minimum design values, are provided in the City Standard Plans for Pavement Design. The base material for all sections shall extend 1 foot beyond the back of the concrete curb or asphalt wedge curb.

Alternate sections providing the same structural number may be proposed, and are subject to approval by the City. The designer may design the alternate pavement section using the process outlined in the AASHTO Guide for Design of Pavement Structures. Emerging new design methods may be considered for review and compared with the AASHTO Guide for Design of Pavement Structure design results, taking into consideration the average daily truck traffic, and the existing soil conditions. The minimum design life for asphalt pavements shall be 20 years, and the minimum design life for a concrete pavement section shall be 40 years. However, the designer should evaluate the life cycle costs of a 40 year asphalt design life. Additionally, in the port area, the standard section may need to be increased upon further review, depending on soil conditions. The City may require a geotechnical analysis for review.

Alternate sections, including permeable pavements, will require a geotechnical analysis and pavement calculations as described above. For permeable pavement sections, geotechnical analysis and recommendations will be required, that will support the proposed permeable ballast base course. The thickness will be determined by the structural design and the stormwater requirements outlined in the SWMM.

5.6 Permeable Ballast Base Course

Permeable ballast base course shall meet the requirements of WSDOT Standard Specifications Section 9-03.9(2). The permeable ballast base course shall be compacted with a minimum 10-ton vibratory roller, in static mode, until no visible movement of aggregate is observed. Immediately following spreading and final shaping each layer of surfacing shall be lightly compacted in one lift to a firm and unyielding condition.

Permeable ballast base course shall be manufactured from ledge rock, talus, or gravel in accordance with the provisions of WSDOT Standard Specifications Section 3-01. The materials shall be uniform in quality and substantially free from wood, roots, bark, and other extraneous material and shall meet the following quality test requirements:

Los Angeles Wear, 500 Rev	30% maximum, WSDOT Test Method T 96
Degradation Factor:	30 minimum, WSDOT Test Method T 113
Minimum Void Ration Content:	30% as determined by AASHTO T19 or ASTM C29, rodding procedure

Permeable Ballast Grading Requirements:

Sieve Size	Percent Passing
2-1/2 inch	100
2 inch	90-100
1 ½ inch	35-70
1 inch	0-15
½ inch	0-5
No. 100	0-3
No. 120	0
% Fracture	90

Note: All percentages are by weight.

Permeable ballast base course shall meet the requirements for grading and quality when placed in hauling vehicles for delivery to the site, after placement in temporary location, when in stockpiles on site, during installation, and after installation and in place after compacted to project specifications.

Final acceptance will be based on conformance testing completed on material that has been delivered, installed, and compacted on site. Acceptance of permeable ballast base course shall be as provided under nonstatistical or commercial evaluations.

5.7 Curb and Gutter

Standard cement concrete curb and gutter shall be constructed per City Standard Plan SU-03, unless otherwise approved by the City Engineer or designee. Curb and gutter with combination sidewalk must be provided for at least 25 feet at bus stops to form a landing to service the front and rear doors of a city bus. Contact Pierce Transit's Bus

Stop Group for more details. Other curb types shown on City Standard Plan SU-03 may be used in specific instances and will be approved on a case-by-case basis as part of the City review and approval process.

In some cases, where full warp street sections are approved, the City will require gutters to be designed "lip down" (such that the gutter does not trap water). Lipped down gutters may also be required in the design of intersections, on street parking stalls, bus turnouts, etc. Lip-down gutters can be at running grades less than 0.3%, if only the rest of the street will be graded to drain according to Section 2 in this chapter.

Alternative curb or gutter-less road edging may be appropriate for green infrastructure designs.

Where there are existing granite curbs and/or brick gutters, consideration shall be made for retaining the historic configuration or salvaging the materials based on approval by the City's Historic Preservation Office. The City shall retain possession of such materials if they are removed.

All curb and gutter shall flow into a stormwater facility, which may include a catch basin, curb cut, etc. If a facility is not available at the end of improvements a wedge curb shall be extended or a stormwater extension will be required. Refer to Chapter 5 of this Manual and SWMM Section *** for requirements on stormwater facilities.

5.8 Asphalt Wedge Curb

In areas where curb and gutter is not required, all new asphalt pavement shall include an asphalt wedge curb. An asphalt wedge curb consists of a 3 inch high by 12 inch wide thickened edge of asphalt. Where a full warp of the street is approved and the proposed asphalt wedge curb is on the downhill side of the warp, a 6 inch by 18 inch asphalt wedge curb shall be used. If there is a bus stop in an area with asphalt wedge only, additional asphalt behind the wedge curb should be included in order to provide a suitable boarding area. Contact Pierce Transit's Bus Stop Group for more details.

Typically, the top of the asphalt wedge curb does not provide for a reliable vertical control point; therefore, the grade point of an asphalt wedge curb shall be the flowline as referenced by the City Standard Plan SU-26. The back of the wedge curb shall denote the alignment.

All curbs shall flow into a stormwater facility, which may include a catch basin, curb cut, etc.

5.9 ROW Transition to Private Property (Cut and Fill Slopes)

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.

The toe of the fill or the top of the cut shall be a minimum of 2 feet behind the back of the walk. In areas where sidewalk will not be constructed at this time, the toe/top of slope shall be a minimum of 2 feet behind the future sidewalk alignment. In areas where the construction of sidewalks has been waived, the toe/top of slope shall be a minimum of 2 feet behind the back of the new curb. This 2 foot transition zone shall be sloped at a

maximum of 2%. Special designs differing from these typical cases can be proposed, and shall be evaluated on a case-by-case basis.

SECTION 6 Access

The frequency and location of access points creates traffic conflict points, which increases traffic congestion and the likelihood of crashes. This section addresses access design to improve traffic safety, provide access for land development, maintain roadway capacity, and reduce travel times.

6.1 Functional Classification and Connectivity

Roadway layout shall be based primarily on the safety, efficiency of traffic flow, and functional use of the roadway. Roadways of all classifications shall be planned to provide for connectivity of existing and proposed streets in relation to adjoining parcels and possible future connections as approved by the Public Works Department. The City Traffic Engineer will classify all new roadways.

Arterial roadways are intended for the efficient movement of people and goods and have the highest level of access control. Collector arterials generally connect commercial, industrial, and residential projects to other collectors; these roadways have a moderate level of access control. Residential streets shall interconnect with each other and with collectors and have a minimum level of access control. Roadway classifications can be found in the Transportation Element of the City's Comprehensive Plan, and in TMC 11.05. Courts and alleys are intended to provide local access with encouraged use of alleys in residential neighborhoods.

To encourage a safe and efficient transportation system, the City has adopted a policy of interconnected streets. New developments shall provide new roadways and connections which support interconnectivity including pedestrian accessibility to bus stops and non-motorized routes. Grid connections, connections to adjacent parcels, shared access, and new roadways shown in the Transportation Element of the City's Comprehensive Plan are examples of ways the City requires interconnectivity of the roadway network. Connections between similarly zoned properties shall be provided. Internal access ways shall provide stubs to adjacent parcels and reciprocal access agreements. Roadway connections shall be extended to and through property lines.

6.2 Access Management

Access management focuses on the location, spacing, and design of entrances, street intersections, and alleys. Each access location creates conflict points where vehicles interact with other vehicles or pedestrians causing delay and potential safety concerns. State facilities operated within the City shall meet these access standards in addition to the access management regulations required by the state in Revised Code of Washington (RCW) 47.50, Washington Administrative Code (WAC) 468-51, and WAC 468-52.

Determination of permitted access, including number, location, and size, shall be the responsibility of the City. The following information will be used to evaluate access and should be consulted prior to street design:

1. The Citywide Design Guidance Documents (Section 1.2.1) and Area-Specific Design Guidelines (Sections 1.2.2), zoning, and land development regulations as set forth in adopted City comprehensive plans.
2. The current functional classification of the roadway (or potential classification in the case of a new roadway).
3. Existing and projected traffic volumes, crash history, non-motorized volumes, and other operational considerations.
4. Existing and projected state, local, and regional planning organization transportation plans and needs, including considerations of new or improved facilities.
5. Drainage requirements and utilities.
6. The physical features of land adjoining the roadway.
7. The type and volume of traffic requiring access.
8. The availability of alternative or shared connections to the existing roadway network.
9. The cumulative effect of existing and projected connections on the roadway's ability to provide safe and efficient movement of people and goods.

6.3 Access Location and Spacing

Minimum access spacing provides drivers with sufficient perception-reaction time to minimize the number of potential conflicts to address at a time, which improves safety for both motorized and non-motorized traffic.

Access points shall be located to reduce the possibility of weaving, lane shifts, or other conflicts in the traffic stream. Existing access on both sides of the roadway shall be analyzed to determine proper location for a new access. Spacing is important to maintain the safety and capacity of a roadway, as well as the appearance of a corridor. New access points shall be placed outside the functional area of nearby intersections and other existing access points. The following criteria shall be used for determining the minimum spacing between access points, unless special authorization is given by the City Engineer.

Posted Speed Limit (per TMC Title 11)	**Functional Classification** (Transportation Element of the Comprehensive Plan)	**Access Spacing*** (centerline to centerline)
35 or 40 miles per hour	All	600 feet
≤ 30 miles per hour	Principal or Collector Arterial	300 feet
	Minor or Unclassified Arterial	150 feet
	Local Street	50 feet

* The spacing standards are for full access. Restricted access (right-in, right-out), shall be half the amount shown in the table above provided that a physical median restricts left turns. No reduction shall be made on local streets, and no reduction shall be made when measuring from highway ramps or existing or planned traffic signals or roundabouts.

If the spacing requirements and the connectivity requirements as outlined in this chapter cannot be met, the access shall be designed using the objectives herein and as approved by the City's Engineering Division.

6.4 Medians

Painted (flush) and raised medians can provide effective access control when designed and implemented appropriately. Raised medians, whether used exclusively for access control or otherwise, shall be designed according to the design parameters in the AASHTO Policy, with the following City design criteria:

- The median shall be bordered by a concrete curb. This curb can be a traffic barrier curb or a curb and gutter, per City Standard Plan SU-03.
- The width of the median between the top back of curb on each side shall be 6 feet minimum.
- Medians can contain green infrastructure features, landscaping, irrigation, artwork, a brick paver style surfacing, or a patterned concrete.
- For at-grade pedestrian crossings, a depressed section of the median can be used to provide a pedestrian refuge access at crosswalks.
- The Citywide Design Guidance Documents (Section 1.2.1) and Area-Specific Design Guidelines (Sections 1.2.2) shall be applied to determine design aspects and/or amenities appropriate for the specific project area.
- Access/parking for authorized vehicles only shall be considered and provided as necessary for medians that contain items that require maintenance.

6.5 Driveways

All driveways shall be in conformance with the TMC, Chapter 10.14 and Chapter 13.06. In cases where driveway provisions applicable to a particular application exist in either referenced TMC section, or other section of the TMC, all standards shall apply (with the more stringent provisions prevailing in the case of a conflict created by application of separate standards). Exceptions may be allowed by the City Traffic Engineer for public safety or if strict application of these standards would prohibit vehicular access to a development, pursuant to TMC, Chapter 10.14.

New driveways are subject to review and approval by the City Engineer pursuant to TMC, Chapter 10.14, taking into account safe traffic flow, existing and planned transit operations, the objectives and requirements of this chapter, and the efficient functionality of the development. New driveways can be prohibited or their associated traffic movements restricted on designated pedestrian streets.

New driveways shall be located from an alley or court when suitable access is available, such as an abutting ROW that is or can practicably be developed.

City Standard Plan SU-07 and SU-08 show driveways used for residential and commercial access and at the entrance to private access ways. Driveways shall be designed to meet applicable ADA and Public Rights-of-Way Guidelines (PROWAG) standards, and applicable design guidelines of the City.

Type 1 and Type 2 concrete driveways are to be constructed where concrete curb and gutter is proposed or existing. Temporary asphalt driveways should be constructed elsewhere. Please note that for historic districts, special design standards may apply.

The City may require an increased driveway thickness or steel reinforcement over that shown in the standard plans (PD-01 and PD-02) in the area of the Tideflats or where poor soil conditions exist.

Use of pervious pavement for driveways is subject to City review on a case by case basis.

6.6 Private Access Ways (Serving up to 4 Lots)

A private access way serving 4 lots or fewer may be designed as outlined in this section. Private streets serving plats and/or five 5 or more lots shall be designed to City standards as outlined in this chapter and in Chapter 5. Private streets will not be allowed if there is the ability for a future roadway extension.

It is incumbent upon the design engineer to provide safe adequate access for all lots. The City strongly recommends that the engineer/designer follow the recommendations from the AASHTO Policy as discussed in this chapter.

All private streets and access ways shall:

1. address adverse impacts to adjacent private property;
2. be permanently established by tract or easement which provides legal access to serve private property and includes provisions for future use by adjacent property owners when applicable;
3. not landlock other parcels;
4. not obstruct public street circulation;
5. be supported by covenants to provide for maintenance (covenants will be verified and approved by the City and recorded with the County);
6. meet all applicable standards for sidewalks and ADA accessibility;
7. meet the applicable requirements of the SWMM; and
8. meet private streetlighting requirements throughout a plat per TMC 13.04.165.

Private accessways shall meet all of the following criteria:

1. Type 1 or 2 concrete driveway provided where the private access way enters onto public ROW where permanent concrete curb and gutter exists or is proposed (a temporary asphalt approach shall be provided if concrete curb and gutter does not exist nor is proposed);
2. Street section is in conformance with the standards and requirements discussed in this Chapter;
3. Turn-around meets the standards and requirements discussed in this Chapter (see Section 6.10);
4. Longitudinal grades are less than 15% (greater grades may be considered if constructed with concrete); and
5. Provide streetlighting at the point of the access meeting the City's standards (see Chapter 6 of this Design Manual).

Where new development is proposed with access from a gravel roadway, the road shall be paved to the nearest paved connector street to the approval of the City Engineer to ensure adequate access.

6.7 Requirements for Plats/Short Plats

TMC Title 13 provides the requirements for pavement widths and sidewalks for plat and short plat development. The following table provides a quick representation of design requirements for development. The applicant is responsible to review all city, local, state, and federal requirements to ensure the ROW design is sufficient.

	Greater than 4 Lots	3 to 4 Lots	2 Lots
Designation	Public street ROW or private street easement	Private access way	Private access way
Right-of-way or Easement Width	52 feet[1]	32 feet	27 feet
Pavement Width	28 feet[2]	24 feet[2]	16 feet with additional 4 feet graded and graveled surface to meet the requirements of the International Fire Code
Pavement Section (Residential)	Refer to Section 5 of this Chapter.	Refer to Section 5 of this Chapter.	Refer to Section 5 of this Chapter.
Driveway	Required at entrance to all lots[3]	Required at entrance to private accessway[3]	Required at entrance to private accessway[3]
Sidewalk	Required along all lot frontages.	Required along all lot frontages.	Required along all lot frontages.
Street Trees	Both sides	See TMC 13.06.502.B.2	See TMC 13.06.502.B.2
Street Edge Improvements [4]	Both sides	Required for combination sidewalks	Required for combination sidewalks
Asphalt Wedge Curb	N/A	Required	Required

1 May be reduced to a minimum of 41 feet for private roadways due to site specific constraints, with approval from the City Engineer.

2 For roadways with on-street parking, 28 feet is the required minimum width. In limited circumstances this width may be reduced to a minimum of 20 feet, with City Engineer approval. These circumstances may include development within high density zoning districts, to accommodate a site plan with clustered onsite parking, as part of a Low Impact Development roadway design, or when designed for one-way travel.

3 A temporary asphalt driveway approach is required when no concrete curb and gutter exists on the City street. A cement concrete driveway approach is not allowed unless concrete curb and gutter is either present, or will be installed with the driveway approach. Approved pervious pavement sections may be allowed in either case.

4 Street edge improvements include gutter, planting strip and street trees.

6.8 Alleys

A minimum ROW width of an alley in a residential block, when platted, shall be 20 feet. Alleys (courts) may be required in the rear of commercial and industrial districts and, where required, shall have a ROW of at least 20 feet (per TMC 13.04.200).

Improvements of alley ROW may be required when the alley is to be utilized as access to a residence, parking lot, or as otherwise directed by the Engineering Division of the Public Works Department or the Environmental Services Division of the Environment Services Department. Typical alley designs shall conform to City Standard Plan PD-01 or PPD-01. Incorporation of Low Impact Development Best Management Practices (BMPs) are encouraged when practicable (see the City's Stormwater Management Manual).

The geometric design shall conform to the criteria as set forth in Section 2 using a 20 mph design speed, when practicable. The typical paved width of an alley in a residential area is 16 feet with wedge curbs on both sides. When constructing a new alley that connects to existing or proposed curb and gutter, a concrete alley return conforming to City Standard Plan SU-09 shall be provided. City Standard Plan SU-09 also details the sidewalk section through the alley. Please note that for historic districts, special design standards may apply.

6.9 Dead Ends

Dead end roadways shall not be allowed without approval of the City Traffic Engineer.

To promote connectivity, roadways shall connect with nearby existing roadways except in cases when topography, land ownership, or other factors make this infeasible. In cases when it is not feasible to connect roadways, but feasible to establish a non-motorized pathway, then the pathway shall be constructed.

In general, dead end streets shall not be longer than 500 feet. Any dead end street in excess of 150 feet in length shall terminate in a turn-around or cul-de-sac (see Sections 6.10 and 6.11 below). Any dead end street with four or fewer lots accessing the street may satisfy this requirement with the construction of a T-type/hammerhead or branch turnaround subject to approval by the City Engineer (per TMC 13.04.190).

Barricades with reflectors conforming to the City Standard Plan SU-13 shall be provided at dead ends. Two feet of clearance between the limits of the street improvements and the barricade, shall be maintained. In areas where extreme slopes or other hazards exist, a Type 2 concrete barrier (WSDOT/APWA Standard Plan C-8) with reflectors may be utilized.

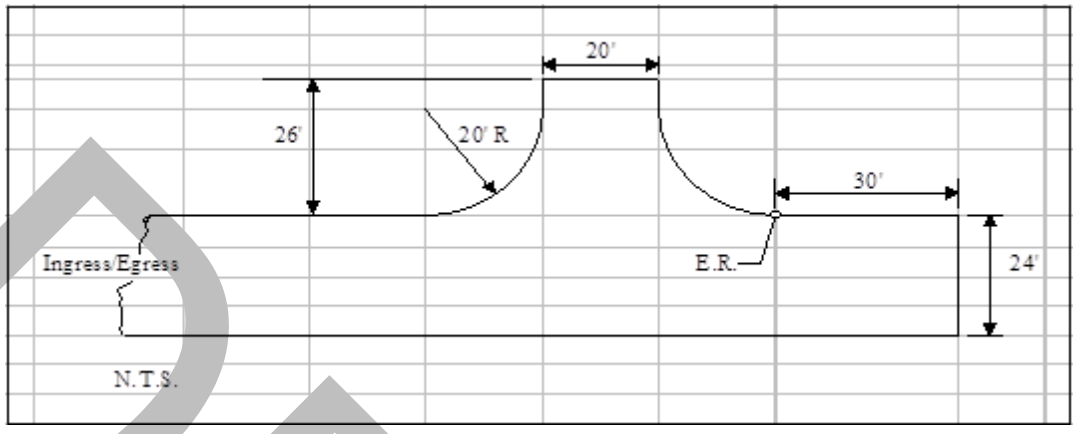
Barricades or posts may not be required where a private driveway accesses the dead end street through the end of the street or turn-a-round.

6.10 Turn-arounds

As stated in the International Fire Code, a turn-around meeting the design requirements discussed within this section, shall be designed and constructed for all dead end streets or private accessways over 150 feet in length. Regardless of length, all public dead end streets shall provide a turn-around to the approval of the City Engineer.

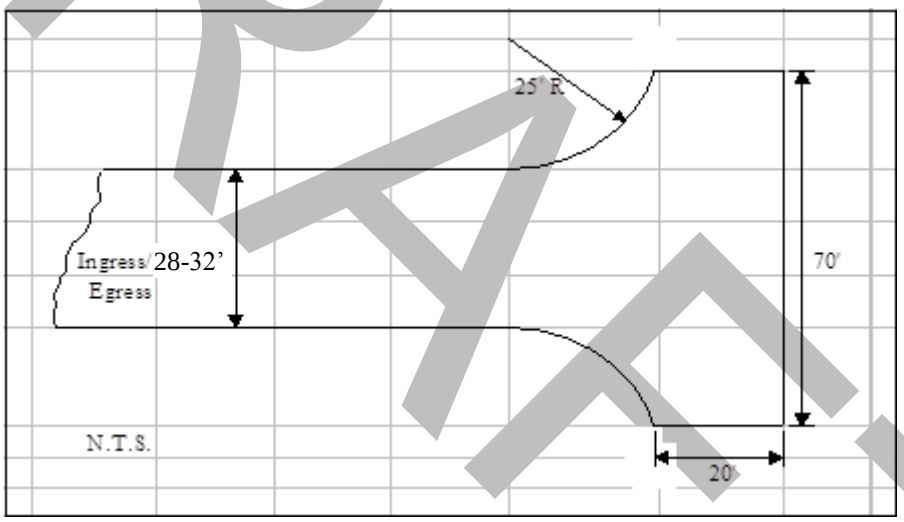
For private accessways serving 3 to 4 lots a City standard "hammerhead" or "branch" (also T-type) turn-around should be constructed as shown in Figure 4-3.

Figure 4-3: Example of Turn-around for Private Access Ways



For residential streets (or private access ways) serving 3 to 4 lots, a standard "T-Type" turn-a-round should be used as shown in Figure 4-4.

Figure 4-4: Example of T-Type Turn-around for Residential Street



6.11 Cul-de-sacs

Cul-de-sacs shall be constructed where a dead end street will serve 5 or more residential lots. Cul-de-sacs are primarily constructed as permanent improvements in City ROW where the future extension of the street is not likely. The typical cul-de-sac design will include a through connection for pedestrians and bicycles, per the Complete Street Design Guidelines when appropriate with the City street network.

Cul-de-sacs shall be designed to meet the minimum requirements set forth in the City Standard Plan DR-06. Typically, cul-de-sacs shall be designed with a landscaped center island or designed as a depression to accept stormwater runoff. A standard curb or mountable curb may be used to define the inner island.

SECTION 7 Mobility Facilities

Pedestrian mobility is a vital transportation mode. Designers must be aware of the various physical needs and abilities of pedestrians in order to ensure facilities provide universal access. All pedestrian facilities as outlined in this section shall be in compliance with the ADA requirements as well as the City's adopted design guidelines outlined at the beginning of this Chapter (see Section 1.2) and Chapter 12 of this Design Manual.

7.1 Sidewalk, Amenity Zone and Buffer Widths

The City minimum standard sidewalk width is 5 feet. Additional width is required in the circumstances listed below by roadway type/area. In all cases a minimum of 5 feet shall be provided for unobstructed pedestrian passage.

A minimum 5 foot sidewalk shall be provided across the planter strip at bus stops, connecting the street to the sidewalk. Sidewalks adjacent to bus stops with no planter strip shall be a minimum of 8 feet wide (measured from the face of curb). Contact Pierce Transit's Bus Stop Group for more details.

7.1.1 Residential

Adjacent to residential streets, sidewalk widths shall be a minimum of 5 feet (excluding the curb and buffer or planting strip). A planter strip measuring 5 feet from the face of curb to the front of walk shall be provided. If necessary and approved by the City Engineer, the planter strip may be reduced to accommodate sidewalk widening.

7.1.2 Arterials

Adjacent to arterials, sidewalk widths shall be a minimum of 7 feet (excluding the curb and buffer or planting strip). Additional width may be required, unless specified in the TMC or City design guidelines. Pervious sidewalks will be evaluated on a case-by-case basis. In general, if a 5 foot wide or less planter strip is provided, pervious sidewalks will not be permitted.

7.1.3 Mixed-Use Centers

For these high pedestrian activity areas, the City Council has directed that wider sidewalk and amenity zones be provided (see Complete Streets Mixed-Use Centers Design Guidelines). The following requirements apply either to match fully improved sidewalks or when a minimum half-block length (or 100 foot on longer frontages) site frontage improvements are being constructed.

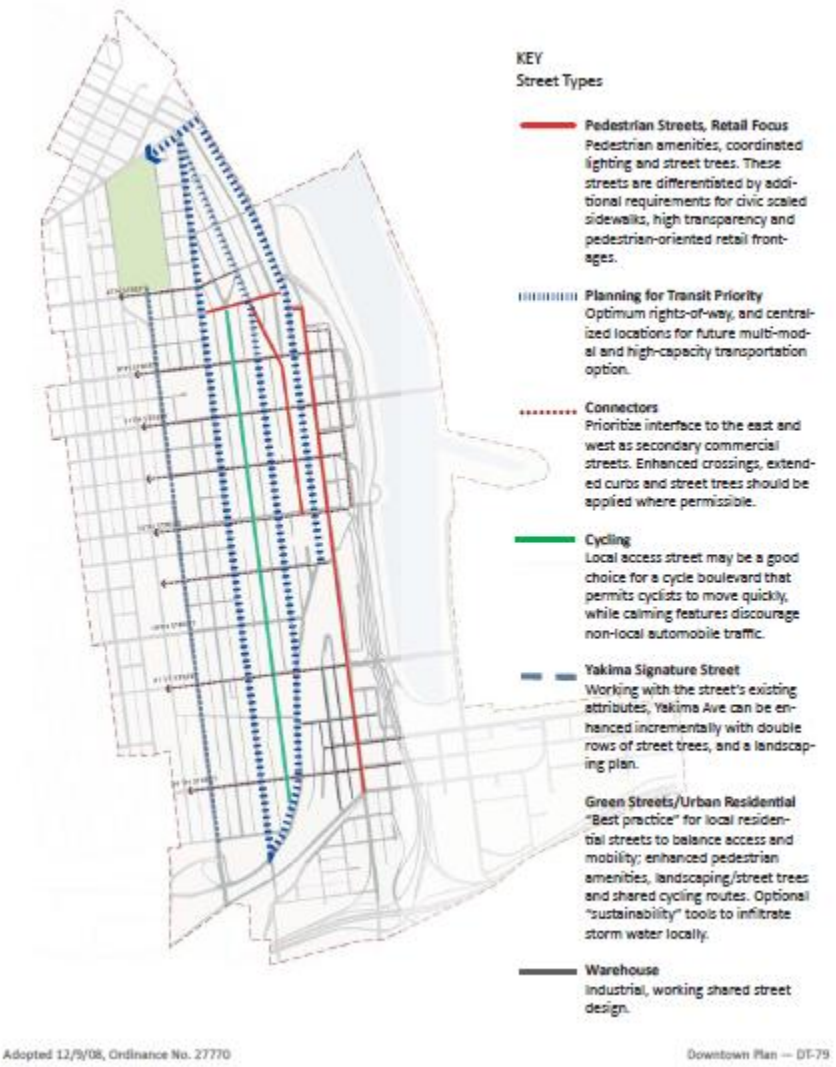
On streets designated as primary pedestrian or pedestrian streets in TMC 13.06 and 13.06A, a typical sidewalk width of 10-12 feet and an additional amenity zone width of 6-8 feet shall be provided. With the approval of the City Engineer, this combined total width of the sidewalk and amenity zone may be reduced to a minimum of 12 feet (excluding the curb) in order to accommodate a safety issue or unique site constraints. Reductions should be avoided if feasible on primary pedestrian streets. In all circumstances, a minimum width of no less than 7 feet shall be provided for unobstructed pedestrian passage.

7.1.4 Downtown

On streets within downtown Tacoma, specific sidewalk and amenity zone widths are called out by street in the Downtown Element of the Comprehensive Plan. In

all circumstances, a minimum 7 feet shall be provided for unobstructed pedestrian passage.

Figure 4-5: Downtown Tacoma Plan



Downtown Tacoma – Desired Sidewalk/Amenity Zone Widths

Street Types	Sidewalk/Amenity Zone Widths
Pedestrian, retail streets	15.5 feet
Transit priority	14 feet
Connectors	11 feet
Cycling boulevards	18 feet
Urban residential	10 feet
Green streets	20 feet
Yakima Avenue	20 feet
Warehouse District	Varies

7.2 Planting Area and Street Trees

In accordance with City policies to establish a healthy and diverse urban forest, as defined in the Urban Forest Policy Element adopted in 2010 as part of the City's Comprehensive Plan, refer to the Urban Forestry Manual for standards that apply to all trees required by TMC 13.06.502. See also the Landscaping Chapter of this Manual.

Planting areas are located between the curb and sidewalk or behind the sidewalk. They serve as a buffer between pedestrians and vehicles, as well as provide environmental benefits. Planting areas are not allowed to be paved. Basic treatments for an unpaved planting area include:

- A minimum 3 foot depth of amended existing native soil or new topsoil non-mechanically compacted to account for settling shall be provided for all newly transplanted trees, except when the tree is planted within the drip line of existing mature trees. In the case of street trees, the finished soil level including mulch (finished grade) shall be 1 inch below the adjacent pavement surface or curb. Refer to City Standard Plan LS-01, as well as the Urban Forestry Manual for minimum and recommended planting area sizes for trees.
- Planting: groundcovers, perennials and shrubs with mulch covering exposed soil area. Plants (other than trees) must be less than 3 feet in mature height if planted in the public ROW.
- Mulch: organic wood chip mulch and/or permeable inorganic mulch. Finished grade after mulch application shall be a minimum of 1 inch below the adjacent pavement surface or curb.

7.3 Curb Ramps and Crosswalks

All curb ramps shall be designed and constructed to be ADA-compliant in accordance with City Standard Plans and Public Right-Of-Way Accessibility Guidelines (PROWAG). ADA and PROWAG requirements are discussed in Chapter 12 of this Design Manual. The City's Curb Ramp Installation Matrix should also be consulted to identify the extent of curb ramp improvements related to ROW improvements.

A legal crosswalk exists at every intersection, unless it is otherwise signed. However, marked crosswalks encourage pedestrians to cross at designated locations. Some marked crosswalks are best accompanied by other treatments such as signs or beacons. The Engineering Division of the Public Works Department must approve all new marked crosswalks (see Chapter 8 for more information).

7.4 Traffic Calming and Intersection Treatments

Traffic calming is a way to design streets to improve safety, reduce the amount of cut-through traffic traveling on residential streets, and generally encourage people to drive more slowly. Along with education and enforcement, traffic calming has been used in many Tacoma neighborhoods to slow speeds on residential streets and improve neighborhood livability by reducing cut-through traffic and improving the environment for pedestrians and bicyclists. Traffic calming may include or be provided in conjunction with Low Impact Development stormwater features.

Although traffic calming is typically used on residential streets, there are certain tools that are appropriate for use on some arterial roadways. When a traffic calming approach is considered for any street, the City applies the following guidance:

- **Vehicle speed** is more critical than volume in terms of safety and should be addressed first where there are constraints.
- **Neighborhood involvement** is important to successful implementation. Rationale for traffic-calming and management measures should be explained clearly to community residents and installation of these treatments should incorporate public input.
- Traffic-calming and management measures should fit into, and preferably **enhance, the street environment**.
- Traffic-calming designs should be **predictable and easy to understand** by drivers and other users.
- **Devices that meet multiple goals** are usually more acceptable. For example a raised crosswalk may be more understandable to motorists than a speed hump. The former has a clear goal whereas the latter may be perceived as a nuisance.
- **Treatments need to be well designed** and based on current available information on their applications and effects. Information on U.S. experiences with various traffic-calming measures can be found in Institute of Transportation Engineers (ITE's) Traffic Calming: State of the Practice at http://safety.fhwa.dot.gov/speed_manage/docs/ses1intro.pdf.
- Devices should **accommodate emergency vehicles**. Emergency response times shall be considered.
- Traffic-calming areas or facilities should be **adequately signed, marked, and lit** to be visible to motorists.
- **Treatments need to be spaced appropriately to have the desired effect on speed** – too far apart and they will have a limited effect, too close and they will be an unnecessary cost and annoyance. Devices usually need to be spaced about 300 to 500 feet apart. If they are spaced too far apart, motorists may speed up between them.
- **Whole street designs** are usually able to create an environment that supports slower speeds for the entire length.
- **Facilities should not be under-designed or they will not work**. Keeping the slopes too gradual for a speed table or curves too gentle for a chicane will not solve the problem and will appear as a waste of money and may ruin chances for future projects.
- Traffic-calming measures should **accommodate bicyclists, pedestrians and people with disabilities**, such as providing bicycle by-pass features.
- If a measure is likely to divert traffic onto another local street, **the area-wide street system should be considered** so as not to shift the problem from one place to another.
- Devices should be thought of as **elements of a traffic calming system** and be placed to improve pedestrian conditions throughout an area.

Table 4-4: Traffic Calming Devices and Applications

Traffic Calming Device	Typical Use	Residential Streets (non-arterial)	Collector Arterials	Minor Arterials	Principal Arterials
Curb bulb-outs	Pedestrian Crossing Conditions	●	●	●	●
On-street parking (parallel and angle)	Conditions Along Streets	●	●	●	●
Streetscape improvements (street trees, lighting, street furniture, special paving treatments)	Conditions Along Streets	●	●	●	●
Signs	Managing Traffic	●	●	●	●
Crossing islands or short medians	Pedestrian Crossing Conditions		●	●	●
Medians	Managing Traffic		●	●	●
Neighborhood speed watch program	Managing Traffic	●	●		
Limited access	Managing Traffic	●	●		
Raised crosswalks	Pedestrian Crossing Conditions		●		
Raised intersections	Managing Traffic		●		
Chicanes	Managing Traffic	●			
Chokers	Managing Traffic	●			
Diverters	Managing Traffic	●			
Partial street closure	Managing Traffic	●			
Speed humps	Managing Traffic	●			
Traffic circles	Managing Traffic	●			

Legend:
Appropriate for Consideration (●)
Note: Refer to SU-XXXX (new) for speed hump standard plan. Other devices shall be approved by the City Engineer.

SECTION 8 Monumentation

All new/replaced monuments constructed in a street section shall be a poured monument (see Standard Plan SU-01). Monuments shall be constructed within the limits of the permanent street improvements (located within the ROW) as follows:

- at the intersection of any two monument lines;
- at the intersection of any monument line and any section line or quarter section line;
- at the beginning and end of a horizontal curve where the point of intersection of the curve is not located within the pavement section;
- at the point of intersection of a horizontal curve where the point of intersection of the curve is located within the pavement section (excluding the curb and gutter); or
- at any horizontal angle point of the monument line;

Projects must comply with WAC 332-120 regarding locating all known survey monuments, including property corners, within the project limits. No survey monument may be removed without a permit being obtained in advance from the Washington State Department of Natural Resources, and later, prior to replacing the monument.

SECTION 9 Street Amenities and Additional Design Features

9.1 Amenity Zone

The amenity zone and sidewalk zone often complement one another and should be thought of as a system. Amenity zones help to buffer pedestrians from traffic and may contain many of the amenity features that contribute to an attractive and vibrant streetscape; including water features, street furniture, pedestrian lighting, street trees and vegetation, bicycle parking, loading/unloading room for on-street parking, kiosks, and public art. In constrained situations where the preferred sidewalk width is not achievable, the amenity zone can widen and enhance the sidewalk zone both visually and physically. Amenity zones may vary in width depending on available ROW. However a minimum width of 4 feet will minimize encroachment into the sidewalk zone when accommodating features such as street furniture, lighting and tree pits.

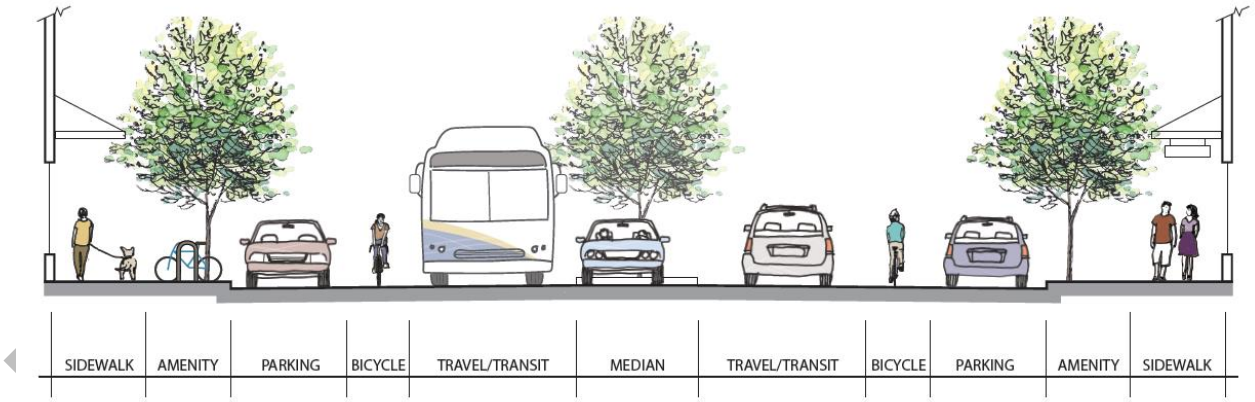
Objects, sidewalk cafes, and landscaping placed in the amenity zone should not encroach upon the sidewalk zone, causing interference and unsafe conditions for the visually impaired – a minimum 7 feet clear walk zone should be provided within the sidewalk zone along arterials and high volume pedestrian areas.

The amenity zone can be the location of a range of optional enhancements or required features, which will be designed and laid out differently depending upon the available space, community priorities, available resources and other factors. Such features must comply with applicable safety, accessibility and circulation requirements, and be designed to avoid conflicts with movement, required lines-of-sight, traffic circulation. See also other sections of this Manual which apply to utilities, vegetation, and pedestrian features.

Where load zones for accessible transportation and/or handicapped parking spaces are provided, the amenity zone should be clear of obstacles that might impede the loading, unloading and movement of persons with disabilities. Objects and landscaping in the amenity zone should not encroach upon the sidewalk zone, causing interference and unsafe conditions for the visually impaired. Crime Prevention Through Environmental Design principles should be considered.

Consult with City staff to determine if there are design parameters and guidelines that apply to specific streets. For additional guidance, see the City's Design Guidelines.

Figure 4-6: Street Zones



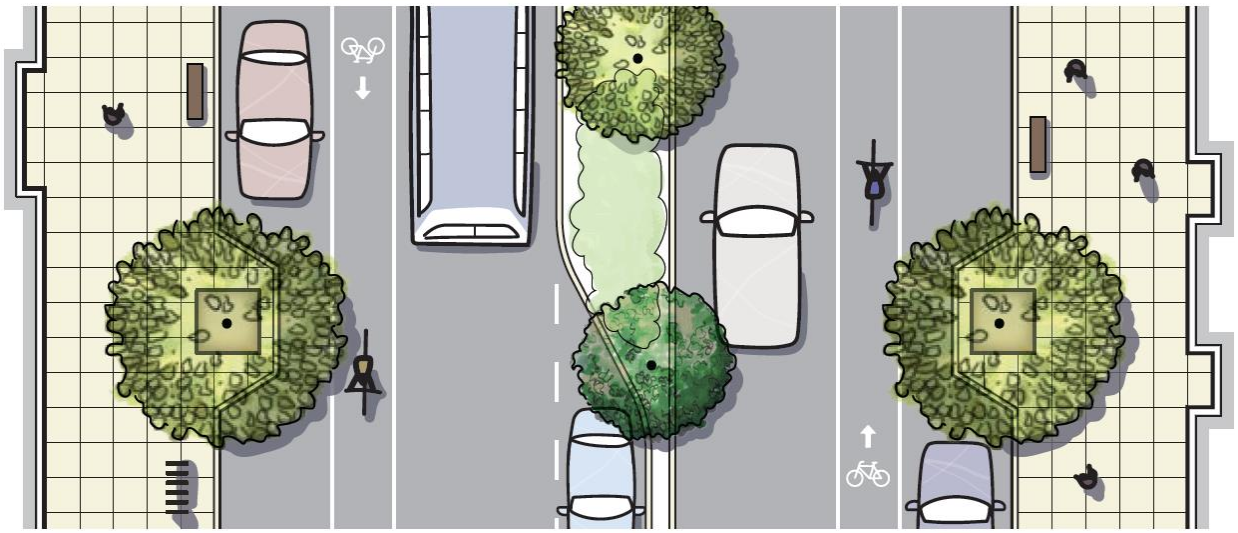
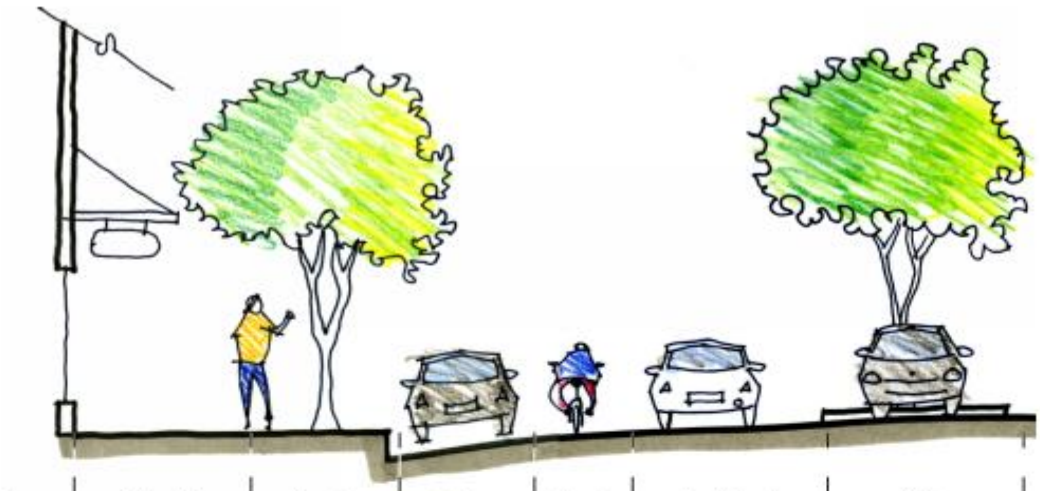


Figure 4-7: Complete Streets Zones



Zone	Sidewalk	Amenity	Parking	Bicycle	Travel/Transit	Median
Function	pedestrian movement, business interface, cafe seating, signage, planters	street furnishings, street trees, utilities, low-impact development features, clear zone for parked cars, bicycle parking, bus stop, traffic signage	on-street parking, bulb-outs, landscape islands, bus lane, on-street bicycle parking	safe bicycle travel	movement of vehicles including streetcar	restrict turn movements, accommodate trees/LID, reduce perceived width of street; provide a refuge for pedestrians crossing the street (particularly at identified mid-block crossings)
Character	unobstructed path for 2-3 abreast walkers, distinctive paving	hard surface except where LID; pervious pavers or tree grates for healthy tree growth	extension of travel/transit zone	visible markings indicating separate or shared lane	minimize width while accommodating larger vehicles such as emergency, freight, transit	landscaped or hard surface where needed to accommodate clear zone for emergency vehicles

9.2 Signage

Signage is an essential component of the streets for providing traffic control, wayfinding, as well as visual cues that indicate how the street is used by each mode. A number of sign standards are applicable within the City, including the MUTCD, AASHTO, City standards, Tacoma's Bicycle and Pedestrian Guidelines, Business District standards and Chapter 8 (Channelization and Signing) of this Manual.

Wayfinding signage shall be included as a standard feature for the addition of bicycle facilities along a designated bicycle corridor, unless waived by the City Engineer.

9.3 Utilities

Utilities of all kinds need to be accommodated within the public ROW, whether in the roadway or the sidewalk and planting strip. The following points should be considered as well consulting with Tacoma Public Utilities:

- Alleys provide an invaluable opportunity to open up the street for improvements. Whenever feasible, above ground utilities and municipal services should take place within alleys.
- Utility poles and other utility-related structures should typically be placed within the planting strip and a minimum of 5 feet unobstructed sidewalk should be maintained.
- Utility vault covers and manhole covers must have non-slip surfaces; all features shall meet ADA requirements.
- Utility structures such as switch boxes, poles, etc. should be visually integrated into the streetscape.
- Pedestrian scale lighting shall be designed and located to improve visibility and help define pedestrian areas.
- The City supports underground power lines to improve aesthetics, however a range of factors must be considered. Consult the City's design guidelines and with Transmission and Distribution at Tacoma Power.

9.4 Street Furniture

Street furniture such as benches, kiosks, newspaper stands, lighting, 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. Several Neighborhood Business Districts have developed streetscape design plans that identify a street furniture palette, which should be referred to when making streetscape improvements. See Chapter 6 (Illumination) of this Design Manual for more information about pedestrian lighting and the Citywide Design Guidelines in Section 1.2.

9.5 Walls

Where a public wall supports fill from entering onto the ROW, the wall shall be placed no closer than 2 feet from the back of the walk or future walk. In areas where a wall will be placed to support the ROW, care should be taken by the engineer to provide measures that will assure the safety of both traffic and pedestrians.

Rock walls are designated as a protective facing to enhance the resistance of an exposed cut or fill face to weathering and erosion. While a rock wall possesses some undetermined retention qualities due to the mass, size and shape of the rocks, it is not to be used in place of an engineered retaining wall. Under no circumstances shall a rock wall be constructed to support a surcharge from adjacent improvements. Where the wall will not be affected by a surcharge, a rock wall may be constructed up to a height of 4 feet without a permit or requirement to submit a design for City review and approval. Rock walls over 4 foot in height shall conform to the Standard Rock Wall Construction Guidelines by the Associated Rockery Contractors (ARC). An online copy is available at www.ceogeo.com/are-2.htm

In areas where a wall will be supporting a surcharge from adjacent improvements, an engineered retaining wall will be required based on the following loadings:

Street:	H-20
Sidewalk:	250 lbs. /ft^2
Concentrated Load:	8,000 lbs.

Concentrated loading for sidewalks shall be distributed as specified in Table 1607.1 of the 2003 International Building Code.

Private walls shall be a minimum of 2 feet back of ROW. A Street Occupancy Permit will be required for any private walls approved to be located within the ROW.

9.6 Stairs, Fences, Handrails, Guardrails

Public stairs, fences, handrails, and guardrails should be constructed no closer than 2 feet behind the back of walk, the future back of walk, or the edge of the roadway, and shall meet applicable ADA, PROWAG and other requirements.

Stairs, fences, handrails, and guardrails on private property should be constructed no closer than 2 feet behind the ROW line and shall meet applicable ADA, Building Code and other requirements.

9.7 Mailboxes

The applicant must contact the United States Post Office serving the area in order to determine the requirements in regards to mailbox access for the development. In some instances, the design of the street section will be affected by the requirements set forth by the Postmaster General. In areas of combination walk where mailboxes are required to be adjacent to the street, the design should reflect the requirements of City Standard Plan SU-06. In areas where a Neighborhood Delivery and Collection Box Unit are required, the applicant should refer to the Postmaster General.

9.8 Bus Stops and Transit Routes

Prior to application for City permits for any development impacting existing transit stops and routes the applicant must coordinate with the appropriate transit agencies. Transit stop locations are restricted and controlled, through coordination of the designer/engineer, City, and the transit agency, to achieve maximum safety and efficiency. A minimum 5 by 8 foot clear area (with the 8-foot dimension extending laterally from the curb) must be provided at transit stops placed within the amenity/sidewalk zone to meet ADA standards.

9.9 Bike Parking

The City requires long and short term bicycle parking in association with development activities (see TMC 13.06). The City's Bike and Pedestrian Design Guidelines apply to bicycle parking located within the public ROW.

9.10 Public Art, Civic and Cultural Features

Municipal projects are subject to a one percent contribution to the City's Municipal Art Program (see TMC 1.28B). The installation of public art and interpretive features shall

be subject to the review and approval by City staff and designated City commissions. Consult with the City's Historic Preservation Officer and Arts Coordinator to obtain guidelines applicable to public art, civic and cultural features proposed to be located within the public ROW.

Existing features located within the public ROW can have historic or cultural significance. Prior to removal of existing features which potentially may have such significance, consult with the City's Historic Preservation Officer.

Any proposal that would affect or is adjacent to artwork from the Municipal Art Collection shall be coordinated with the Tacoma Arts Administrator. Protection during construction may be required by the City even if the artwork will not be moved or altered. Costs associated with moving, relocating or protecting art are the responsibility of the project proponent.

5 CHAPTER 5
STORMWATER AND WASTEWATER SEWER DESIGN

INTRODUCTION

This chapter provides design criteria for the construction of all publicly owned wastewater, sewer and stormwater conveyance systems.

Tacoma Municipal Code 12.08 provides the City the regulatory authority for wastewater and stormwater discharges within the City.

The City of Tacoma Stormwater Management Manual (SWMM) provides guidance on the measures necessary to control the quantity and quality of stormwater runoff produced by new development and redevelopment. The SWMM establishes minimum requirements for new development and redevelopment projects. The minimum requirements are satisfied by the application of Best Management Practices (BMPs). The SWMM should also be used to identify options for retrofit situations. Where guidance within this Manual differs from the SWMM, the SWMM shall take precedence.

The SWMM is available online at: www.cityoftacoma.org/stormwatermanual. For stormwater related questions, email stormandsewer@cityoftacoma.org.

The City of Tacoma Side Sewer and Sanitary Sewer Availability Manual (Side Sewer Manual) contains design guidance for side sewers and private pump systems. The manual is available online at www.cityoftacoma.org/sidesewer.

The design criteria in this chapter apply to all proposed connections to the City wastewater and stormwater systems, as applicable.

SECTION 1 Existing System Drawings

Design and record drawings for most City-owned and maintained wastewater and stormwater systems and facilities can be viewed online at City's govME website, www.govME.org. These drawings can be printed from the City's govME website. Design and record drawings can also be viewed electronically at the Permit Intake Center, located on the third floor of the Tacoma Municipal Building, 747 Market Street.

Drawings available on the City's govME website shall not be used solely for design of a project and are not a substitute for field investigation or field survey. For all projects, survey data shall be used for project design.

SECTION 2 In Lieu of Assessment

All parcels connected to a wastewater sewer are responsible for the cost of constructing the public wastewater sewer serving the parcel. This responsibility can be met by paying the charge in-lieu of assessment fee.

If a proponent is extending the public wastewater sewer, an In Lieu of Assessment Release Form shall be completed and returned to the City prior to work order approval. This form identifies parcels that do not have to pay future side sewer assessment fees. The form is necessary to waive the Connection Charge-in-lieu-of-assessment as required by TMC 12.08.350 and to remove from the public record the property or properties subject to additional tap or connection charges for sanitary sewers as may be required by RCW Chapter 65.08.

After the work is completed and the record drawings received and accepted by the Site Development Group, a certificate of payment and release will be filed with the Pierce County Auditor's office. Parcels can be transferred without the notice to title.

A copy of the In Lieu of Assessment Release Form and an information sheet regarding the form are provided at the end of Chapter 9, Construction Related Permits and Easements.

SECTION 3 Sizing the Stormwater and Wastewater System

3.1 Wastewater Sewer Sizing

The wastewater conveyance system shall be appropriately sized for the proposed development. A downstream capacity analysis may be required before connecting to existing wastewater conveyance system.

For the wastewater sewer, the Side Sewer Manual provides guidance on when a capacity analysis is required before connecting to the City wastewater sewer system. The Department of Ecology Criteria for Sewage Works Design (Orange Book) provides additional guidance on determining capacity of the wastewater system.

The Orange Book is available at:
https://fortress.wa.gov/ecy/publications/summarypages/9837.html

If the existing public wastewater system is determined to be under capacity, it may be necessary to upsize the existing downstream system.

3.2 Stormwater System Sizing

The stormwater system shall be appropriately sized for the proposed development. A quantitative downstream analysis may be required before connecting to the existing stormwater system. All project proponents shall review Minimum Requirement #10 of the SWMM (reference Volume 1 – Section 3.4.10) to determine if an analysis of the downstream system is required and to determine if mitigation measures are necessary.

If the existing public stormwater system is determined to be under capacity, it may be necessary to upsize the existing downstream system or provide detention onsite.

SECTION 4 Gravity Pipe Design Criteria

4.1 Pipe Size

Any extension of a City stormwater or wastewater sewer greater than 8 inches in diameter will require an environmental checklist. Refer to Chapter 9 of this manual for additional information regarding the environmental checklist.

4.1.1 Wastewater Sewer Pipe Size

The minimum pipe diameter for the wastewater conveyance system is 8 inches.

4.1.2 Stormwater System Pipe Size

The minimum pipe diameter for the City maintained stormwater conveyance system is 12 inches.

Catch basin leads shall be a minimum of 12 inches in diameter.

4.2 Pipe Slope

Maximum slopes, velocities, and anchoring requirements are shown in Section 4.9. If velocities exceed 15 feet per second, provide anchors and/or restrained joints at bends and junctions.

4.2.1 Wastewater System Pipe Slope

The minimum slope for wastewater pipes is 1%. Slopes less than 1% may be allowed provided calculations are provided showing that the proposed system meets or exceeds a 2 feet per second scouring velocity.

4.2.2 Stormwater System Pipe Slope

The minimum slope for all stormwater pipes is 0.5%. Slopes less than 0.5% may be allowed provided calculations are provided to demonstrate that a minimum velocity of 2 feet per second can be maintained at full flow.

4.3 Pipe Material

4.3.1 Wastewater Conveyance Pipe Material

The following table lists the acceptable pipe materials for the wastewater conveyance system. The maximum deflection allowed in flexible pipes is 5%.

Table 5-1: Acceptable Wastewater Conveyance System Pipe Materials

Pipe Material	Minimum SDR/Class	Reference	Specification Reference	Applicability
Solid Wall Polyvinyl Chloride (PVC); 15 inches in diameter or less	SDR 35	ASTM D 3034	WSDOT 9-05.12(1)	Standard use
Solid Wall PVC; 18 inches in diameter or greater	115 psi SDR 26	ASTM F 679	WSDOT 9-05.12(1)	Standard use
Vitrified Clay	Extra Strength	ASTM C 700	WSDOT 9-05.8	Standard use
Solid Wall PVC; 12 inches in diameter or less	SDR 18	AWWA C 900	WSDOT 9-30.1(5)A	Shallow or deep cover, non-standard separation from water main
Solid Wall PVC; 12 inches in diameter or greater	SDR 18	AWWA C 905	WSDOT 9-30.1(5)A	Shallow or deep cover, non-standard separation from water main
Lined Ductile Iron	Special Thickness Class: 50 Minimum Pressure Class: 350	ANSI A 21.51 AWWA C 151	WSDOT 9-05.13	Shallow or deep cover, non-standard separation from water main

	(If joined using bolted flanged joints – Special Thickness Class 53 required)			
Solid Wall High Density Polyethylene (HDPE), Heat Welded, Butt Fused	SDR 17	ASTM D 3350	City 9-05.23	Pipe bursting or steep slope installation
Profile Wall HDPE, Integral Bell Joints (Spirolite or engineer approved equal)	Per pipe design, minimum class 100	ASTM F 894 ASTM F 477 ASTM D 3350	Requires prior approval from Environmental Services. Additional design requirements may apply.	Large diameter
PVC Lined Reinforced Concrete (Ameron T-Lock or engineer approved equal)	Per pipe Design	AASHTO M170 (RCP) ASTM D412 (PVC Liner)	Requires prior approval from Environmental Services. Additional design requirements may apply	Large diameter

4.3.2 Stormwater Conveyance Pipe Materials

The following table lists the acceptable pipe materials for stormwater conveyance systems. See the SWMM for allowable pipe materials for stormwater treatment and flow control facilities. The maximum deflection allowed in flexible pipes is 5%. Galvanized, aluminized, and/or corrugated iron or steel pipes are not allowed within the public right of way or as a connection to the Municipal system.

Table 5-2: Acceptable Stormwater Conveyance Pipe Materials

Pipe Material	Minimum SDR/Class	Reference	Specification Reference	Applicability
Solid Wall Polyvinyl Chloride (PVC) 15 inches in diameter or less	SDR 35	ASTM D 3034	WSDOT 9-05.12(1)	Standard use
Solid Wall PVC 18 inches in diameter or greater	115 psi SDR 26	ASTM F 679	WSDOT 9-05.12(1)	Standard use
Vitrified Clay	Extra Strength	ASTM C700	WSDOT 9-05.8	Standard use
Solid Wall PVC 12 inches in diameter or less	SDR 18	AWWA C900	WSDOT 9-30.1(5)A	Shallow or deep cover, non-standard separation from water main

Solid Wall PVC 12 inches in diameter or greater	SDR 18	AWWA C905	WSDOT 9-30.1(5)A	Shallow or deep cover, non-standard separation from water main
Lined Ductile Iron	Special Thickness Class: 50 Minimum Pressure Class: 350 (If joined using bolted flanged joints – Special Thickness Class 53 required)	ANSI A21.51 or AWWA C151	WSDOT 9-015.13	Shallow or deep cover, non-standard separation from water main
Plain Concrete 12” diameter or less	Class 2	AASHTO M86	WSDOT 9-05.7(1)	Standard Use
Reinforced Concrete 12” diameter or greater	Per pipe Design	AASHTO M170	WSDOT 9-05.7(2)	Standard Use; Large Diameter
Solid Wall High-Density Polyethylene (HPDE) Pipe, Heat Welded, Butt Fused	SDR 17	ASTM D 3350	City 9-05.23	Pipe Bursting or Steep Slope Installation
Profile Wall HDPE, Integral Bell Joints (Spirolite or engineer approved equal)	Per pipe design, minimum class 100	ASTM F894 ASTM F477 ASTM D3350	Requires prior approval from Environmental Services. Additional design requirements may apply.	Large Diameter

4.4 Pipe Depth

The standard depth for new stormwater and wastewater conveyance systems is shown in City Standard Plans DR-04 and DR-05.

4.5 Pipe Cover

The minimum pipe cover is 3 feet unless otherwise specified by the pipe manufacturer. All pipe shall be designed using an HS-20 loading criteria. Pipe cover is measured from the finished grade elevation down to the top of the outside surface of the pipe.

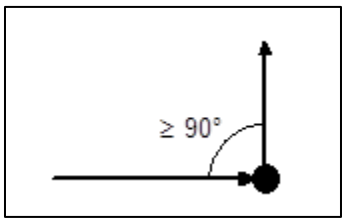
4.6 Pipe Alignment

The standard alignment for new stormwater conveyance system and wastewater sewers is shown on City Standard Plans DR-04 and. DR-05.

Pipes shall be laid true to line and grade with no curves, bends, or deflections in any direction.

The angle between any wastewater sewer mains entering or exiting a manhole should not be less than 90 degrees, as shown in Figure 5-1.

Figure 5-1: Wastewater Sewer Mains Entering or Exiting Manhole Angle



Where crossing an existing or proposed utility, the alignment of the stormwater or wastewater sewers shall be such that the two systems cross as close to perpendicular as possible.

Where the vertical separation of two parallel systems exceeds the horizontal separation, additional horizontal separation may be required to provide future access to the deeper system.

4.6.1 Pipe Casings

Casings shall be required for all pipes when the depth of fill, adjacent improvements or structures, heavy traffic or any other considerations would make conventional open trench replacement or repair work impractical. Some examples of improvements that would require a casing for stormwater or wastewater utilities are railroads, freeways, buildings, bridge abutments, retaining walls, structural slabs, and utility vaults. Requirements for casings include:

1. The casing material and joints shall be ductile iron or steel able to withstand the anticipated loadings.
2. The casing inside diameter shall be, at a minimum, 33% greater than the outside diameter of the carrier pipe or two standard pipe diameters larger than the carrier pipe, whichever is greater. However, the casing may need to be larger due to anticipated future upsizing of wastewater or stormwater sewer systems. Actual casing sizes will be specified by Environmental Services.
3. The casing shall be leak proof. The ends of the casing pipe shall be sealed to prevent entry of water.
4. An analysis shall be performed to determine if cathodic protection or an increase in thickness is necessary to guarantee the pipes will maintain structural integrity for a minimum of 100 years.
5. All casing pipe welds shall be inspected by a third party testing agency, including both 100% visual weld inspection and using a non-destructive testing method recommended by the testing agency.
6. The casing shall extend to a point outside the loading zone of influence.
7. Pre-manufactured non-metallic or non-corrosive casing spacers shall be used to support the carrier pipe in the casing to facilitate pipe removal/installation and to prevent vertical movement of the carrier pipe. Spacing devices shall

be sized to fit the casing pipe and installed in accordance with the manufacturer's recommendations.

8. The annular space between carrier pipe and casing may be required to be filled as specified by Environmental Services.

4.7 Pipe Couplings

Rigid Couplings, manufactured by Romac Industries, Inc., or City approved equal, shall be used at any pipe joint in which bell and spigot or fused joints are not used and when connecting two dissimilar pipe materials. Flexible couplings are not permitted.

4.8 Pipe Bedding, Backfill and Backfill Compaction

Pipe bedding and backfill shall conform to City Standard Plan SU-16. Backfill compaction shall conform to City Standard Plan SU-28.

4.9 Pipe Anchors

The following table shows criteria to be used in determining whether pipe anchoring is required. Anchor design shall be submitted to Environmental Services for approval.

Table 5-3: Pipe Anchor Requirements

Pipe Material	Pipe Slope Requiring Pipe Anchors	Minimum Anchor Spacing	Maximum Slope Allowed	Maximum Velocity at Full Flow
PVC[1]	≥20%	1 anchor per 100 L.F. of pipe	30%[3]	30 fps
Vitrified Clay[1]	≥10%	1 anchor per 50 L.F. of pipe	20%[3]	30 fps
Lined Ductile Iron[4]	≥40%	1 anchor per pipe section	None	None
Solid Wall HDPE[2]	≥50%	1 anchor per 100 L.F. of pipe - cross slope installations only	None	None
Concrete	10%	1 anchor per 50 L.F. of pipe	20%[3]	30 fps

1 Not allowed in landslide hazard areas.
2 Butt fused pipe joints required. Above-ground installation is required on slopes greater than 40% to minimize disturbance to steep slopes.
3 Maximum slope of 200% allowed for these pipes with no joints (one section) with structures at each end and properly grouted.
4 Restrained joints required on slopes greater than 25%. Above-ground installation is required on slopes greater than 40% to minimize disturbance to steep slopes.

4.10 Considerations for Future Development

The potential for future development shall be considered in the design of the stormwater and wastewater sewer systems. Environmental Services may require a change in the size and depth of the systems.

SECTION 5 Manhole Design Criteria

5.1 Manhole Locations

The maximum distance between manholes is 400 linear feet for the wastewater sewer system and 350 linear feet for stormwater conveyance system. For the stormwater system if the minimum slope requirement of 0.5% cannot be met, the maximum distance between manholes shall be 200 linear feet. In addition, manholes are required in the following locations:

- the intersection of any sewers;
- the dead end of a conveyance system;
- any alignment or grade changes;
- catch basin lead connections;
- any connection of private side sewers that are at equal or greater size than the public sewer; or
- as otherwise required by Environmental Services.

5.2 Manhole Types

All manholes shall either be Type 1 or 2 concrete manholes with concentric cones as shown on the City Standard Plans SU-17 and SU-18. The use of Type 3 concrete manholes requires prior approval from Environmental Services. The use of non-concrete manholes requires prior approval from Environmental Services.

Manhole size shall be determined by pipe diameter and orientation at the manhole. The engineer should verify that the manhole diameter is large enough to accommodate all incoming and outgoing pipes without jeopardizing the integrity of the manhole. City Standard Plans SU-17, SU-18, and SU-19 provide the minimum distance allowed between pipe openings.

A plan view of the manhole, drawn to scale, will be required when more than four pipes enter the structure on the same plane, or if angles of approach and clearance between pipes is of concern. The plan view (and section if necessary) must demonstrate the minimum distance requirements between knockouts per the City of Tacoma Standard Plans (SU-17, SU-18, or SU-19) can be maintained.

The bases of all manholes shall be channeled in accordance with City Standard Plans SU-17, SU-18, and SU-19. City manholes do not have sumps though some manholes, such as flow control manholes associated with the stormwater system, may contain sumps.

5.3 Manhole Covers

All manhole frames and covers shall be as shown on City Standard Plan SU-22.

All manholes located in sidewalk sections shall have a solid locking cover. The sidewalk section shall be a minimum of 6 inches thick in the vicinity of the manhole.

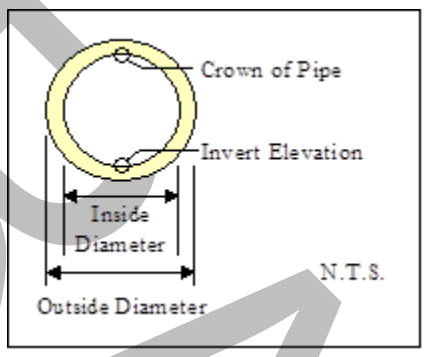
Other manholes needing solid locking covers may be identified through the City of Tacoma review/design process on a case-by-case basis. Examples where locking manhole lids might be required include: floodplains, sidewalks, gulches, undeveloped ROWs, and other low drainage areas (to prevent inflow of stormwater).

5.4 Connections to Manholes

Where connecting two or more mains of equal size to a manhole, the invert elevations of the upstream pipes shall be 0.1 foot higher than the invert elevation of the downstream pipe.

Where connecting two or more mains of different diameters, the invert elevations shall be located such that the crown of all of the pipes are at the same elevation (refer to Figure 5-2). For the stormwater system, pipes of different diameters shall be aligned vertically in manholes by one of the following methods, listed in order of preference: match pipe crowns, match 80% diameters of pipes, match pipe inverts or use City approved drop inlet connection. Where inlet pipes are significantly higher than outlet pipes, special design features may be required.

Figure 5-2: Elevations Diagram when Connecting Mains of Different Diameters



Drop connections are not permitted for wastewater sewer mains or private side sewer connections to the City system unless otherwise approved by Environmental Services. Drop connections are permitted for catch basin leads. Catch basin leads shall connect below the cone of the manhole.

A flexible pipe-to-manhole connector shall be employed in all connections of all pipes to new precast concrete manholes to provide a watertight joint between the pipe and the manhole. The connector shall be “Kor-N-Seal” with “Wedge Korband”(Type 1 or 2 as required for pipe diameter) manufactured by NPC, Inc. based in Milford, New Hampshire or Environmental Services approved equal. The connectors shall be installed in accordance with the manufacturer’s recommendations.

Connections to existing brick manholes may be allowed on a case by case basis. Manhole replacement may be required by Environmental Services based upon the condition of the existing manhole.

SECTION 6 Catch Basins

The following criteria shall be used when designing a stormwater conveyance system that uses catch basins. Catch basins shall not be installed as part of the wastewater sewer system.

- Connections to the stormwater system shall be made at a structure. Tributary connections shall be made at 90 degrees to the main. Slight variations may be allowed.

- The maximum surface run between catch basins shall not exceed 350 feet. Catch basin locations shall be based upon the quantitative downstream analysis when required (see Section 2.2)
- Catch basin size shall be determined by pipe diameter and orientation at the structure. A plan view of the structure, drawn to scale, will be required when more than four pipes enter the structure on the same plane, or if angles of approach and clearance between pipes is of concern. The plan view (and sections if necessary) must demonstrate that the minimum distance requirements between knockouts per the City Standard Plans (SU-17, SU-18, SU-19) can be maintained.
- Catch basins shall be Type 1, Type 1L or Type 2 catch basins conforming to WSDOT Standard Plans B.5.2-01, B.5.4-01, or B.10.20-01.
- Type 1 and Type 1L basin heights shall not exceed 8 feet.
- Type 2 (48 inches minimum diameter) catch basins shall be used at the following locations or for the following situations:
  - when overall structure height exceeds 8 feet; or
  - when all pipes tying into the structure exceed the limits set for Type 1 structures.
- All Type 2 catch basins shall be specifically approved by Environmental Services.
- In sag conditions, a combination inlet per WSDOT Standard Plan B-25.20-01 is required.
- Catch basin grates shall be vaned grates per WSDOT Standard Plan B-30.30-01 or WSDOT Standard Plan B-30.40-01.
- Where existing catch basins are modified, grates may be required to be replaced with vaned grates. Environmental Services will make the final determination based on the condition of the existing grate.
- To accommodate maintenance, do not place quarry spalls around catch basin inlet.
- The maximum slope of ground surface for a radius of 5 feet around a catch basin grate shall be 3:1. The preferred slope is 5:1 to facilitate maintenance access.
- Catch basins shall be designed for H-20 loading.
- Catch basin leads shall be no longer than 50 feet unless specifically approved by Environmental Services.
- Catch basins shall be located:
  - such that the inlet is placed next to the face of the curb and at an elevation to collect stormwater runoff (the structure offset shown on the plans shall be to center of grate, not center of structure to ensure grate location is appropriate);
  - at the low point of any sag vertical curve or grade break where the grade of roadway transitions from a negative to a positive grade;
  - prior to any intersection such that a minimal amount of water flows across the intersection, through a curb ramp, or around a street return;
  - prior to transitions from a typical crown to a full warp through a downhill grade; or
  - upstream of curb ramps outside of the wing of the curb ramp.
- Catch basins shall not be located:
  - in areas of expected pedestrian traffic;
  - in crosswalks;

- in the wheel path of vehicles;
- in driveways;
- in graveled areas or high sediment generating areas unless pretreatment is provided (reference SWMM, Volume 5); or
- where they will conflict with other utilities.

- Where the City of Tacoma Curb Ramp Installation Matrix or other departmental review or requirements require a new curb ramp, a replacement of a curb ramp, or an upgrade to a curb ramp, drainage shall be provided to ensure water does not flow across the curb ramp. This may require the installation of new catch basins, the removal and replacement of existing catch basins or other revisions to the stormwater system as necessary to ensure appropriate stormwater mitigation.
- All catch basins, inlets, etc. shall be marked as follows. Environmental Services stocks some curb markers. Contact Environmental Services at 253.591.5588 to determine if curb markers are available for a given project.
  - "Dump no waste. Drains to Stream"; or
  - "Dump no waste. Drains to Sound."
- Changes in pipe direction, or increases or decreases in pipe size shall only be allowed at structures.
- For Type 1 and 1L, catch basin to catch basin connections shall not be allowed.
- Bubble up systems shall not be allowed.
- Connections to catch basins shall use sand collars.

SECTION 7 Low Pressure Grinder Pump Wastewater Systems

The use of a low pressure grinder pump wastewater system may be an alternative to conventional gravity wastewater system only if the site cannot be serviced by a conventional gravity system due to topography. Grinder pump systems consist of using individual grinder pumps for each parcel served which are connected to a shared pressure pipe then discharged to a gravity wastewater system. These systems require prior approval from Environmental Services.

Grinder pump systems shall be designed in accordance with the Washington State Department of Ecology Criteria for Sewage Works Design. Additional design criteria may apply based on site specific conditions and layouts of the site to be served.

All shared pressure pipes shall be publicly owned. Pressure pipes and grinder pumps servicing each individual parcel shall be privately owned to the point of connection to the shared pressure pipe. Property owners are responsible for repair, replacement, and maintenance of the service line, tanks, pumps, alarms, etc.

Environmental Services may limit the number of grinder pumps discharging into the public gravity system or may require the installation of corrosion protection on downstream pipes or manholes. The length of the system requiring corrosion protection will depend on the specific site, materials of the existing downstream system, and the number of grinder pumps installed.

Low pressure systems shall follow all applicable requirements for locations, easements, separation from other utilities, etc. as identified in this Manual.

The type and model of pumps shall be the same for all parcels served in the system unless otherwise approved by Environmental Services.

Privately owned pumps and tanks shall be located outside the dedicated public right-of-way areas. A covenant and easement agreement is required for the proposed pump system to ensure proper maintenance and inform future property owners of the requirements of being served by this type of system. The covenant and easement agreement also provides information regarding which type and size of pump is acceptable for replacement to ensure the system remains in good working condition for all future property owners. The document shall be recorded to title. The City shall review and approve all covenant and easement agreements before they are signed and recorded.

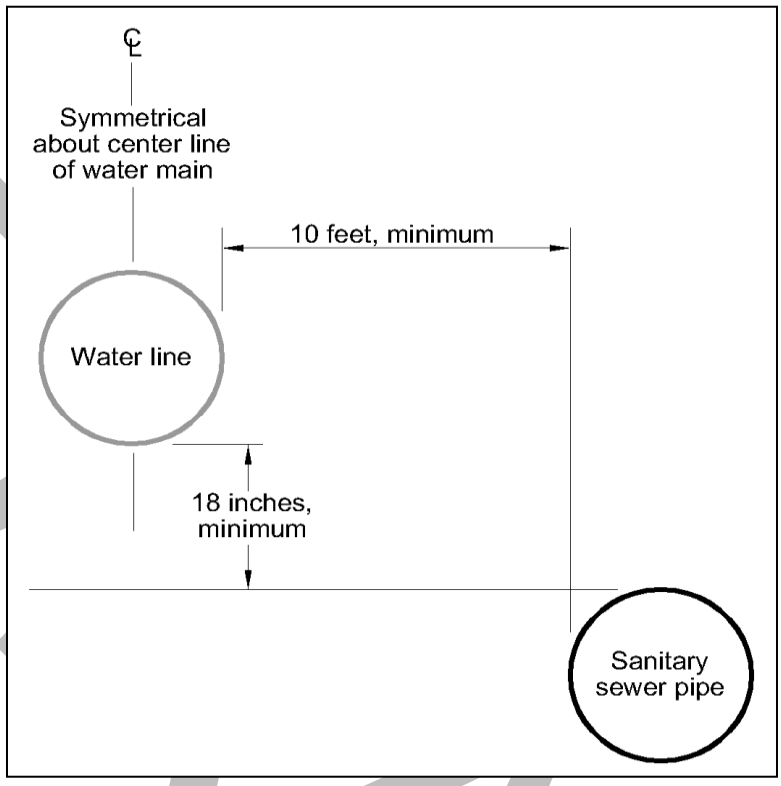
SECTION 8 Open Channel Design Criteria

The stormwater conveyance system may have open channel flow. See SWMM, Volume 3 for design criteria specific to open channel flow.

SECTION 9 Separation Requirements

- Separation between manholes and other structures (vaults, light poles, buildings, retaining walls, etc.) shall be a minimum of 10 feet.
- A minimum of 5 feet horizontal separation shall be maintained between wastewater sewers and stormwater mains, wastewater sewers and other wastewater sewers, stormwater mains and other stormwater mains, stormwater mains and wastewater side sewers that run parallel to mains, wastewater sewers and wastewater side sewers that run parallel to mains.
- A minimum of 10 feet horizontal separation and 18 inches vertical separation shall be maintained between all gravity wastewater conveyance systems and potable water pipes or as otherwise directed by Tacoma Water. (Figure 5-3)
- A minimum of 5 feet horizontal separation shall be maintained between the stormwater conveyance system and water pipes or as otherwise directed by Tacoma Water.
- Gravity wastewater conveyance pipes not meeting the minimum separation requirements and all pressurized wastewater pipes shall be designed in accordance with the Department of Ecology's Criteria for Sewage Works Design.
- Horizontal separation requirements from wastewater side sewers shall comply with the Side Sewer Manual.
- The distance between utilities shall be measured from edge of pipe to edge of pipe.

Figure 5-3: Separation Requirements



SECTION 10 Access and Easements

See Chapter 9 of this Manual for additional information concerning ROW and easements.

Maintenance access shall be provided for all City-owned facilities and conveyance systems. A minimum 15 foot wide access easement shall be provided to manholes not accessible via a public utility easement. The access easement shall have a minimum 12 foot wide crushed rock or hot mix asphalt surface. The access may consist of hot mix asphalt with a maximum grade of 15% or crushed surfacing base course with a maximum grade of 12%. Hot mix asphalt shall be a minimum thickness of 2 inches and in accordance with City Special Provision 5-04 and WSDOT Specification 5-04. Crushed surfacing base course shall be a minimum thickness of 3 inches and in accordance with WSDOT Specification 9-03.9(3). If access is required over sidewalks, sidewalks shall be designed for HS-20 loading.

Public easement are easements granted by private entities to the City for access, maintenance, and protection of City infrastructure.

For easements dedicated to the City for the purpose of stormwater systems or wastewater sewers, the following typically applies. The actual easement document will contain all applicable restrictions or allowances.

No permanent structures(s) shall be erected within the easement area(s) unless specifically approved in writing by the Director of Environmental Services. Permanent structures shall mean any concrete foundation, concrete slab, wall, rockery, building, deck, and overhanging structures, fill material, recreational sport courts, carports, portable sheds, private utilities,

fences, or other site improvement that will unreasonably interfere with the need to access or construct utilities in said easements(s). Permanent structures shall not mean improvements such as normal landscaping, asphalt paving, gravel, or other similar site improvements that do not prevent the access of people, materials, and machinery across, along, and within the said easement area. Land restoration by the City within the said easement area will be strictly limited to grass seed, grass sod, and/or asphalt replacement unless otherwise determined by the City.

Preliminary project planning should take into account the potential loss of buildable area or the need to purchase more property as a result of stormwater facilities and wastewater sewers and their associated necessary easements/tracts.

All publicly maintained wastewater sewers and stormwater conveyance systems shall be located in dedicated tracts, public easements, or public right-of-ways. All pipes and channels shall be centered within the easement. Easement widths may be increased for pipes greater than 3 feet in diameter and channels with top widths greater than 5 feet. The depth or proximity of steep slopes to the public system may necessitate a larger easement requirement for future excavation and maintenance purposes. See Table 5-4 and Table 5-5 below for appropriate easement widths based upon depth of pipe.

Public wastewater sewer easements shall conform to the following table:

Table 5-4: Wastewater Sewer Easement Width Requirements

Invert Depth	Width
Less than 10 feet	20 feet
10 to 15 feet	25 feet
15 to 20 feet	30 feet
Greater than 20 feet	40 feet

Notes:
* Greater width may be required for large diameter pipe or unfavorable site conditions.
* Pipe shall be installed in center of easement.
* If two public pipes are to be installed in an easement, add 10 feet to the easement widths listed above. Use the deeper of the two pipes in selecting the easement width from this table.

Public stormwater easements shall be a minimum of 20 feet in width and conform to table below.

Table 5-5: Stormwater Conveyance System Easement Width Requirements

Channel Width	Easement Width
Channels less than or equal to 10 feet wide	Channel Width + 15’ on one side
Channels greater than 10 feet wide	Channel Width + 15’ on both sides
Pipe Invert Depth	**Easement Width**
Less than 10 feet	20 feet
10 to 15 feet	25 feet
15 to 20 feet	30 feet
Greater than 20 feet	40 feet

Notes:
* Greater width may be required for large diameter pipe or unfavorable site conditions.

* Pipe shall be installed at center of easement.
* If two public pipes are to be installed in an easement, add 10 feet to the easement widths listed above. Use the deeper of the two pipes in selecting the easement width from this table. Install pipes with 10 feet of horizontal clearance between them.

6 CHAPTER 6
ILLUMINATION

INTRODUCTION

Illumination in the public ROW improves both traffic safety and individual safety along streets, sidewalks, and trails by allowing for visual perception of conditions and potential hazards throughout all hours of the day. Illumination plans may be required for a variety of reasons depending on varying environments encountered throughout the City.

Tacoma Municipal Code (TMC) sections 13.04, 13.06(A), and 13.07 provide regulatory authority for streetlighting for new plats, illumination within certain zoning districts, and streetlighting within landmarks and historic special review and conservation districts, respectively. TMC sections 10.14 and 10.22 provide regulatory authority for streetlight provisions when placing or relocating driveways, and when working in the ROW in general, respectively. When TMC requirements trigger offsite improvements, streetlighting will also be addressed as a part of these improvements. This includes but not limited to:

- New plats shall be required to install streetlights in accordance with TMC 13.04.165.
- New developments on arterial streets shall be required to install new streetlights or upgrade existing streetlights to current standards.
- High-density development on non-arterial streets shall be required to install new streetlights or upgrade existing streetlights to current standards when recommended by the City Engineer.
- High-density and/or commercial developments shall be required to install new streetlights or upgrade existing streetlights to current standards when recommended by the City Engineer.
- Projects in mixed-use centers and/or designated business districts shall be required to install new streetlights or upgrade existing streetlights to current standards.
- Projects on core pedestrian streets shall be required to install new streetlights or upgrade existing streetlights to current standards.
- Projects within landmarks and historic special review and conservation districts may be subject to streetlighting requirements specific to that district in accordance with TMC 13.07.120.
- Projects involving undergrounding Tacoma Power's existing overhead infrastructure on which City streetlights are mounted shall be required to upgrade streetlights to current standards.
- Low-density development for which streetlights are not required may still be required to install conduit for future streetlights where there is new or upgraded street frontage.
- New or replaced driveways and newly paved planting strips shall provide conduit for future streetlights in accordance with TMC 10.14.070.

When private funding (or third-party public funding used for development) is involved in streetlighting, the permitting, design, and construction elements are an integral part of the ROW Construction Permit, a Local Improvement District project, or a specific capital improvement project. Third-party design and implementation of City-owned streetlight infrastructure must be closely coordinated with the Traffic Engineering Section of the Engineering Division throughout the process as outlined in Chapter 2 of this Manual and shall conform to the design requirements in this section.

SECTION 1 ILLUMINATION IN THE RIGHT-OF-WAY

1.1 Construction and Inspection

All construction shall be in conformance with National Electric Code and the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions.

If the project has been approved through a ROW Construction Permit, the applicant will be responsible for obtaining a licensed electrical contractor for the installation of the streetlights. The applicant will also be responsible for project management; including scheduling and coordinating work between the various contractors and utilities. Additionally, the applicant shall be responsible for coordinating the location of underground utilities and identifying conflicts in the location of these utilities. Before beginning work, the City will locate all streetlights and junction boxes as a part of the one-call (811) service.

The contractor shall notify the City Streetlight Inspector for inspection of the work:

- before conduit is buried;
- before placing streetlight, service, or cabinet foundations ("Ufer," supplemental grounding, and all grounding connections must be in place);
- before placing concrete adjacent to junction boxes (the contractor is responsible for determining proper grades);
- when construction is substantially complete; and
- as a part of final inspection of the streetlight system.

1.2 Project Completion

Before project closeout, the City will notify the applicant that the final inspection has passed and that the City has found the streetlighting complete and operational. At this time, the City will accept the streetlights, which will be operated and maintained by the City.

Acceptance of the streetlighting system is one of the requirements for final plat approval.

SECTION 2 Illumination Design

The first step to providing illumination design in the ROW is to assess the existing condition in relation to the lighting requirements for a particular project.

When required, illumination in the ROW must meet design criteria described in the latest version of IES' American National Standard Practice for Roadway Lighting (IESNA RP-8) or AASHTO's Roadway Lighting Design Guide. Pavement classification, road and pedestrian conflict areas and other design assumptions must be clearly stated in the illumination memo or photometric plan sheet.

Other design criteria may be substituted in specific cases when approved by the City Traffic Engineer.

When a photometric analysis is provided, luminaire fixture types, mounting heights and locations (pole and luminaire arm length) must be labeled accordingly in the document.

AGi32 is the preferred and recommended software for illumination analysis. When AGi32 is utilized, electronic project files shall be submitted to the City Traffic Engineer.

2.1 Lighting Zones

Illumination in the ROW shall meet the project design criteria as determined above, but not to the detriment of the surrounding property, land use context, and environment. Light trespass outside of the project area, either across property lines or wasted upward, shall be addressed. At a minimum, the surrounding uses will require Backlight, Uplight, Glare (BUG) ratings to be specified in the project plans in accordance with this section.

BUG ratings are defined by the IES to classify light fixtures based on the percentage of light emanating in specific directions from the fixture. The lower a rating, the less light escapes creating backlight, uplight, and glare respectively. The higher a rating, the less desirable the fixture is when considering the surrounding environment.

To determine appropriate BUG ratings for specific projects, consider the adjacent property. A Lighting Zone (LZ) classifies areas based on their tolerance for light trespass.

IES generally defines five LZs:

2.1.1 LZ0: No Ambient Lighting

Applied to areas where the natural environment will be seriously and adversely affected by lighting. Impacts include disturbing the biological cycles of flora and fauna and/or detracting from human enjoyment and appreciation of the natural environment. Human activity is subordinate in importance to nature. The vision of human residents and users is adapted to the darkness, and they expect to see little or no lighting. When not needed, lighting should be extinguished.

2.1.2 LZ1: Low Ambient Lighting

Applied to areas where lighting might adversely affect flora and fauna or disturb the character of the area. The vision of human residents and users is adapted to low light levels. Lighting may be used for safety and convenience but it is not necessarily uniform or continuous. After curfew, most lighting should be extinguished or reduced as activity levels decline.

2.1.3 LZ2: Moderate Ambient Lighting

Applied to areas of human activity where the vision of human residents and users is adapted to moderate light levels. Lighting may typically be used for safety and convenience but it is not necessarily uniform or continuous. After curfew, lighting may be extinguished or reduced as activity levels decline.

2.1.4 LZ3: Moderately High Ambient Lighting

Applied to areas of human activity where the vision of human residents and users is adapted to moderately high light levels. Lighting is generally desired for safety, security and/or convenience and it is often uniform and/or continuous. After

curfew, lighting may be extinguished or reduced in most areas as activity levels decline.

2.1.5 LZ4: High Ambient Lighting

Applied to areas of human activity where the vision of human residents and users is adapted to high light levels. Lighting is generally considered necessary for safety, security and/or convenience and it is mostly uniform and/or continuous. After curfew, lighting may be extinguished or reduced in some areas as activity levels decline.

As shown in Table 6-1, lighting in the ROW shall meet the following BUG ratings where adjacent to the following LZs.

Table 6-1: BUG Ratings

Lighting Zone	Examples	Maximum BUG Rating	
		Cobraheads and Overhead	Ornamental Lighting
LZ-0	Nature preserves, wilderness areas	Not Applicable within Tacoma	
LZ-1	Low-density residential	B1-U0-G1	B1-U3-G1
LZ-2	Medium- and high-density residential; Along arterials and within mixed-use centers; and Mixed-use and light commercial outside of specified commercial areas.	B2-U1-G2	B2-U3-G2
LZ-3	City-defined business districts and downtown; and Areas around Tacoma Mall, transit centers, and major public facilities.	B3-U1-G3	B3-U3-G3
LZ-4	Theater District and Dome District vicinities	B3-U1-G3	B3-U4-G3

For projects spanning multiple LZs, consult with the Traffic Engineering Section of the Engineering Division. Additional back cut-offs/shields shall only be utilized as allowed by the Traffic Engineering Section and per manufacturer's recommendations.

2.2 Luminaire Spacing

Luminaire spacing is a function of fixture type, mounting height, lateral location, and roadway corridor elements such as width, material, and other environmental conditions. Required spacing is based on the photometric analysis provided. With residential plats, typical luminaire spacing is 150 feet maximum, center-to-center, using Type II distributions at a mounting height of 30 feet. Typical spacing for ornamental post-top luminaires is 100 feet center-to-center.

Regardless of the spacing schedule or photometric analysis, all light standards shall be located a minimum of 5 feet from driveways and 3 feet from the curb face. Light standards shall be placed on property lines whenever possible, minimizing utility conflicts, and not interfering with accessible paths.

2.3 Typical Light Standards and Fixtures

Typical light standards throughout the City include metal pole standards as specified in Section 9-29.6 of the WSDOT Standard Specifications for Road, Bridge, and Municipal

Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions.

The City of Tacoma Universal Pole standard and Section 9-29.6 specifications apply to new construction on most arterials and commercial areas. General criteria include:

- 30 or 40 foot metal octagonal or round tapered pole with flush handhole
  - Handholes shall not be narrower than 3.5 inches in length or width.
- Fixed base foundation per City Standard Plans
  - Anchor bolts shall not be buried below grade or grouted over such that access to the bolts is restricted.
- Luminaire arm with approximately 2 foot rise utilizing a three-bolt flanged connection per City Standard Plans
  - Banding or clamp-style attachments to poles will not be permitted unless approved by the City Traffic Engineer.
- Rain-tight pole cap

On all new construction and when replacing two or more existing fixtures, LED lights shall be used unless a detailed cost estimate is provided showing the overall lighting cost with LEDs is greater than 20% of the overall lighting cost without LEDs. Metal halide fixtures shall not be used.

At the time of this publication, all LED cobrahead fixtures shall be one of the following unless otherwise approved:

- Beta/Cree – XSP/XSPR series and LEDway series
- Leotek – GreenCobra series
- GE – Evolve series
- American Electric Lighting/Holophane – Autobahn series

All fixtures shall have the following features:

- Tool-less entry
- National Electrical Manufacturers Association (NEMA) 7-pin LED-compatible Photocell Receptacle
  - Photocell shall have a 20-year design life
- Time Delay Fuse (in fixture)

Fixture optics shall meet the following criteria:

- Color Correlated Temperature from 4000 K to 5300 K
- Minimum Color Rendering Index of 70
- See the Lighting Zones section for BUG ratings

At the time of this publication, the standard pedestrian-scale ornamental light consists of an exposed-aggregate concrete post (13 feet, direct bury with 3" tenon) topped with a Holophane GranVille II LED Classic Standard:

- Housing – black GranVille II LED with leaf style swing open design (3 inch diameter tenon)
- Accessories – black standard finial without trim
- Auto-sensing voltage (120-277 V) with wattage based on design
- 4000K color temperature with optics pattern based on design

Otherwise, certain business districts, mixed-use centers, and historic/residential areas have specific decorative light standards unique to the designated area. Coordinate with the City Traffic Engineer for specific use of light standards in these areas. Use of LED ornamental lights shall be approved by the City Traffic Engineer prior to incorporation into the project. A product sample may be required to access quality, durability, and ease of maintenance.

When timber poles are allowed by the City Traffic Engineer, they shall be Class II with single-point luminaire arm connections per City Standard Plans. When attaching a cobrahead luminaire to an existing utility pole, City crews will perform that body of work at the applicant's expense.

2.4 Conduit and Electrical Design

The City still has series lighting circuits in some areas. Contact the Traffic Engineering Section of the Engineering Division before beginning any electrical design.

All streetlight conductors shall meet the requirements of Section 9-29 of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions.

All streetlight conduit shall be 1¼ inch in diameter. Conduit installed under streets and commercial driveways shall be PVC Schedule 80 pipe. Conduit installed behind the sidewalk shall be PVC Schedule 40 pipe. Refer to Sections 8-20.3(5) and 9-29.1 of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions for construction and material details, respectively.

Each streetlight circuit should have a maximum of 20 lights unless otherwise approved. Wire shall be maximum #6 gage or minimum #8 gauge stranded copper wire unless otherwise approved.

Traffic signal controller service wire and streetlight wire may share a conduit and junction box.

Junction boxes shall meet the requirements of Section 9-29.2 of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions. A WSDOT Type 1 standard duty junction box with alternative 2

locking lid shall be utilized per WSDOT Standard Plan J-40.10-03, unless otherwise approved by the City Traffic Engineer.

Junction boxes shall be provided at each end of a roadway crossing and within several feet of each streetlight pole, no matter the pole spacing.

SECTION 3 Electrical Service Components

Service enclosures and load centers shall be exterior (NEMA 3R) rated. Unless power outlets or other equipment unrelated to illumination in the ROW are connected to the City's streetlight circuits, a power meter shall not be provided.

7 CHAPTER 7
TRAFFIC SIGNALIZATION

INTRODUCTION

Traffic signals and warning beacons are the most accepted and widely used traffic control devices approved by FHWA and the MUTCD when conveying "right-of-way" and other traffic control messages at more traveled at-grade intersections/conflict points in any corridor open to public use. Their reliability and consistency in appearance and application is a vital part of maintaining a safe public ROW for all users. TMC Title 10 – Public Works and Title 11 – Traffic establish additional authority for permitting and specific uses of these facilities in the City.

When private funding (or third-party public funding used for development) is involved in traffic signalization or installation of warning beacons, the permitting, design, and construction elements are an integral part of either the ROW Construction Permit or a Local Improvement District project. Third-party design and implementation of City-owned traffic signal infrastructure must be closely coordinated with the Traffic Engineering Section of the Engineering Division throughout the process as outlined in Chapter 2 of this manual.

ROW Construction Permits, as well as Local Improvement District and City-designed/funded projects must adhere to the design requirements and policy stated and referenced herein.

For all signal work, no matter how limited the scope, the engineer is encouraged to schedule a pre-design meeting with the Traffic Engineering Section of the Engineering Division to review specific traffic signalization design requirements.

For all construction involving arterial roadways and/or curb ramps, a design meeting shall be set up with the assigned Traffic Engineering Section of the Engineering Division and the ADA Coordinator to discuss accessible pedestrian signals (i.e. pushbutton) needs and potential issues between pedestrian circulation and electrical equipment.

SECTION 1 PERMITTING FOR WARNING BEACONS AND TRAFFIC SIGNALIZATION

1.1 Construction and Inspection

All construction shall be in conformance with National Electric Code and the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions. All construction must be performed by a licensed electrical contractor.

A City Traffic Signal Inspector will be assigned to inspect the traffic signalization project and assist the assigned City Construction Inspector. All signal equipment shall be field located by the City Traffic Signal Inspector.

Controller equipment purchased by the applicant shall be delivered to the City Signal Shop for testing prior to installation. All cabinet hardware shall be tested, programmed, and landed by City staff at the expense of the project.

1.2 Project Completion

The applicant shall provide warranty(s) for all electrical and mechanical equipment, and strain poles and signal standards for satisfactory in service operation for one year

following project acceptance. Warranty shall include troubleshooting, labor, materials and all other costs to bring the equipment to a satisfactory level of service. Normal maintenance is not included in the warranty.

SECTION 2 Traffic Signalization Plans

The engineer should refer to Chapter 3 for general requirements regarding the plan format.

Plan sheets for a work order involving traffic signalization shall show all existing features and identify all pavement removal. The plans shall provide a traffic signalization plan and show all applicable details on the plan. Details include but are not limited to:

- proposed channelization;
- sidewalks and curb ramps;
- above- and below-ground utilities;
- detection devices;
- signal phasing diagram per standard;
- preemption requirements;
- intersection illumination; and
- any available speed and traffic information.

Where applicable, the plan shall also provide a signal schematic and wiring diagram, signal mast arm/pole attachment, and foundation design schedules.

SECTION 3 Signalization Design

Traffic signal design in the city shall conform to MUTCD, state, and federal law requirements; the latest AASHTO Policy; National Electrical Code; and all applicable City of Tacoma General Special Provisions and Standard Plans. At the time of publication, construction and material details concerning signalization design are contained in Section 8-20 and 9-29 of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions.

3.1 Typical Signal Supports

The standard traffic signal design consists of cantilevered mast arm signal poles with luminaire extensions (WSDOT Type 3) surrounded by other satellite posts to meet ADA and MUTCD standards (WSDOT Types PPB and 1). Other standards may be approved by the City Traffic Engineer for specific applications, such as vertical shaft standards for shoulder-mounted displays (WSDOT Type 1) and strain poles for span wire installation (WSDOT Types 4 and 5).

All new signals or an existing signal rebuild shall be mast arm construction unless a detailed cost estimate submitted for review shows the estimated mast arm replacement costs more than 20% over rebuilding those existing components.

Pole placement should consider competing factors, such as utility conflicts (both above and below ground), roadside clearance, minimizing mast arm length, construction

feasibility (present and future plans), ease of maintenance, and ADA/pedestrian access effects, while meeting signal face visibility requirements in the MUTCD.

A minimum 10 foot clearance is required from overhead power systems rated 50 kilovolts or below. Additional clearance is required for higher voltages.

Most poles and their attachments should not be within 3 feet of the curb face nor within 5 feet of a driveway. Pedestrian pushbutton poles shall not be closer than 5 feet to the curb face unless approved by the City Traffic Engineer.

Any poles used for pedestrian pushbuttons should be within 5 feet of the extension of the crosswalk line and within 6 feet of the curb face when feasible. When 6 feet from the curb is not feasible, all pushbuttons shall be mounted within 10 feet of the curb face. Reference Section 3.4 for more information.

Mast arm length should be kept to a minimum and designs exceeding 50 feet will require preapproval by the City Traffic Engineer. Mast arm length and pole placement should consider future signal phasing, lane configurations, and equipment upgrades. Poles should be placed so technicians working in and around them are not unduly exposed to traffic and other hazards. Handholes should be accessible to staff, but secure. The head of handhold security bolt must be flush with face of plate, and the face plate of handhole must be flush with pole.

Poles supporting multiple traffic signal appurtenances should be considered as long as mounting locations for specific federal requirements are not compromised. Three poles on any one intersection corner should be feasible in most applications, e.g., two pushbutton posts and one mast arm support with all signal displays or two Type I poles with a pushbutton and pedestrian signal each and one mast arm support with no pedestrian appurtenances.

Poles mounted for the primary vehicular signals should allow those signals to be located between 40 feet and 180 feet of the stop bar location.

For specific foundation and attachment details, see the City of Tacoma Standard Plans and WSDOT Standard Plans.

3.2 Typical Signal Displays

Traffic signal displays must conform to the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions and other WSDOT and MUTCD requirements.

Two separate indications for the primary movement on each approach shall be provided. Vehicular signal heads should be placed overhead in line with the applicable vehicular movement into the intersection where feasible, but mounted no closer than 8 feet from other signal heads. Turning/shared-face vehicle signal heads may be placed over the applicable lane line. Care should be taken to avoid blocking another approach's signal faces.

Bimodal vehicular signal heads shall not be utilized unless otherwise approved by the City Traffic Engineer. All vehicular indications shall be 12 inch LED, and all signal heads shall have aluminum housing. All new signal heads installed on mast arms shall have backplates with a 1 inch wide yellow border and be attached using a WSDOT Type M mount.

LED 8 inch displays are reserved for specific uses such as bike-only indications, emergency signals, warning beacons, and as otherwise approved by the City Traffic Engineer.

When a left-turn protective/permissive phase is added as part of a traffic signal modification or on new construction, the indication shall be a flashing yellow arrow, unless otherwise approved by the City Traffic Engineer.

Pedestrian signal heads shall conform to Section 9-29.20 of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions. New pedestrian signals shall utilize an aluminum housing, single-section clamshell-style mount with hand/man indications accompanied by a countdown display during the 'DON'T WALK' interval.

Pedestrian signal heads shall be located between 7 and 10 feet above the receiving sidewalk area and clearly visible from the opposite curb ramp area served by the pedestrian signal.

3.3 Vehicular Detection Systems

New detection systems should be non-intrusive and aerial-mounted, selected in coordination with the City Traffic Engineer. All new and modified detection systems shall be capable of bicycle detection to comply with RCW 47.36.025. Detection systems shall conform to Section 9-29.18 of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions.

At the time of publication, acceptable detection systems include:

- Thermal detection: FLIR camera with Traficon in-cabinet hardware
- Infrared detection: Leddar™ d-tec system
- Microwave detection: Wavetronix SmartSensor Matrix™ system
- Fisheye camera detection: Aldis GridSmart system

Not all systems work well in all locations; it varies based on topography and other environmental conditions. The designer should analyze the design constraints specific to the intersection and provide the best system for the application. A letter should be provided from the manufacturer/supplier certifying that the physical conditions do not prohibit the proper performance of the proposed system.

Replacement of existing induction loops will be allowed for modifications to existing signal locations involving four or fewer affected loops. However, wireless in-road detection systems such as the Sensys Networks Inc. system are the preferred

replacements to induction loops when non-intrusive systems cannot be used. Loops shall be placed only in new asphalt or concrete or a section receiving a minimum 2 inch overlay.

A fee in lieu of loop replacement, based on the estimated replacement costs, may be an option for the applicant for certain situations. Contact the Traffic Engineering Section of the Engineering Division for discussion of this topic.

When Sensys Networks Inc. system is the selected option, the MicroRadar™ sensor must be used for stopbar detection (VSN240-M per manufacturer's recommendations) and magnetometers may be used for other detection zones (VSN240-T).

When five or more affected induction loops are concentrated on a single intersection approach, a non-intrusive device should be used to replace the entire approach's detection.

Consideration should be given to the amount of room in the controller cabinet to accommodate the detection system. At some existing traffic signal locations, an upgrade to a P-sized cabinet may be required.

3.4 Pedestrian Systems

When prescribed by City ADA policy and PROWAG, new pedestrian systems shall be fully compliant with MUTCD and PROWAG APS requirements.

As stated in Section 3.1, pole and support locations shall allow for pedestrian pushbuttons to be located meeting MUTCD and ADA standards. For optimal maintenance and use, the designer should ensure:

- Pushbutton posts shall be a minimum of 5 feet from the curb face.
  - Placement as close as 1.5 feet from the curb face will be allowed if it is demonstrated during design to be protected from potential knockdown and damage.
  - Placement any farther than 10 feet from the curb face will not be allowed.
- Pushbuttons should be within 5 feet of the extension of the crosswalk line and within reach of an ADA-compliant clear space, see Pedestrian Facilities Chapter
  - Target height is 3.5 feet above grade; 4 feet is the maximum height
- All pushbuttons are oriented with the face of pushbutton and sign assembly parallel to the corresponding crosswalk

The new APS system must be programmable/customizable by the end user with in-cabinet controls. The APS system must be capable of providing user-programmed vocal messages. Four-wire connection to controls in pedestrian heads is not allowed.

New pedestrian signage at the pushbutton shall include MUTCD's R10-3b sign at 9 inches by 12 inches.

Consideration should be given to the amount of room in the controller cabinet to accommodate the APS system. At some existing traffic signal locations, an upgrade to a P-sized cabinet may be required.

3.5 Preemption Systems

All signalized intersections must have emergency preemption systems. Emergency preemption systems shall utilize Opticom™ 700 Series Detectors, Model 760 Card Racks, and Model 764 Multimode Phase Selectors.

Rail and transit preemption systems must be designed in coordination with the City Traffic Engineer.

3.6 Conduit System

Conduit must conform to the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions.

All traffic signal conduit shall be 2 inch, except 1 inch conduit will be allowed when only a pushbutton post with one pushbutton is served. Conduit installed under streets and commercial driveways shall be PVC Schedule 80 pipe. Conduit installed behind the sidewalk shall be PVC Schedule 40 pipe.

Typically, install four 2 inch traffic signal conduits and one 1¼ inch streetlight conduit for each street crossing. However, conduit fill calculations must be provided and verified by the designer.

3.7 Junction Boxes

Junction boxes shall meet the requirements of Section 9-29 of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions.

All new/replaced junction boxes must meet one of the following criteria:

- WSDOT Type 1 standard duty junction box with alternative 2 locking lid shall be utilized per WSDOT Standard Plan J-40.10.
- WSDOT Type 2 standard duty junction box with alternative 2 locking lid shall be utilized per state WSDOT Standard Plan J-40.10 where connecting interconnect cable/conduit.
- Junction boxes exposed to vehicular traffic shall be heavy-duty. Junction boxes installed within an intersection radius and within 4 feet of the curb face shall be heavy-duty unless otherwise approved.
- Junction boxes larger than outlined above may only be utilized with prior approval from the City Traffic Engineer.

Junction boxes shall be provided at each end of a roadway crossing and within several feet of each pole, cabinet, and signal appurtenance to be served by conduit in the signal system. They should be kept outside of the pedestrian access route but still adjacent the sidewalk or other paved service. Any junction box located in the accessible route must have an ADA slip-resistant lid as defined by WSDOT Standard Specifications.

Standard size junction boxes shall be installed at the base of the pole for all service riser assemblies. Additionally, ground rod boxes are required for service riser assemblies. Standard size junction boxes shall also be installed at the base of the pole for a

communication riser assembly prior to entering the controller foundation due to the length of the run and/or drainage considerations.

Relocating junction boxes at a signalized intersection to avoid ADA curb ramp installation should be a last resort due to the amount of rewiring required.

3.8 Wire Specifications

All traffic signal and streetlight conductors and cable shall meet the requirements of Section 9-29.3 of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions.

Traffic signal controller service wire and streetlight wire may share a conduit and junction box.

Low voltage traffic signal cable consists of detection cable, interconnect cable, and pedestrian pushbutton cable. Unless otherwise directed by the City Traffic Engineer, low voltage traffic signal wiring may be combined in a single vault/junction box with five-conductor cable for traffic signal heads and other high voltage equipment.

A separate ground wire shall be installed in every conduit run.

All signal wiring shall be 5 conductor or 2 conductor 14 gauge stranded wire as described below:

- All wiring to signal heads shall be 5 conductor wire. For five section signals heads and bimodal (where approved) 2-5 conductor, 14 gauge wire shall be utilized.
- 5 conductor wire may not be split for high and low voltage in a single cable; separate 2 conductor shall be pulled for pushbuttons when sharing a common pole with a pedestrian head.
- A single 5 conductor wire may be split between two pedestrian heads on a common pole with a jumper across the neutral.

Opticom™ and detection wiring shall be per manufacturer's recommendations.

Splices of communication cable is not allowed. When communication cable or part of the interconnect system has been affected or compromised by construction, a new un-spliced communication cable shall be installed between cabinets.

3.9 Traffic Signal Controls, Cabinets, and Components

For traffic signal interoperability and in the interest of the traveling public and City investment, standardization of traffic signal cabinets and controllers is necessary. All traffic signal controller housings and components shall meet the requirements of Section 9-29 of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions. Specific equipment and requirements at this time include:

- Controller: Siemens M60 – Contact the City of Signal Shop at (253) 591-5287 to obtain the current firmware version
- Malfunction Management Unit shall be:

- Peek Double Diamond, Model TS2-MMU
- Eberle Design Inc., Model MMU-16LEip SmartMonitor® (where approved)
- Reno A&E, Model MMU-1600GE (where approved)

NEMA TS2, Type 2 P44 cabinets are required. A level area of 4 feet clearance shall be provided in front of cabinet opening as a safe work space for signal technicians.

As required by the City Traffic Engineer, an uninterruptible power supply battery backup system will be installed at signals within 300 feet of rail lines and in the vicinity of schools. See the City of Tacoma General Special Provisions for additional cabinet requirements.

3.10 Interconnect and Communications

Traffic signal communication systems and hardware shall conform to the following unless otherwise required by the design:

- Conduit shall be 2 inches in diameter at a minimum with 24 inch sweeps
- WSDOT Type 2 junction boxes for traffic signal interconnect
- Maximum 300 feet between pull locations
- Ethernet over copper switch – Actelis Networks ML684D with two SFP-LC ports or ML698 where four-way communication is required

New signals shall be physically connected underground and incorporated into the existing communications network.

SECTION 4 Warning Beacons

The method and type of warning beacon installation varies according to desired purpose. Selection of appropriate devices and their applications shall be coordinated with the Traffic Engineering Section of the Engineering Division.

4.1 Pedestrian-Actuated Warning Beacons

New installations of pedestrian-actuated warning beacons must utilize rectangular rapid flashing beacons (RRFBs) as interimly-approved by WSDOT and the FHWA. JSF Technologies' AB-9405 and compatible pushbuttons should be used for most applications. Additional emphasis as determined by the City Traffic Engineer may necessitate use of JSF Technologies' AB-9407 or an approved equal. Pushbuttons shall be located and oriented to meet ADA and MUTCD requirements. Selection of mounting equipment and posts should be coordinated with the Traffic Engineering Section of the Engineering Division and the City Signal Shop.

Warning beacons in advance of the pedestrian crossing shall not be RRFB, but they must communicate with the RRFB system to ensure concurrent operation. They shall be circular and in accordance with MUTCD requirements.

4.2 Continuously-Operating Warning Beacons

Warning beacons in continual flashing operation shall be circular and in accordance with MUTCD requirements. They include red stop beacons, school beacons, overhead

crosswalk beacons, and other miscellaneous yellow warning beacons. Selection of mounting equipment and posts should be coordinated with the Traffic Engineering Section of the Engineering Division and the City Signal Shop.

SECTION 5 Electrical Service

Service enclosures and load centers shall be exterior (NEMA 3R) rated. Unless power outlets or other equipment unrelated to signalization are connected to the City's circuit, a power meter shall not be provided.

The following list of equipment is preapproved at the time of publication, and all electrical service must conform to National Electrical Code and the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions.

8 CHAPTER 8
CHANNELIZATION AND SIGNING

INTRODUCTION

This chapter contains general requirements and design guidance for channelization and signing of roadways and paved trails within the public ROW. The intent of this information is to establish standard procedures to be used by applicants or their traffic engineering consultants during the design and plan preparation phases of a project and to supplement the guidance found in the latest edition of the MUTCD as adopted and amended by WAC 468-95.

SECTION 1 Common Terms

Below are terminology and definitions that will be used throughout this chapter and within the referenced standard plans:

Barrier Centerline – A very wide—18 inches minimum, usually 20 inches comprised of five 4 inch lines—solid yellow line or a combination of two single 4 inch solid yellow lines with yellow crosshatching between the lines, with a total width not less than 18 inches, used to separate opposing traffic movements where all movements over the line are prohibited.

Centerline – channelization that is yellow and indicates the transition between travel lanes in opposite directions; typically is composed of two 4 inch solid yellow stripes separated by 4 inches, but can also consist of a single yellow stripe with a skip pattern.

Crosswalk line – white pavement marking lines that identify a pedestrian crossing when utilized in a series.

Dotted Extension Line – A broken white or yellow line that is an extension of an edge line or centerline used at intersections, multiple turn lanes, and other locations where the direction of travel for through traffic is unclear.

Edge line/stripe – channelization that typically defines the right-side of a travel lane (when the stripe is white) adjacent to the edge of pavement but other applications can also include defining the left-side of a travel lane (when the stripe is yellow), and defining an on-street parallel parking lane.

Gore line/stripe – channelization that is white and used to delineate an exclusive use lane like a left-/right-turn lane; typically is 8 inches wide (i.e., twice the width of a typical lane line).

Lane line/stripe – channelization that is white and defines the width and number of travel lanes; pattern can include gaps in between solid striping or completely solid; typically is 4 inches wide (certain applications with respect to bike lanes warrant a 6 inch width)

Pavement Marking – A colored marking applied to the pavement to provide drivers with guidance and other information.

Pavement Paint – specially formulated material for use on roadways; typically sprayed or rolled onto the pavement surface at a thickness specified by the project; either waterborne- or solvent-based composition.

Stop line/bar – shall consist of solid white line (a minimum of 12 inches wide) extending across approach lanes to indicate the point at which a vehicle is intended or required to stop.

Thermoplastic – specially formulated material for use on roadways that is a mixture of glass beads, pigments, binder, and filler materials that when heated becomes liquid to facilitate application; either hydrocarbon- or alkyd-based composition.

Two-Way Left-Turn Centerline – Two yellow lines, one solid-pattern and one broken-pattern, used to delineate each side of a two-way left-turn lane (TWLTL).

SECTION 2 Project Initiation

2.1 Project Scope

The engineer/designer responsible for the channelization and/or signing design should obtain or develop a description of the project showing all proposed improvements and the limits of the project. The engineer/designer should be familiar with all aspects of the project.

2.2 Identification of Design Elements

The engineer/designer for the channelization/signing plans shall identify elements pertinent to the channelization and/or signing for the project. The following list provides guidance in carrying out this task:

- Consult design standards applicable to the design; a list of current design standards is included on the City's website.
- Elements of channelization will typically be dependent on the design speed for the roadway within the project (consult Chapter 4, Section 2.1 for information concerning the determination of the design speed). The engineer/designer shall verify with the City the design speed and posted speed limit for the roadway.
- As part of conforming with the project limits, the channelization and signing design shall also include elements needed to incorporate the new design with the existing channelization and signing elements on the roadway.
- Verify the channelization and/or signing materials to be used on the project. Generally, the following will apply:
  - Lane lines (including those for bikes), edge lines, gore lines, and centerlines can be implemented in paint or thermoplastic (all types), as specified for the project and in accordance with Section 9-34 of WSDOT Standard Specifications for Road, Bridge, and Municipal Construction.
  - Stop lines (bars), crosswalk lines, symbols, and word markings shall be thermoplastic, with the type (either A, B, C, but not D per Section 9-34 of WSDOT Standard Specifications for Road, Bridge, and Municipal Construction) specified for the project.
- Raised pavement markers shall be selectively used on projects dependent on the roadway type and channelization material specified for the project. Generally, WSDOT Type 1 (non-reflective) raised pavement markers will only be used with applications of paint on a new roadway surface. WSDOT Type 2 (reflective) raised pavement markers will be used on all projects regardless of pavement or channelization types. See City Standard Plan X.
- Channelization elements shall conform to the applicable City Standard Plan. Substitution of a WSDOT Standard Plan or APWA standards is not acceptable unless explicitly approved by the City for use on the project.
- Traffic signs shall be installed using the following criteria:
  - Signs to be installed per City Standard Plan X-Z.

- Generally, all sign posts are to be 2 inch square perforated metal in accordance with City Standard Plan X and shall meet the requirements of Section 9-28 of WSDOT Standard Specifications for Road, Bridge, and Municipal Construction.
- Placement of new signs that can take advantage of available City-owned streetlight poles is preferred (with prior approval from the Traffic Engineering Section of the Engineering Division). Followed by combining new signs with existing signs (as appropriate) on new (and possibly taller) posts at already established locations. Signs may not be placed on utility poles, but sign decals may be proposed instead for consideration by the Traffic Engineering Section of the Engineering Division.

2.3 Design Coordination

For unique conditions or in cases where the design standards cannot be met, the engineer/designer shall coordinate with the Traffic Engineering Section of the Engineering Division at the City to determine the expected and acceptable design elements.

The engineer/designer shall coordinate their efforts with other disciplines within the project (e.g., civil, traffic signal, landscaping, streetlighting) and with other adjacent projects to ensure minimal design conflicts and continuity of the channelization and/or signing design. This coordination shall be conducted throughout the project process or as contributing design elements change. Special attention should be made to this coordination when the roadway geometry changes or elements of the roadway design may be unexpected by the driver, such as in the examples below:

- Lateral deflections (i.e., lane shifts), roadway tapers, and lane reduction tapers for speeds less than 45 mph:

$$L\ (\text{minimum}) = \frac{W\left(S^2\right)}{60}$$

  Where:

  L = length of deflection/taper in feet,

  S = posted or "85th Percentile" speed in mph, and

  W = lateral shift in feet

- Storage lengths for turn lanes
  - Typical minimum storage length of full width lane = 80 feet
  - Typical minimum gap/opening length upstream of storage = 80 feet
- Determination of advisory speeds when geometric design cannot accommodate posted or "85th Percentile" speed

SECTION 3 Documentation of Conditions

3.1 Site Visit

A site visit by the engineer/designer is highly recommended in order to assess existing conditions, inventory existing channelization/signing elements, and identify physical features that may affect the design or limit sign, intersection, or driveway visibility. Some examples of collected information regarding the site physical features include:

- roadway width;

- extents of curb/gutter;
- presence/width of sidewalk (and possible planter strip);
- curb ramp locations/extents;
- median configurations and dimensions;
- street light poles/locations;
- signal/electrical equipment;
- vegetation and/or landscaping; and
- structures.

3.2 Inventory of Existing Elements

As part of the site visit, the engineer/designer shall perform an inventory of existing channelization and signing elements. At a minimum, the inventoried elements shall include:

- The configuration of the channelization at the location where the project improvements will meet or match the existing roadway and within the project limits. This effort shall include, at a minimum, the measurement of lane widths, including any bike lanes; determination of striping pattern; presence (current or in the past) of raised pavement markers; and any shoulder or median treatments.
- Intersecting roadway channelization and signing (e.g., "STOP" signs, street name signs, stop lines, etc.) shall also be reviewed to determine if additional elements need to be replaced or relocated as part of the project work.
- Sign sizes, panel/sheeting material, any identifying labels/markings, and the general condition of the sign sheeting.
- Sign type and legend, including specialty (or non-standard) signs such as bus stop signs, guide signs, informational, etc.).
- Location of the posted speed limit signs and what the limit is.
- Sign post type/material, foundation type, and mounting height of sign(s) as measured to the bottom of the sign.

3.3 Identification of Project Extents

In addition to identifying channelization/signing needs within the project limits, improvements may be required to transition to and from the project limits. This may require channelization/signing extending beyond the original project limits.

SECTION 4 Plans Preparation

4.1 General Requirements

The engineer/designer should refer to Chapter 3 of this Design Manual for the standard requirements relating to the plan format. The channelization/signing plans should stand on their own, with enough information to construct the stated improvements. All items relating to channelization and pavement marking should be clearly labeled and identified. The following list identifies general aspects of the plans that shall be included and/or addressed:

- Channelization and signing designs shall be depicted in the same plan view unless otherwise specified by the City.
- Plans shall be presented on 22 inches by 34 inches full size sheets and drawn to a scale of 1 inch to 20 feet horizontal scale and a 1 inch to 5 feet vertical scale unless otherwise approved by the City.
- All plan sheets shall have a title block and border that is consistent with the overall project plans (see Chapter 3 of this Design Manual for details).
- Roadway conditions shall be shown for a minimum of 300 feet past the project limits, or to the nearest logical intersection/junction as approved by the City, to ensure adequate transitions and tapers to maintain traffic at the design speed.

4.2 Plan Sheet Content

At a minimum, the following items are expected to be included within the channelization/signing plan sheet set (also see Chapter 3 of this Manual for additional details):

1. City of Tacoma Channelization and Signing General Notes (See Attachment 8-1)
2. Key map
3. Sheet index
4. Existing speed limit and design speed (*for existing/proposed*)
5. Channelization legend (*for only the elements applicable to the project*)
6. Sign legend (*for only the signs applicable to the project*)
7. North arrow
8. Drawing scale
9. Roadway curb and gutter, or edge of pavement*
10. Sidewalks and curb ramps*
11. Intersecting roadways and driveways
12. Labeling of street names
13. Centerline with stationing* and match lines (with associated station)
14. ROW and easements (with dimensions)
15. Project limits and location where new meets existing
16. Indications of existing channelization to remain and/or to be removed
17. Existing signs with designations of whether they will remain, or to be removed/salvaged, or to be relocated
18. New and existing signs graphically depicted (or labeled in association with a sign table) in the direction of travel with MUTCD sign name and code, size, station, and offset
19. New and existing* striping shall be called out with a channelization legend identifier with widths (center to center) completely dimensioned across the roadway at every transition point (e.g., begin/end of tapers, turn lanes, lane transitions, change of stripe type, etc.)

20. New pavement arrows, symbols, legends, and crosswalks shall be located at their centers with station and offsets
21. New stop lines shall be dimensioned to a physical feature that can be easily located in the field (e.g., face of curb at end of radius)
22. Dimensions indicating length of turn lanes and gaps, taper lengths (as measured parallel to the travel lane), transitions to/from intersections, and curved edge lines
23. Striping change locations with begin/end stations and offsets
24. Striping and curb angle points with stations and offsets
25. Radii of curved striping
26. Control points, clearly identifiable and dimensioned to a physical feature that can be easily located in the field
27. Supporting calculations for sight distances, taper lengths, advisory speeds, and curve designs
28. New and existing* streetlights, traffic signal poles, and traffic signal detection equipment
29. Existing* and proposed landscaping, vegetation, and/or structures that may obstruct (or limit) signs or sight visibility along the roadway as prescribed in the MUTCD
30. Any other information necessary to make the plans clear and complete and convey the intent of the channelization and signing

** These elements shall be shown screened back on the plan sheets.*

4.3 Design Guidance

Many of the typical channelization and signing needs within a project are addressed in the City's Standard Plans which are available on the City website or are governed by the MUTCD. Any unusual circumstances or specialized needs shall be discussed with Traffic Engineering Section of the Engineering Division as part of the design coordination phase of the project.

4.3.1 Crosswalk Installation

In particular, guidance for when marked crosswalks may be installed at uncontrolled locations is shown in the Table 8-1 below:

Table 8-1: Guidance for Marked Crosswalks at Uncontrolled Locations

Roadway Traffic	**Average Daily Traffic (2-way total) ≤ 9,000**			**Average Daily Traffic (2-way total) > 9,000 to 12,000**			**Average Daily Traffic (2-way total) > 12,000 to 15,000**			**Average Daily Traffic (2-way total) > 15,000**		
Speed Limit (in MPH)	≤30	35	40	≤30	35	40	≤30	35	40	≤30	35	40
Total Lanes												
Two	C	C	P	C	C	P	C	C	N	C	P	N

Three	C	C	P	C	P	P	P	P	N	P	N	N
Four or more (with raised median*)	C	C	P	C	P	N	P	P	N	N	N	N
Four or more (without raised median)	C	P	N	P	P	N	N	N	N	N	N	N

Key:
C = Candidate sites for marked crosswalks (assuming ADA and PROWAG requirements are met).
P = Possible increase in pedestrian crash risk may occur if crosswalks are added without other pedestrian facility enhancements
N = Marked crosswalks alone are insufficient, since pedestrian crash risk may be increased by providing marked crosswalks alone

* The raised median or crossing island must be at least 4 feet wide and 6 feet long to serve adequately as a refuge area for pedestrians, in accordance with the MUTCD and the AASHTO *A Policy on Geometric Design of Highways and Streets*.

These guidelines include intersection and midblock locations with no traffic signals or "STOP" signs on the approach to the crossing. They do not apply to school crossings. A two-way center turn lane is not considered a median for the purposes of these criteria.

Crosswalks should not be installed at locations that could present an increased safety risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider implementation of other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing.

The indications in the table above are general recommendations; good engineering judgment should be used and ADA/PROWAG needs and/or implications considered in individual cases for deciding where to propose/install crosswalks.

4.3.2 Candidate Sites for Marked Crosswalks

Marked crosswalks must be installed carefully and selectively. Before installing new marked crosswalks, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, while a more in depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, and other factors may be needed at other sites—consult with the Traffic Engineering Section of the Engineering Division at the City. It is recommended that a minimum utilization of 20 pedestrian crossings per peak hour (or 15 or more elderly and/or child pedestrians) be confirmed at a location before placing a high priority on the installation of a marked crosswalk alone.

In some situations (e.g., low-speed, two-lane streets in downtown areas), installing a marked crosswalk may help consolidate multiple crossing points. Engineering judgment should be used to install crosswalks at preferred crossing locations (e.g., at a crossing location at a streetlight as opposed to an unlit crossing point nearby). While overuse of marked crossings at uncontrolled locations should be avoided, higher priority should be placed on providing crosswalk markings where pedestrian volume exceeds the threshold mentioned above. Marked crosswalks and other pedestrian facilities (or lack of facilities) should be routinely monitored to determine what improvements are needed.

Certain locations have the potential for the pedestrian crash risk to increase if a crosswalk(s) is added without other pedestrian facility enhancements. These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk.

4.3.3 Additional Treatments at Crosswalks

Marked crosswalks alone are insufficient, since pedestrian crash risk may be increased by providing only marked crosswalks at some locations. Consider using other treatments, such as traffic-calming treatments, traffic signals with pedestrian signals where warranted, or other substantial crossing improvement to improve crossing safety for pedestrians (see applicable scenarios in Table 8-1 above).

SECTION 5 Construction Requirements

As dictated by the design, the installation of channelization and/or signing shall be in accordance with Sections 8-21 and 8-22 of WSDOT Standard Specifications for Road, Bridge, and Municipal Construction; City Standard Plans; City of Tacoma Channelization and Striping General Notes (Attachment 8-1); and the MUTCD.

All work areas where new channelization transitions into or replaces existing channelization shall be removed. Removal of channelization elements shall be required as specified in Section 8-22.3(6) of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction or in accordance with the project specifications.

When work is performed in the roadway, traffic control devices shall be installed to warn and protect motorists, bicyclists, and pedestrians at all times. The City requires that all flagging, signs and all other traffic control devices conform with Section 1-07.23 and 1-10 of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction as supplemented or amended by the Washington State Chapter of APWA. Construction traffic control shall also conform to the current edition of the MUTCD, Part 6 and the City's Traffic Control Handbook. Refer to Chapter 7 of this Design Manual or additional traffic control requirements.

A pre-construction meeting with City staff will be required prior to installing any signs, sign posts, or pavement markings within the ROW (see Chapter 3 of this Design Manual for more details).

SECTION 6 Non-Essential Signs

6.1 Description

Destination/wayfinding signs, cultural interest signs, memorial signs, and other similar signs such as those described in this section are supplemental to other signing and may not be installed where there is insufficient spacing from signing of higher priority. These signs are not required for the safety and operation of the public transportation network. Costs related to the purchase, installation, and maintenance of these signs will be borne by the party requesting the sign. While no maintenance agreement is typically necessary, the signs will typically only be maintained by the City by request to the Engineering Division of the Public Works Department. Advertising and private signs are not addressed herein, but instead are controlled by applicable City ordinances and state and federal regulations.

6.2 Historical and Honorary Street Name Signs

Tacoma Resolution No. 38091, revising the City's Policy on Place Names and Name Changes, describes the process by which the City Council adopts historical and honorary street names. Such names are not used for addressing purposes, will be secondary to the sign which is used for addressing purposes, and will have an appearance and location consistent with the requirements and recommendations found in WAC-468-95 on Uniform Traffic Control Devices.

6.3 Private Street Name Signs

Standards for the construction of private street name signs shall follow the City's Standard Plans. Review of private street names shall follow the same process as for public street name signs in order to ensure proper review for addressing and emergency response purposes. Naming of streets shall adhere with the following and shall consist of three components:

1. Direction Prefix or Suffix
    - The street name prefix shall consist of "N," "S," or "E" according to the following:
        - "N" – All streets north of Division Avenue/6th Avenue between Commencement Bay and Tacoma Narrows.
        - "S" – All streets south of Division Avenue and west of 'A' Street except for those areas included under west end streets
        - "E" – All streets between 'A' Street and Marine View Drive
    - The street name suffix shall consist of "W" or "NE" according to the following:
        - "W" – All streets south of South 19th Street and west of Orchard Street.
        - "NE" – All streets east of Marine View Drive.
2. Street Name
    - Shall confirm to existing grid system.
    - Shall not duplicate or be similar to any other street names, unless confirming to the above or unless it is a numerical street name.
    - Shall not result in any duplicate intersections.

3. Street Type
    - "Avenue"
        - May only be used for north/south oriented streets.
        - When streets are skewed from actual north/south, shall only be used when parallel streets are of the same type.
    - "Street"
        - May be used for north/south or east/west oriented streets.
        - May not be used for north/south numbered streets.
        - When streets are skewed from actual north/south or east/west, shall only be used when parallel streets are of the same type.
    - "Drive," "Blvd," "Way," "Lane," "Road," and "Place"
        - May only be used for meandering streets which cannot conform to "Avenue" or "Street" criteria shown above.
    - "Court"
        - May only be used in conjunction with Street or Avenue where alignment is slightly offset from the Street or Avenue.
    - "Terrace," "Circle," and "Loop"
        - Not allowed.

6.4 Temporary Signs

Political signs and other temporary signs placed within the ROW are allowed according to the provisions of the Tacoma Municipal Code (see TMC 2.05.275 for information about Political Signs).

6.5 Adopt-a-spot, Adopt-a-roadway, and Memorial Signs

Roadside memorials are not permitted on City streets. However, citizens participating in the adopt-a-spot program may recognize people on the recognition sign installed with the adopt-a-spot sign.

Adopt-a-spot and Adopt-a-roadway signs are allowed at locations participating in the litter reduction program administered by Community Based Services.

When the City Council adopts an act or resolution memorializing or dedicating a highway, bridge, or other highway component, Memorial or Dedication Signs shall meet the requirements of Section 2M.10 of the MUTCD.

6.6 Gateway and Neighborhood Signs

Neighborhood gateway signage plans are developed on a case-by-case basis in consultation with the Traffic Engineering Section of the Engineering Division.

6.7 Wayfinding, Guide, and Cultural and Recreational Interest Signs

Signs relating to services and businesses are not typically provided in urban areas, and are not permitted. All other wayfinding, guide, and cultural/recreational interest signs shall meet the requirements of this section and the MUTCD.

6.7.1 Recreational and Cultural Interest Signs

Recreational and cultural interest signs shall meet the requirements of this section and of Section 2M.02 of the MUTCD.

Signs for recreational/cultural interest destinations shall be located in advance of the closest intersection that provides the most direct and best route to the destination. Normally, a sign at the cross street is all that is necessary to provide direction to the destination that may be reached from the intersection. For most locations, the sign may not be located farther than 1 mile from the destination. Destinations which may be considered for recreational and cultural interest signing include:

- Recreational
  - State and national parks and recreation areas
  - Marinas
  - Regional recreational facilities/areas
  - Public golf courses (symbol sign only)
- Cultural Interest
  - National historic sites and landmarks
  - Museums of regional significance
  - Civic centers

6.7.2 Destination Guide Signs

Destination guide signs are governed by section 2D.37 of the MUTCD.

These signs, which use white borders, text, and legends on a green background, are installed on major roadways to provide direction to major traffic generators and major roadways. Destinations which may be considered for destination guide signing include:

- College or university - a resident campus of a degree-granting accredited institution.
- Arena - a stadium, sports complex, auditorium, civic center, amphitheater or racetrack. The facility must have at least 50,000 visitors annually and 5,000 seats.
- Convention center - a center for hosting events with annual attendance of at least 50,000 and a seating capacity of at least 5,000 seats.
- Multimodal transportation facility - ferry terminals; fixed route stations providing on-site ticketing or access to interstate rail service; off-street transit center serving at least 5 routes; or facilities with over 100,000 annual boardings.
- Park and Ride - Government owned and operated facilities providing service to carpool, vanpool, or other transit service.

6.7.3 Community Wayfinding Signs

Community wayfinding signs are addressed in section 2D.50 of the MUTCD.

Destinations may include those destinations allowed under the destination guide and recreational and cultural interest sub-sections, as well as those excluded

from other categories, such as parks and neighborhood centers. Destinations which may be considered for community wayfinding signing include:

- Business districts
- Commercial districts
- Public museums
- Performing arts centers
- Community centers

Within business districts, community wayfinding signs are installed based on recommendations from local stakeholders and the City's Transportation Commission (or their designated sub-committee)—see Transportation Commission website.

6.7.4 Non-motorized Wayfinding Signs

Non-motorized 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.

6.7.5 Destinations Excluded from Signing

Unless explicitly allowed in one of the sign categories above, signs may not include the following destinations:

- Parks, zoos, water parks, golf courses, and fairgrounds
- Historical homes, viewpoints, buildings, or sites
- Churches, religious sites, cemeteries, neighborhood centers, neighborhood parks, libraries, clubs, schools, and similar locations
- Shopping centers, private businesses, privately-owned museums, and theaters

9 CHAPTER 9
CONSTRUCTION RELATED PERMITS AND EASEMENTS

INTRODUCTION

This chapter focuses on miscellaneous subjects that may have applicability to any proposed development within the City Right of Way.

SECTION 1 Temporary Construction Easement

The Temporary Construction Easement shall be completed for each adjacent private property impacted by the project prior to work order approval and construction. Adverse impacts to properties include, but are not be limited to, discontinuity in grade, abrupt meet lines, access to driveways and garages, and drainage problems created or intensified as a result of the project. Measures taken to resolve adverse impacts shall be shown on the project construction drawings. Unless otherwise agreed upon, slopes shall be constructed using cuts and fills no steeper than 2:1. Where sidewalks are not being constructed, a graded pedestrian walk area shall be provided at a 2% slope immediately adjacent to the roadway. It is the engineer's responsibility to identify and resolve adverse impacts to affected properties prior to release of construction plans.

A copy of the easement for construction on private property is provided at the end of this chapter (Attachment 9-1). Private entities should contact the Site Development Group to obtain the most recent version of this document. City staff should coordinate easement language with Real Property Services.

SECTION 2 Right-of-way Dedication

In some instances additional ROW dedication from adjacent property owners may be required to accommodate the proposed improvements. It is then incumbent upon the applicant to acquire said ROW. In instances where additional ROW is required, said ROW must be dedicated to the City prior to work order plan approval, except in the case of pending plat approvals.

In instances where the ROW will be dedicated to the City as part of the plat and/or required in the conditions, said ROW may be dedicated at the time of final plat.

SECTION 3 Easements

Easements are generally divided into two distinct categories: public easements and private easements. A public easement is granted by a party to the City, such as an access easement to allow entry onto private property to access a publicly owned utility facility or a utility easement for a utility to cross private property. An easement to allow City staff to enter a property and inspect a private facility or a site may also be granted.

A private easement is granted between two or more private parties, such as an access easement for a driveway across an adjacent parcel or a utility easement to allow a private utility to cross another private parcel. The City may also require covenant and easement agreements to ensure private facilities are appropriately inspected and maintained. These are agreements between the City and the private entity. All public easements granted to the City or to allow work permitted by the City and all covenant and easement agreements shall be legally recorded with the Pierce County Auditor.

Note: Preliminary project planning should account for the potential loss of buildable area or the need to purchase more property as a result of easement needs.

Refer to Chapter 5 for specific easement requirements for public stormwater and wastewater systems.

3.1 Private Access Way Easements

Private access way easement widths are as specified in Chapter 4 of this manual and shall also comply with applicable design manuals and guidance as specified in TMC 13.04.160. Please note that this is a separate and distinct easement from any public easement required for the site. Public easements may be granted and contained within private access way easements.

3.2 Recording Prior to Work Order Approval

Easements shall be provided to the City prior to work order approval except for plats or short plats where easements may be provided at the time of final plat or short plat approval.

3.3 Easement Recording Procedure

The following procedure shall be used for recording public easements:

- Determine the required easement size, footprint or width and location as outlined in this manual or as mandated through the plan review process of the work order.
- Provide a legal description for the easement and submit it along with an acceptable plan showing the location of said easement to Real Property Services. Real Property Services is located at the Tacoma Municipal Building at 747 Market Street on the third floor; call 253.591.5535 for additional information.
- Real Property Services will review the legal description for accuracy and draft the easement document.
- The draft easement document will be reviewed internally by City staff and signed by the appropriate City staff.
- The signed easement document is sent to the applicant for the required signatures of the property owners. These signatures must be notarized.
- It is then the responsibility of the applicant to return the signed easement form to the Real Property Services, who will record the document with the Pierce County Auditor's office.

SECTION 4 Traffic Control Requirements

All work within the public right of way that may affect traffic (both vehicular and pedestrian) shall provide traffic control. The Traffic Control Handbook available at www.govme.org provides requirements and guidance for creating traffic control plans.

All work orders with new improvements within an existing roadway, or any construction that will adversely impact the flow of traffic shall include the minimum special traffic control requirements on the work order plans.

Exceptions to the typical requirements will be required for any construction contained within an arterial street. Exceptions in these cases will be written by the Traffic Engineering Section of the Engineering Division and will be required to be shown on the work order drawings.

A copy of the typical special traffic control requirements, with the format of typical exceptions, can be found at the end of this chapter.

4.1 Street Closures, Non-Arterial Streets

All street closures will be approved on a project-by-project basis. Generally, non-arterial streets may be closed to through traffic, provided that local access is maintained at all times with a minimum of a 20 foot wide access lane. It is required that closures be coordinated with the businesses and/or residences adjacent to the project site. A minimum of one access shall be maintained to all properties at all times.

4.2 Lane and Street Closures, Arterial Streets

Generally, it is necessary that traffic be maintained at all times on arterial streets. When necessary, and justified, lanes of traffic may be closed during specified hours of the day. The determination of these hours shall be in consultation with and subject to the approval of the City Traffic Engineer. Only in unusual circumstances will full closures of arterial streets be considered. Local access must be maintained at all times with a minimum of a 20 foot wide access lane. Again, it is required that closures be coordinated with the various businesses and/or residences adjacent to the project site. A minimum of one access shall be maintained to all properties at all times.

4.3 Notification

The contractor shall notify the following group three working days prior to any street closure:

Engineering Division	(253) 591-5500
Streets and Grounds	(253) 591-5495
Solid Waste	(253) 591-5544
Tacoma Fire Department	(253) 591-5733
Tacoma Police Department	(253) 591-5951
LESA Communication Center	(253) 798-4721 – Option 3
Tacoma Public Schools Transportation Office	(253) 571-1853
Pierce Transit	(253) 581-8109

SECTION 5 Environmental Checklist and EIS

The State Environmental Policy Act (SEPA), Chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental checklist is required to be filed with the City for all projects that do not meet specific exemption thresholds. The purpose of the environmental checklist is to provide information to help the applicant and the City identify impacts from the proposal (and to reduce or avoid impacts from the proposal, where applicable) and to help the City determine whether an environmental impact statement (EIS) is required. An EIS is required for all proposals that have probable significant adverse impacts on the quality of the environment. See City of Tacoma Tip Sheet P-110 available at www.govme.org.

In many cases, an environmental checklist may be required in conjunction with the improvements outlined on the work order drawings unless the project completely falls under an exemption. The complete set of categorical exemptions is contained in the SEPA rules (Chapter 197-11 WAC) and the City of Tacoma's Environmental Code (TMC Chapter 13.12). The thresholds outlined in WAC 197-11 and TMC 13.12 that are most frequently encountered in the work order process requiring an environmental checklist include:

- Any utility pipe installed greater than 8 inches in diameter.
- Any fill or excavation in excess of 500 cubic yards.

Information on, and the filing of, the environmental checklist shall be through Planning and Development Services – tacomapermits.org and (253) 591-5030. If an environmental checklist is required for the improvements to be constructed under the work order, the environmental review process must be completed and a final environmental determination obtained prior to work order approval. If the project is associated with a land use action, SEPA is typically completed as part of the land use permitting process.

SECTION 6 Erosion Control and Contaminated Soils

6.1 Erosion Control

All projects are responsible for preventing erosion and discharge of sediment and other pollutants into receiving waters. The following projects shall complete a Stormwater Pollution Prevention Plan (SWPPP) per the SWMM requirements – Volume 2:

- Projects resulting in 2,000 square feet, or greater, of new, replaced, or new plus replaced hard surface, or
- Those which have land-disturbing activity of 7,000 square feet or greater.

6.2 Contaminated Soils

Contaminated soils may be located in the City of Tacoma. If contaminated soils are discovered they should be properly disposed of.

The City has developed an internal Soil Management Plan regarding contaminated soil testing and disposal for City capital improvement projects and maintenance projects completed by City staff. The document, "Soil Management Plan – Tacoma Smelter Plume" is available on the Project Development Website.

For projects completed by private developers, the City may require specific soil sampling on a case by case basis.

Attachment 9-1: Temporary Construction Easement

The following form shall be completed for each adjacent private property impacted by the project prior to the release of construction drawings. Adverse impacts to properties shall include, but not be limited to, discontinuity in grade, abrupt meet lines, access to driveways and garages, and drainage problems created or intensified as a result of the project. Measures taken to resolve adverse impacts shall be shown on the project construction drawings. Unless otherwise agreed upon, slopes shall be constructed using cuts and fills no steeper than 2:1. Where sidewalks are not being constructed, a graded pedestrian walk area shall be provided at a 2 percent slope immediately adjacent to the roadway. **It is the consulting engineer's responsibility to identify and resolve adverse impacts to adjacent properties prior to release of construction drawings.**

I (we) _____ hereby grant

_____ or his/her contractor permission to enter

the property known as _____
(address or legal description)

for the purposes of street/sewer construction. The developer agrees to do the following as mitigating measures:_____

_____

_____

_____

The developer further agrees to leave the property in a clean, neat and orderly state.

Agreed this Date: _____

_____
Private Property Owner(s)

_____
Project Applicant (Developer)

Note: If it is determined by the Project Consulting Engineer that there are no adverse impacts to abutting private properties, he/she shall sign below and return this form.

Signature _____

Attachment 9-2: In Lieu of Assessment Release Form

WASTEWATER SEWER PLANS WILL NOT BE RELEASED FOR CONSTRUCTION UNTIL THE "IN LIEU OF ASSESSMENT" RELEASE FORM (ATTACHED) IS COMPLETED BY THE APPLICANT AND RETURNED TO:

Environmental Services / Business Operations
2201 Portland Avenue
Tacoma, Washington

The 'in lieu of assessment' release form is to identify property which should be credited for the construction of wastewater sewers. Credited property is released from future wastewater sewer connection charges (in lieu of assessment charges).

This form must be signed by the property owner or the owner's agent.

Requested assessment limits require review and approval by the City. In general, assessment limits are 120 feet deep across the property frontage. In cases of large lots with buildings outside the 120 feet, the property on which the building is situated may be included.

If you have any questions or need further information, please call 591-5529.

Date: _____

Business Operations
Environmental Services
Tacoma, Washington

Subject: Request for Release of In Lieu of Assessment for Wastewater Sewers

Gentlemen:

This is to certify that I (we) am (are) responsible for the cost of constructing the City of Tacoma wastewater sewer in: (Location)

_____

_____

as provided by Work Order No._____

I hereby request that City records be made to show the portions of the following described property(s) that may be credited for the cost of said wastewater sewer, as determined by the City and that releases be filed accordingly: (Legal Description)

_____
Applicant

_____ _____
Address Signature

_____
Phone

Subscribed and sworn to me this____day of_____, 20___.

_____, Notary Public in and for the State

of_____residing at_____.

SPECIAL TRAFFIC CONTROL REQUIREMENTS

LOCATION: ***Project Vicinity*** **(6000000####)**
The following special traffic controls shall supplement Section 1-07.23 of the Standard Specifications.

The contractor may close non-arterial streets to through traffic, provided that local access is maintained at all times with a minimum of a 20-foot wide access lane. The contractor shall coordinate any closures and cooperate with the various businesses and/or residences adjacent to the project site. A minimum of one access shall be maintained to all properties at all times.

Three (3) working days prior to any street closure, the contractor shall notify:

Tacoma Public Works Engineering Division	(253-591-5500)
Tacoma Public Works Streets and Grounds	(253-591-5495)
Tacoma Environmental Services Solid Waste	(253-591-5544)
Tacoma Fire Department	(253-591-5733)
Tacoma Police Department	(253-591-5951)
LESA Communication Center	(253-798-4721 – Opt. #3)
Tacoma Public Schools Transportation Office	(253-571-1853)
Pierce Transit	(253-581-8109)

ADDITIONAL REQUIREMENTS:

A. XXXX Street shall remain fully open to vehicular and pedestrian traffic at all times. EXCEPTION: **XXXX Street** may be reduced by the contractor to a minimum of one lane flagger controlled between the hours of - a.m. and - p.m.

B. YYYY Street shall remain fully open to vehicular and pedestrian traffic at all times. EXCEPTION: **YYYY Street** may be reduced to a minimum of one lane each direction for two way traffic between the hours of - a.m. and - p.m.

10 CHAPTER 10
TREE AND VEGETATION MANAGEMENT

INTRODUCTION

This chapter establishes required procedures and standards for tree related work within the ROW. The standards and procedures contained herein must be followed to ensure that plants provide the needed benefits while posing minimal conflicts with infrastructure, human health and safety.

The City of Tacoma Urban Forest Manual (UFM) is meant to accompany this Manual, as well as relevant sections of the TMC, including 9.18, 9.19 and 13.06.502 as a source of additional guidance on the technical aspects of tree and vegetation management. Additionally, all tree care work performed within the ROW shall be in compliance with ANSI A300 and Z133.1 practices, most recent version.

Urban Forest Manual (UFM)

The UFM is a technical guide created to facilitate the planning, design, installation and maintenance of landscaping within Tacoma. Volume 3 of the UFM provides guidance on planting that is required for new development and redevelopment, however, the minimum requirements presented in the UFM are in line with industry best management practices (BMPs) for landscaping. Specifically, the standards in the UFM which refer to the ROW shall be used when landscaping within the ROW.

The UFM is available online at: www.cityoftacoma.org/urbanforestmanual or www.cityoftacoma.org/ufm.

American National Standards Institute (ANSI)

All tree care work performed within the ROW shall be in compliance with ANSI A300 and Z133.1 practices. All plant material provided shall be in compliance with ANSI Z60.1 for Nursery Stock.

Tacoma Municipal Code (TMC)

Trees and landscaping within the ROW are discussed in several locations within TMC, including but not limited to TMC 9.18 Trees and Shrubs - Trimming and Removal, TMC 9.19 Trees and Shrubs - Planting, TMC 9.20 Trees and Shrubs - View Blockage, and TMC 13.06.502 Landscaping and Buffering Standards. All of these sections of TMC shall be adhered to in addition to the requirements set forth in this Manual.

SECTION 1 Applicability

1.1 Regulated Trees

All trees within the ROW are considered regulated trees and are subject to the standards for management contained in this Manual. Per TMC 9.18 and 9.19, a Tree Work in the Right-of-Way Permit is required for the planting, pruning, or removal of any regulated tree.

1.2 Required Practices

Required practices are to be implemented by the property owner, project applicant, contractor or designee, and are minimum standards for work undertaken on a regulated tree.

Required practices are reasonable measures consistent with BMPs in the landscape and tree care industry to protect public health, safety and welfare and to promote the health of trees as an environmental priority of the City.

1.3 Recommended Practices

Recommended practices are those which provide guidance to ensure that proactive measures implemented for the care of trees (supplemental watering, fertilization, mulching, treatment to discourage pests, etc.) are consistent with current industry standards, and City policies and procedures. Recommended practices are not required, however, the City has discretionary authority to require recommended practices as a condition for approval of a project permitted by the City or as mitigation for damage to trees in the ROW.

SECTION 2 Tree Planting, Removal and Replacement

2.1 Permitting

A regulated tree must be protected and preserved unless otherwise approved through a Tree Work in the Right-of-Way Permit, issued by the City's Planning and Development Services Department in advance. Tree work requiring a Tree Work in the Right-of-Way Permit includes all tree planting, pruning or removal activities on regulated trees.

Tree Work in the Right-of-Way Permit applications may be obtained online at www.tacomapermits.org, or through the Planning and Development Services Permit Center located at 747 Market St #345, Tacoma, WA 98402.

2.1.1 Exceptions

Exceptions to this requirement are made for emergency removal necessary to mitigate a threat to public health, safety of welfare, in which case the City must be notified of the hazardous conditions warranting the removal of the tree immediately (prior to removal), and a Tree Work in the Right-of-Way Permit must be obtained within 24 hours following the removal.

A hazardous tree is that which has been designated as a hazard by an International Society of Arboriculture (ISA) Certified Arborist, who has obtained an ISA Tree Risk Assessor Course and Exam (TRACE) certification or Tree Risk Assessment Qualification (TRAQ). Tree hazards include dead or dying trees, dead parts of live trees, or unstable live trees (due to structural defects or other factors) that are within striking distance of people or property (a target). Hazard trees are those which have the potential to cause property damage, personal injury or fatality in the event of a failure.

2.2 Tree Planting

All trees planted within the ROW shall comply with TMC 9.19 and 13.06.502 as well as the standards set forth in the UFM, Volume 3, Chapter 4.2 General Landscaping Standards. In addition to these standards contained in TMC and the UFM, the following process and standards shall apply.

2.2.1 Permit Application

Planting trees within the ROW when not otherwise permitted through a Work Order Permit requires a separate Tree Work in the Right-of-Way Permit. A Tree Work in the Right-of-Way Permit will be granted if the adjacent property owner can sufficiently demonstrate that the standards of this Section can be met.

The application must include a sketch showing all of the following:

Existing site features

- Location(s) of all buildings;
- streets;
- sidewalks;
- known utility locations (overhead and underground); and,
- existing trees.

Pertinent proposed tree planting information:

- proposed number of trees
- proposed planting spaces; and,
- tree species identification.

In addition, the applicant must select a tree from the City of Tacoma Approved Tree List available at www.cityoftacoma.org/ufm (Appendix 7). If an applicant proposes an alternative tree that is not listed on the Approved Tree List, information on the growing characteristics of the tree from a published source such as a nursery "cut sheet" must accompany the application.

2.2.2 Tree Clearances

Standard clearances for trees in the right-of-way are as defined in UFM and in the City Standard Plan LS-02. There are limited exceptions allowed based on site specific review and approval by the City. These exception requests must be submitted to the City with the Work Order or Tree Work in the Right-of-Way Permit submittal, and will be reviewed based on demonstration of mitigating potential impacts to public infrastructure.

2.2.3 Line of Sight

For adequate line of sight, street trees must be placed no closer than 25 feet from intersections; measurement taken at the extension of the outside face of curb. Shrub and groundcover plants located in planting strips within 30 feet of a street intersection must be selected for compatibility with sight distance requirements, limiting height to 36 inches. Refer to the latest edition of the AASHTO Green Book on recommended sight distance for intersection control conditions.

2.2.4 Alternate Specifications

The Department of Planning and Development Services will review proposed alternatives to the standards contained here and in the UFM. These alternate specifications must be submitted to the City with the Work Order or Tree Work in the Right-of-Way Permit submittal. Approvals may be granted as long as it is demonstrated that these alternatives are designed to support street tree installations for optimum tree health and longevity and compatibility with other infrastructure in the ROW. Examples of these alternative specifications include engineered or structural soil mixes, structural support systems, modular structural pavement systems (Silvacells), etc.

2.2.5 Planting Strip Treatments

The following is a list of typical planting strip treatments and associated requirements.

(1) Pedestrian Crossings

Treatments in planting strips to accommodate for pedestrian crossings should be considered if the project site has on-street parking and is located within a mixed-use center, commercial area or other locations that experience heavy pedestrian traffic. Guidance on standards for pedestrian crossings are located in the Mobility Master Plan (MoMAP).

(2) Vegetation

Preapproved options for planting areas include:

- Planting: groundcovers, perennials and shrubs with mulch covering exposed soil area. Plants (other than trees) must be less than 3 feet in mature height if planted within 30 feet of a street intersection in the ROW.
- Mulch: organic wood chip mulch and/or permeable inorganic mulch. Finished grade after mulch application shall be a minimum of 1 inch below the adjacent pavement surface or curb.

(3) Low Impact Development/GSI

The SWMM outlines requirements for stormwater mitigation including low impact development. The type of mitigation is based upon the impacts created by a new or redevelopment project. Projects with 7,000 square feet or more of land disturbing activities or 2,000 square feet or more of new plus replaced hard surfaces will need to refer to the SWMM to determine if low impact development will be a requirement for their project. Information contained in the SWMM may also be helpful for retrofit type projects.

Low impact development/GSI in the ROW can include retained and/or new street trees required as a City condition for new development per TMC 13.06.502. Planted bioretention swales are also often proposed as low impact development/GSI in the planting strip area. All proposed stormwater facilities within the ROW including bioretention swales will need to acquire a permit prior to construction in the ROW. Please contact the Department of Planning and Development Services for permit requirements.

(4) Paving and Permanent Constructed Improvements in the ROW

Per TMC 10.14, paving the outer planting strip requires special permission from the Director of Public Works. In addition, a Street Occupancy Permit is required from the City to install any other permanent improvements in the planting strip, to include irrigation and raised planter boxes. Contact the Department of Planning and Development Services to apply for a Street Occupancy Permit to construct permanent improvements within the planting strip.

(5) Raised Planter Boxes

Raised planter boxes may be installed in the ROW, provided that a Street Occupancy Permit is obtained prior to doing so. All planter boxes shall be no more than 24 inches in height, and shall have a minimum setback of 2 feet from the curb and from the edge of sidewalk. They may be no longer than 40 feet in length, and must provide a minimum of 3 feet of unimpeded clearance at each end to provide pedestrian access between the sidewalk and curbside vehicles.

Plant height in a raised planter box shall be measured from the surrounding ground level, not the ground level within the planter box.

2.2.6 Planting Materials

(1) Stakes and Ties

Tree stakes shall be treated 2 inch diameter lodgepole pine or equivalent, two stakes per tree. Ties shall be one inch wide rubber tree ties or equivalent, such as V.I.T. Products, tree supports, twist brace, fabric-reinforced rubber (0.375 inch minimum). Refer to City Standard Plan LS-01.

(2) Root Barrier

Root barrier (18 inch depth by 10 foot length) is required along the edge of roadways, sidewalks, curbs and driveways for all trees whose trunks are within 4 feet of the paved edge. Root barriers shall be an injection molded or extruded modular component made of high density polypropylene plastic. Refer to City Standard Plan LS-01.

(3) Arborist Wood Chip Mulch

Mulch shall be coarse untreated wood chips 0.5 to 6 inch in size, free of weeds, weed seeds and invasive plant parts. Mulch shall be installed to provide a 3 inch depth over a minimum area twice the diameter of the root ball. The mulch should be kept at least two inches away from the trunk. Refer to City Standard Plan LS-01.

(4) Tree Grates

Tree grates are allowed but not recommended by the City as a tree pit treatment based on the maintenance necessary to ensure a surface flush with adjacent sidewalk for public safety, and routine expansion for clearance from the trunk of a tree as it grows. If proposed, all tree grates must meet the requirements set forth for ADA compliance, including surfacing (slip resistance) and maximum opening size. Refer to Chapter 12, Section 6 Pedestrian Circulation Paths for the requirements regarding tree grates.

2.3 Tree Pruning (Trimming)

A Tree Work in the Right-of-Way Permit is required for all proposed pruning activities on regulated trees, and shall comply with TMC 9.18 and 13.06.502 as well as the standards set forth in the UFM.

Pruning (trimming) is defined as the removal of plant parts, dead or alive, in a systematic manner as to not damage other parts of the plant. Pruning is most often performed for the purposes of improving plant health, structure, aesthetics or safety of the vegetation. Pruning must be performed according to American National Standards Institute (ANSI) A300 (current version) guidelines by an individual or company with a valid state contractor's license, City of Tacoma license and current bonding. In addition to the standards contained in TMC and those contained in the UFM, the following process and standards shall apply.

2.3.1 Permit Application

A Tree Work in the Right-of-Way Permit may be granted provided that the adjacent property owner (applicant) can sufficiently demonstrate the reasoning for pruning the regulated tree, and that the public benefit provided by the tree's foliage is outweighed by significant tree defects or threats to public safety.

All Tree Work in the Right-of-Way Permit applications for pruning must include the following:

- Location of the proposed tree;
- photograph of the vegetation;
- a statement of the problem (objective) to be addressed through the proposed pruning;
- proposed solution; and,
- the approximate percentage of the tree's crown which is proposed to be removed. Note: no more than 25% of the trees foliage may be removed in any pruning event. Topping of regulated trees is explicitly prohibited.

Preapproved objectives for pruning include:

- Removal of dead, significantly damaged or diseased tree parts; and/or,
- Pruning to maintain required tree clearances over sidewalks (8 feet) and roadways (14 feet).

2.3.2 Traffic Control

The property owner or tree care provider must provide appropriate traffic control during all regulated tree work operations. Traffic Control Plans are needed for activities in or near the right-of-way where equipment, materials, or people entering or using the street and sidewalk areas could create safety hazards or traffic congestion. Traffic control plans must be submitted with the Tree Work in the Right-of-Way Permit and must comply with the City of Tacoma Traffic Control Handbook, available at: www.govme.org/download/PDF/Traffic_Control_Handbook.pdf.

2.4 Tree Removal

A Tree Work in the Right-of-Way Permit is required for all regulated tree removals, and shall comply with TMC 9.18 and 13.06.502 as well as the standards set forth in the UFM. In addition to these standards contained in TMC and the UFM, the following process and standards shall apply.

2.4.1 Permit Application

A Tree Work in the Right-of-Way Permit may be granted if the adjacent property owner (applicant) can sufficiently demonstrate that the public benefit provided by the tree is outweighed by significant tree defects. Trees that are determined to be dead, dying, "hazard trees," or "inappropriate species" are automatic candidates for removal. The following factors shall not be considered as criteria for removal of a street tree:

- obstruction of view;
- potential future damage to public infrastructure or private property, if that damage can be avoided by root pruning, root barriers or other management strategies;
- the cost of routine tree maintenance (pruning, watering, fertilizing, etc.)
- normal maintenance activities such as the raking of leaves and flowers and cleaning of gutters; or
- hazards that can be controlled or eliminated through appropriate pruning or maintenance.

If tree removal is permitted, all stumps and surface roots of trees shall be ground or removed to a point at least 18 inches below the top of the adjacent curb/sidewalk or proposed grade.

2.4.2 Traffic Control

The property owner or tree care provider must provide appropriate traffic control during all regulated tree work operations. Traffic Control Plans are needed for activities in or near the right-of-way where equipment, materials, or people entering or using the street and sidewalk areas could create safety hazards or traffic congestion. Traffic control plans must be submitted with the Tree Work in the Right-of-Way Permit and must comply with the City of Tacoma Traffic Control Handbook, available at: www.govme.org/download/PDF/Traffic_Control_Handbook.pdf.

2.4.3 Tree Replacement

The City requires tree replacement as a standard condition for issuance of a permit for removal of a tree if the tree is required for the development as specified in TMC 13.06.502 Landscaping and Buffering Standards.

SECTION 3 Tree Protection During Construction

The UFM contains the mandatory actions in addition to those contained in TMC 9.18.030 for protection of existing trees during construction activities, and permitted construction activities around existing trees.

Per TMC In all instances where construction activities are to occur around existing trees which otherwise have not been permitted to be removed, to include the alteration of any building or portion thereof, proper tree protection guards are required to be installed prior to the commencement of construction. Refer to City Standard Plans LS-08, LS-09, LS-10 and LS-11 for permissible tree protection guards and methods.

For more information on tree protection during construction, the following resources are suggested.

- Tree Protection on Construction and Development Sites, A Best Management Practices Guidebook for the Pacific Northwest
- ANSI A300, Part 5, Construction Management Standard
- International Society of Arboriculture BMPs, Managing Trees During Construction

11 CHAPTER 11
SHARED-USE PATHS

INTRODUCTION

As with any roadway project, shared-use path projects need to fit into the context of a community. Shared-use paths are designed for both transportation and recreation purposes and are used by pedestrians, bicyclists, skaters, and other users. Some common locations for shared-use paths are along rivers, streams, ocean beachfronts, canals, utility ROW, and abandoned railroad ROW; within college campuses; and within and between parks as well as within existing roadway corridors.
The intent of a shared-use path is to create separation from motorized uses and to create the spine of a well-developed non-motorized network. There might also be situations where such facilities can be integrated into a planned development or a shared-use path parallel to an arterial. This chapter provides guidance on how to achieve the appropriate design, amenities, and separation. Exhibits are provided throughout this chapter to illustrate possible design solutions, which should be treated with appropriate flexibility as long as doing so complies with corresponding laws, regulations, standards, and guidance.

The City of Tacoma has a well-defined plan for locating shared-use paths. Each facility is to function with the citywide transportation system while promoting the unique characteristics consistent with its location. In locations with subarea plans, the document shall be consulted for additional design guidance for new or replacement shared-use paths. The goal is to ensure that the design and construction of shared use paths are carried out consistent with the most current regulations, guidelines, and community plans. (See section B. Design Guidance for additional references).

In the following pages, there are minimum standards for shared-use paths. The minimum standard is appropriate for areas of low demand or in areas lacking connections to activity centers. A minimum standard is unlikely to meet the expectations of the users in high demand area or places with a mix of users such as skateboarders, recreational cyclists, rollerbladers, and dog-walkers. For example, a multi-use path adjacent to water frontage will generally have higher demand and a greater variety of users. It is preferable to have a wider shared-use path (up to 24 feet) to help improve usability and safety. Therefore, applicants can be expected to have their shared-use path designs reviewed by a City interdisciplinary team (currently named the Design Integration Review Team or DIRT) to ensure their designs and user amenities are compatible with the intended location of the path.

This chapter is about shared-use paths. For low-impact pedestrian trails design information, refer to the Metro Parks Tacoma's Trail Management Plan. This document was updated in 2012 and provides guidance on many issues related to low-impact paths for pedestrian usage. The City and Metro Parks Tacoma work closely on many projects and shared use of their guide will provide for consistency between agencies.

SECTION 1 References

1.1 Federal/State Laws and Codes

Americans with Disabilities Act of 1990 (ADA)
ADA (28 CFR Part 35, as revised September 15, 2010)
23 CFR Part 652, Pedestrian and Bicycle Accommodations and Projects
49 CFR Part 27, Nondiscrimination on the Basis of Disability in Programs or Activities Receiving Federal Financial Assistance (Section 504 of the Rehabilitation Act of 1973 implementing regulations)

1.2 Design Guidance

Rails-to-Trails Conservancy Trail-Building Toolbox with informative chapters ranging from Bridges, Accessibility and User Type - http://www.railstotrails.org/build-trails/trail-building-toolbox/

Tacoma Waterfront Design Guidelines (2014)
http://www.cityoftacoma.org/cms/one.aspx?portalId=169&pageId=15801

Pedestrian and Bicycle Design Guidelines (2010)
http://cms.cityoftacoma.org/Planning/Dome-Brewery%20Subarea/MoMaP%20Design%20Guidelines_Final.pdf

Guide for the Development of Bicycle Facilities, 4th Edition, AASHTO, 2012

Revised Draft Guidelines for Accessible Public Rights-of-Way (PROWAG), November 23, 2005, U.S. Access Board. The current best practices for evaluation and design of pedestrian facilities in the public right of way per the following FHWA Memoranda:

- http://www.fhwa.dot.gov/environment/bikeped/prwaa.htm
- http://www.fhwa.dot.gov/civilrights/memos/ada_memo_clarificationa.htm
- www.access-board.gov/prowac/draft.htm

Manual on Uniform Traffic Control Devices for Streets and Highways, USDOT, FHWA, as adopted and modified by Chapter 468-95 WAC "Manual on uniform traffic control devices for streets and highways" (MUTCD)

Standard Plans for Road, Bridge, and Municipal Construction (Standard Plans), M 21-01, WSDOT

ADA Standards for Accessible Design, USDOJ, 2010; consists of 28 CFR parts 35 & 36 and the *ADA and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities* (ADA-ABAAG; also referred to as the 2004 ADAAG), July 23, 2004, U.S. Access Board http://www.access-board.gov/ada/

1.3 Supporting Information

Pedestrian Bicycle Information Center http://www.bicyclinginfo.org/engineering/paths-principles.cfm

SECTION 2 Definitions

rest area An area to the side of a path.

running slope A slope measured in the direction of travel, normally expressed as a percent.

shared-use landing A level (0 to 2% grade cross slope and running slope) paved area within the shared-use path, designed to provide turning and maneuvering space for wheelchair users and as a resting place for pedestrians.

shared-use path A facility physically separated from motorized vehicular traffic within the highway right of way or on an exclusive right of way with minimal crossflow by motor vehicles. Shared-use paths are primarily used by bicyclists and pedestrians, including

walkers, runners, skaters, and pedestrians with disabilities, including those who use non-motorized or motorized wheeled mobility devices. With appropriate design considerations, equestrians may also be accommodated by a shared-use path facility.

SECTION 3 Shared-Use Path Design – The Basics

When designing shared-use paths, the bicyclist is just one of the critical design elements to consider. For example, at many intersections between roads and paths there is likely to be a variety of travel modes. Because the pedestrian is the slowest mode, the design of the crossing should be prioritized to accommodate them first. Accommodate all intended users, and minimize conflicts.

3.1 Design Speed

The design speed for a shared-use path is based on the bicycle user and is dependent on the terrain and the expected conditions of use. Design the shared-use path to encourage bicyclists to operate at speeds compatible with other users. Higher speeds are discouraged in a mixed-use setting or in a densely populated urban setting. Design shared-use paths to maintain speeds at or below the speeds shown in Table 11-1 by designing to the horizontal curve radii shown.

Table 11-1: Bicycle Design Speeds

Conditions	Design Speed	Curve Radius (feet)
Long downgrades (steeper than 4% and longer than 500 ft)	30	166
Open country (level or rolling); shared-use paths in urban areas	20	74
Approaching intersections	12t	27

When minimum radius curves cannot be obtained because of ROW, topographical, or other constraints, consider installing the following mitigation measures for traffic calming to slow bicyclists when approaching curves:

- Intermittent curves to slow or maintain desired speeds.
- Standard curve warning signs and supplemental pavement markings in accordance with the MUTCD.
- Perpendicular stripes painted on the pathway in decreasing intervals to provide the perception of increased speed.
- Changes in pavement texture to encourage reductions in speed at tight curve approaches.

The negative effects of tight radius curves can also be partially offset by widening the pavement through the curves. Steeper vertical grades affect the running speed of bicycles. A shared-use path should be designed not to exceed 5%. Refer to 1515.04(3) for further guidance.

SECTION 4 Shared-Use Path Design Widths

The minimum width of a shared-use path for exclusive use by one mode is 14 feet including, 10 feet of paved width and 2 feet gravel shoulders on either side. A shared-use path adjacent to a street will not require gravel on the curb side or on the path edge if landscaping/grass is used or present.

The minimum width of a shared-use path is 14 feet including, 12 feet of paved width and 1 foot gravel shoulders on either side. A shared-use path adjacent a street will not require gravel on the curb side or on the path edge if landscaping/grass is used or present.

The pavement width for a shared-use path in an area of higher demand and a mix of modes ranges from 14-24 feet, excluding 1 foot shoulders on either side (the appropriate design width will be determined by the City). A shared-use path adjacent to a street will not require gravel on the curb side or on the path edge if landscaping/grass is used or present.

Exhibits 1515-3 through 1515-5 provide additional information and cross-sectional elements.

4.1 Deviations from Standards

At the request of the applicant, the City will consider exceptions to the standard path widths. The applicant is responsible to explain and/or present the circumstances warranting deviation from the standard. Potential circumstances warranting a reduced path width:

- Exclusive use by one mode.
- Horizontal and vertical alignments provide frequent, well-designed passing and resting opportunities.
- The shared-use path is for a short distance such as a spur connection to a neighborhood.
- Topographic and geographic constraints

The City approves the requested reduction then the applicant will refer to the MUTCD for appropriate signing and pavement markings for such conditions.

4.1.1 Existing Shared-Use Paths – Considerations

There are some existing shared-use paths or trails that have a narrower dimension compared to current standards. The City will evaluate on a case-by-case basis the replacement of these older non-standard trails/paths. The applicant should be prepared to meet the current shared-use path standards.

SECTION 5 Slope

5.1 Cross Slope

The maximum cross slope on a paved shared-use path is to be 2%. The cross slope of the shoulder cannot exceed 6H:1V. For drainage purposes the entire section, including the shoulders, ought to transition through the curves. It is desirable to design the pivot point on the outside edge of one shoulder to avoid a pavement crown (see Exhibits 1515-3 through 1515-5). It is recommended that cross slopes be designed to be less than the allowed maximum to account for some tolerance when the path is constructed.

Sloping the pavement surface to one side is desirable and usually simplifies drainage design and surface construction. Generally, surface drainage from the path is dissipated as it flows down the side slope.

5.2 Side Slopes and Pedestrian Rail

Side slopes along shared-use paths are an important design feature. Embankment side slopes of 6:1 or flatter provide a gently sloping path border.

For shared-use paths with side slopes steeper than 3:1, or where obstacles or waterways may exist, evaluate the potential risk and provide mitigation such as:

- A minimum 5 foot separation from the edge of the pavement to the embankment edge. This can be accomplished by providing a 5 foot shoulder as shown in Exhibit 1515-5, Example 2.
- A natural barrier such as dense shrubbery on the side slopes.
- A physical barrier, such as pedestrian rail.
- Where a shared-use path is adjacent to a vertical drop of 2 feet 6 inches or more, a pedestrian rail is needed (see Exhibit 1515-5, Example 4).
- If the vertical drop is less than 2 feet 6 inches, a pedestrian rail, chain link fence, or 4 inch curb at the edge of the shared-use path may be installed to delineate the edge.
- Where a shared-use path is constructed on the side of a hill, drainage facilities may need to be considered.

SECTION 6 Clearances

The minimum horizontal clearance from the edge of pavement to an obstruction (such as bridge piers, fence, or guardrail) is 2 feet. The minimum vertical clearance is 10 feet from the pavement surface to any overhead obstruction to accommodate maintenance vehicles and bicyclists.

SECTION 7 Buffers

A buffer area may be provided directly adjacent to the shared use path to create separation and a planting area as practicable. The City recognizes that in a built urban setting buffer area may not be available. Therefore the need for a buffer will be reviewed on a case-by-case basis. Should a buffer area be required, any vegetation provided there shall be of an approved species and maintained per City standards.

Figure 11-1: Two-Way Shared-Use Path; Independent Alignment

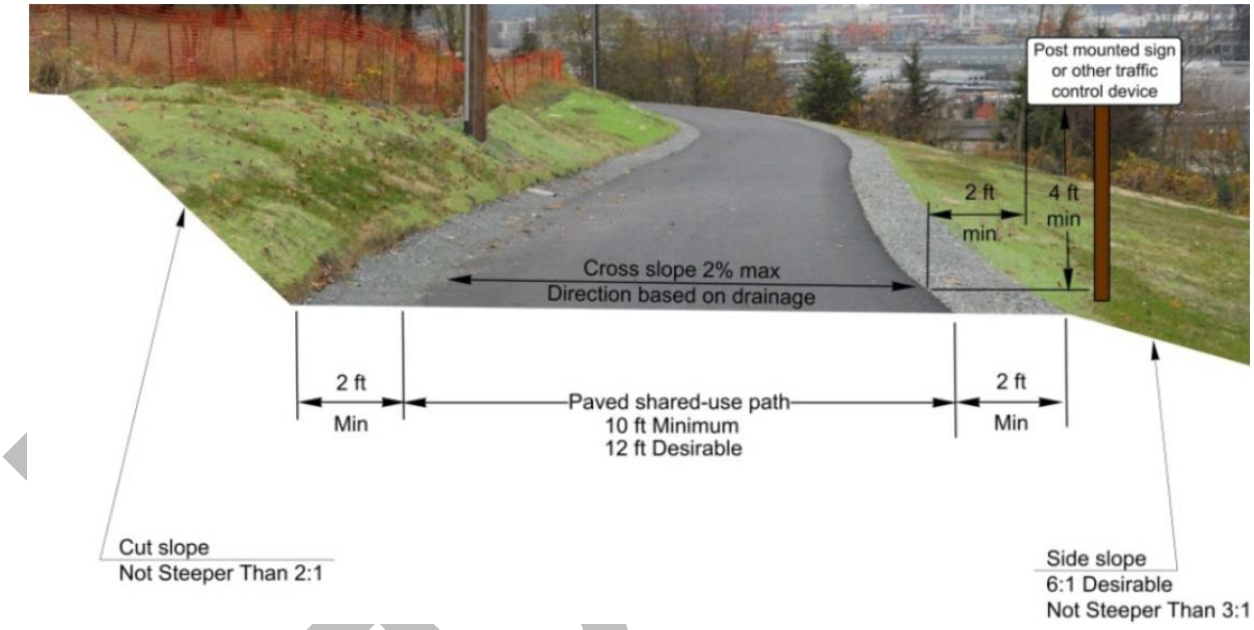
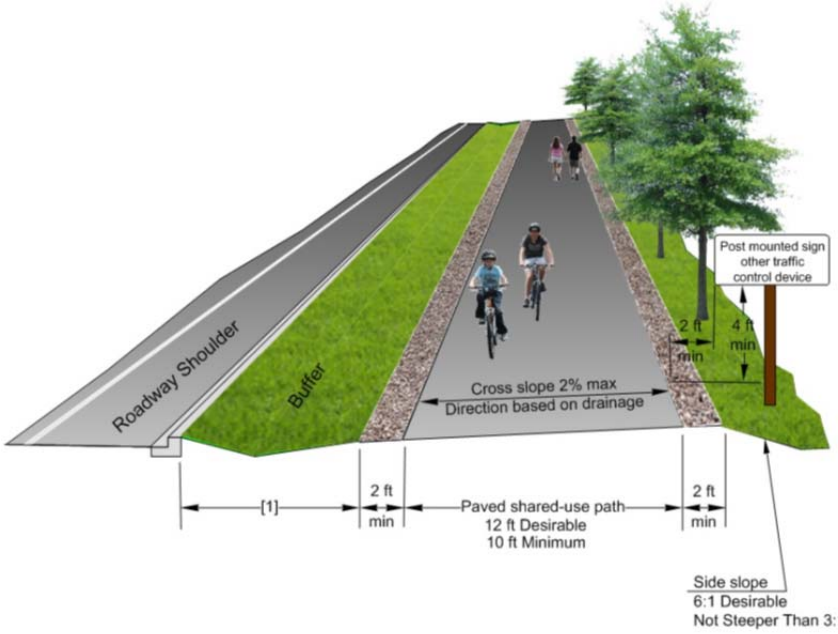
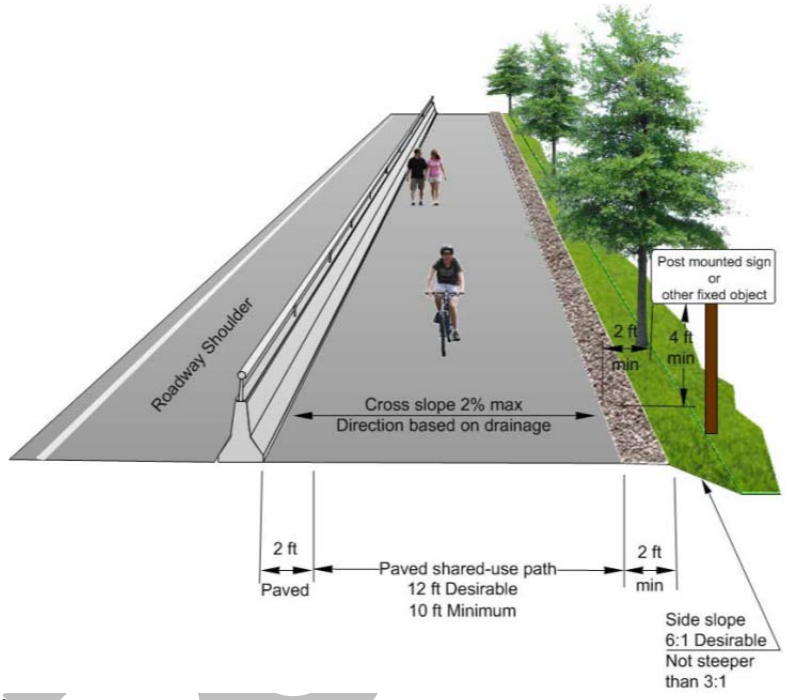


Figure 11-2: Two-way Shared-Use Path: Adjacent to Roadway (≤ 35mph)



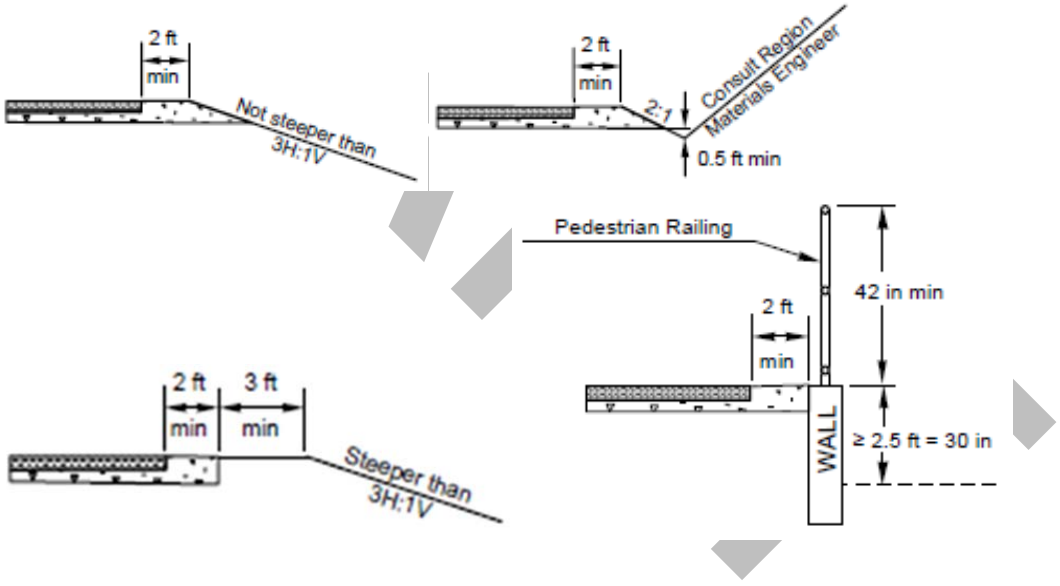
Note:
[1] Example of separation from the roadway. If separation cannot be obtained, a barrier is appropriate in accordance with Exhibit 1515-4c.

Figure 11-3: Two-way Shared-Use Path: Attached to Roadway (≤ 35mph)



Notes:
It is desirable for the cross slope to slope toward grass areas for drainage.

Figure 11-4: Share-Use Path Side Slopes and Railing



Example 1: Embankment: Based on context, flatter slopes are desirable.

Example 2: Shoulder widening to 5 feet or more Used with steeper fill slopes to provide clear space between the hinge point and path. Vegetation can also be used as a buffer on slopes. In lieu of 3 feet additional widening, consider a natural or physical barrier.

Example 3: Cut section with ditch Consult with City staff to determine for appropriate cut slopes.

Example 4: Railing used at drop off Apply railing or fencing a minimum of 42 inches high when a drop off is present, such as along a retaining wall. Consult with City staff to determine if shoulder along wall should be paved.

Note: These drawings depict some common applications for various slope alternatives.

SECTION 8 Separation

8.1 Running Slopes, Landings and Rest Areas

8.1.1 Running Slopes

Design running slopes (grades) on shared-use paths are to be no greater than 5% to accommodate all user types.

An exception is paths in the ROW where running slope can match the general grade of roadway.

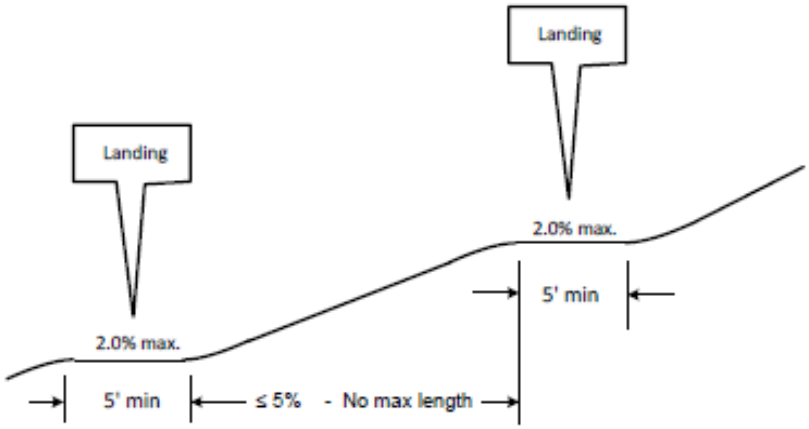
8.1.2 Landings

Shared-use path landings provide users a level place to rest on extended grades. Exhibits 1515-6 and 1515-7 show these features.

Design landings to:

- Permit users to stop periodically and rest.
- Not exceed maximum running slopes and cross slopes of 2%.
- Be in line and as wide as the shared-use path. Landings are to be at least 5 feet long.
- Avoid abrupt grade changes or angle points. Design transitions to landings using vertical curves.

Figure 11-5: Shared-Use Path Landing Profile



Notes:
Landings are desirable on extended grades.
Design vertical curves to transition from the grade to the landing.
Exhibit 1515-7 illustrates a landing and a rest area.

8.1.3 Rest Areas

Providing rest area accommodation adjacent to the shared-use path outside of the path is an acceptable solution for areas where minimum grades cannot be achieved as shown in Exhibit 1515-7.

Requirements for rest areas include:

- The maximum running slope and cross slopes are 2%.
- The minimum size is to be 5 feet by 5 feet.
- If features such as benches are provided, they must meet ADA requirements; consult with the region ADA Coordinator for guidance.

Figure 11-6: Landing and Rest Area Example

Notes:
Design inline landings at least 5 feet long and as wide as the shared-use path.
Design inline landings with a maximum cross slope and running slope of 2%.

SECTION 9 Pavement Structural Section

Design the pavement structural section of a shared-use path in the same manner as a highway, considering the quality of the subgrade and the anticipated loads on the path. (Design loads are normally maintenance and emergency vehicles.) Provide a firm, stable, slip-resistant pavement surface.

Design the pavement structural section as recommended by the Region Materials Engineer.

Use crushed rock or other suitable material for shoulder graded areas. Consult with the Region Materials Engineer. On bridges or tunnels, it is common to pave the entire shared-use path area, including shoulders across the structure.

The use of impervious asphalt should be considered.

SECTION 10 Stopping Sight Distance

The distance needed to bring a shared-use path user to a complete stop is a function of the user's perception and braking reaction times, the initial speed, the coefficient of friction between the wheels and the pavement, the braking ability of the user's equipment, and the grade. Exhibits 1515-14a and 14b provide a graph and an equation to obtain minimum stopping sight distances for various design speeds and grades.

10.1 Stopping Sight Distance on Crest Vertical Curves

Exhibit 1515-15 provides a chart or equations to obtain the minimum lengths of crest vertical curves for varying stopping sight distances and algebraic differences in grade. The values are based on a 4.5 foot eye height for the bicyclist and a 0 foot height for the object (path surface).

10.1.1 Stopping Sight Distance on Horizontal Curves

Exhibit 1515-16 gives the minimum clearances to line-of-sight obstructions for sight distance on horizontal curves. Provide lateral clearance based on the sum of stopping sight distances from Exhibits 1515-14a and 14b for bicyclists traveling in both directions and the proposed horizontal curve radius. Where this minimum clearance cannot be obtained, provide curve warning signs and use centerline pavement markings in accordance with the MUTCD.

SECTION 11 Intersections and Crossing Design

This section covers path/roadway intersections and grade-separated crossings. Detectable warning surfaces are required where shared-use paths connect to the roadway.

11.1 Intersections with Roadways

Clearly define who has the ROW and provide sight distance for all users at shared-use path and roadway intersections.

The common types of shared-use path/roadway at-grade intersection crossings are midblock and adjacent.

For roadway intersections with roundabouts, see Chapter 1320.

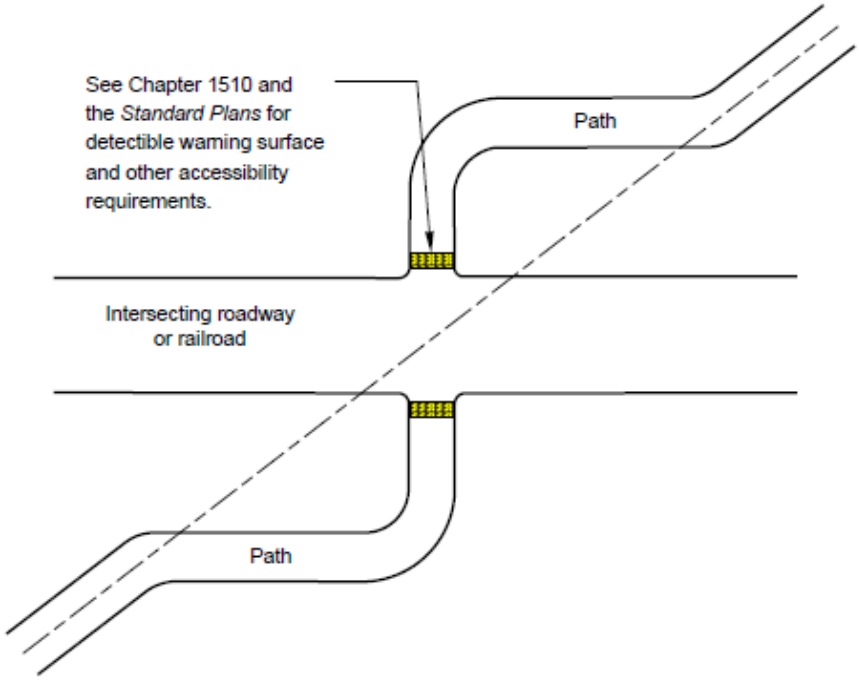
Midblock crossings are located between roadway intersections. When possible, locate the path crossings far enough away from intersections to minimize conflicts between the path users and motor vehicle traffic. It is preferable for midblock path crossings to intersect the roadway at an angle as close to perpendicular as practicable. A minimum 60 degree crossing angle is acceptable to minimize ROW needs. A diagonal midblock crossing can be altered as shown in Exhibit 1515-8.

There are other considerations when designing midblock crossings. They include traffic ROW assignments; traffic control devices; sight distances for

both bicyclists and motor vehicle operators; refuge island use; access control; and pavement markings.

The use of a sign along a path that lights up with Traffic Approaching as a car is approaching is appropriate where path users may not expect to see traffic as they cross a roadway. “LED Lights flash when a vehicle is detected on the through approach.” http://safety.fhwa.dot.gov/intersection/resources/fhwasa11015/sa11015.cfm

Figure 11-7: Typical Redesign of Diagonal Midblock Crossing



Notes:
For path and highway signing and markings, see the MUTCD and the *Standard Plans*. http://www.wsdot.wa.gov/publications/fulltext/Standards/english/PDF/m09.60-00_e.pdf
For radii approaching roadway intersections, see Exhibit 1515-2.

Adjacent path crossings are located at or near public intersection crosswalks and are normally placed with them. These crossings are usually placed with pedestrian crossings, where motorists can be expected to stop. If alternate intersection locations for a shared-use path are available, select the one with the greatest sight distance.

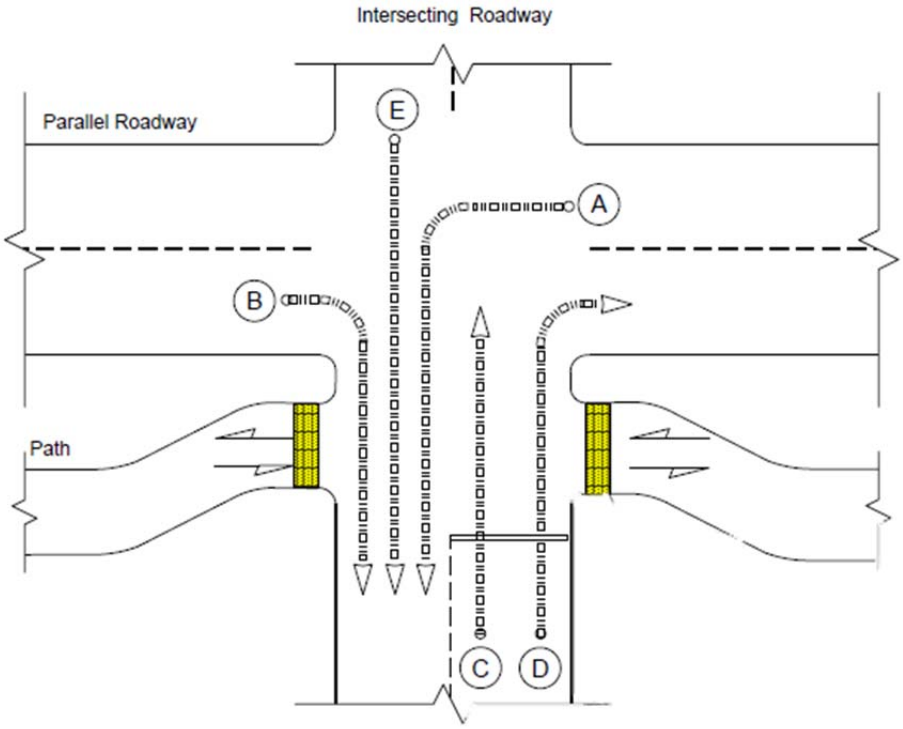
Adjacent path crossings occur where a path crosses an existing intersection of two roadways, a T intersection (including driveways), or a four-way intersection, as shown in Exhibit 1515-9. It is desirable to integrate this type of crossing close to an intersection so that motorists and path users recognize one another as intersecting traffic. The path user faces potential conflicts with motor vehicles turning left (A) and right (B) from the parallel roadway and on the crossed roadway (C, D, and E).

Consider crossing improvements on a case-by-case basis. Suggested improvements include: move the crossing; evaluate existing or proposed intersection control type;

change signalization timing; or provide a refuge island and make a two-step crossing for path users.

Important elements that greatly affect the design of these crossings are traffic ROW assignments, traffic control devices, and the separation distance between path and roadway.

Figure 11-8: Adjacent Shared-Use Path Intersection



Note:
For signing and pavement markings, see the MUTCD and the *Standard Plans*.
Rails to Trails best practices design guidelines should be used for crossings.
http://www.railstotrails.org/build-trails/trail-building-toolbox/trail-building-and-design/crossings/

11.2 Additional Roadway/Path Intersection Design Considerations

Additional roadway/path intersection design considerations include the following:

- Evaluate Intersection Control: Determine the need for traffic control devices at path/roadway intersections by using MUTCD warrants and engineering judgment. Bicycles are considered vehicles in Washington State, and bicycle path traffic can be classified as vehicular traffic for MUTCD warrants. Provide traffic signal timing set for pedestrians.
- Signal Actuation Mechanisms: Place the manually operated accessible pedestrian pushbutton in a location that complies with ADA requirements. For additional information, see Chapters 1330 and 1510. A detector loop in the path pavement may be provided in addition to the manually operated accessible pedestrian push button.

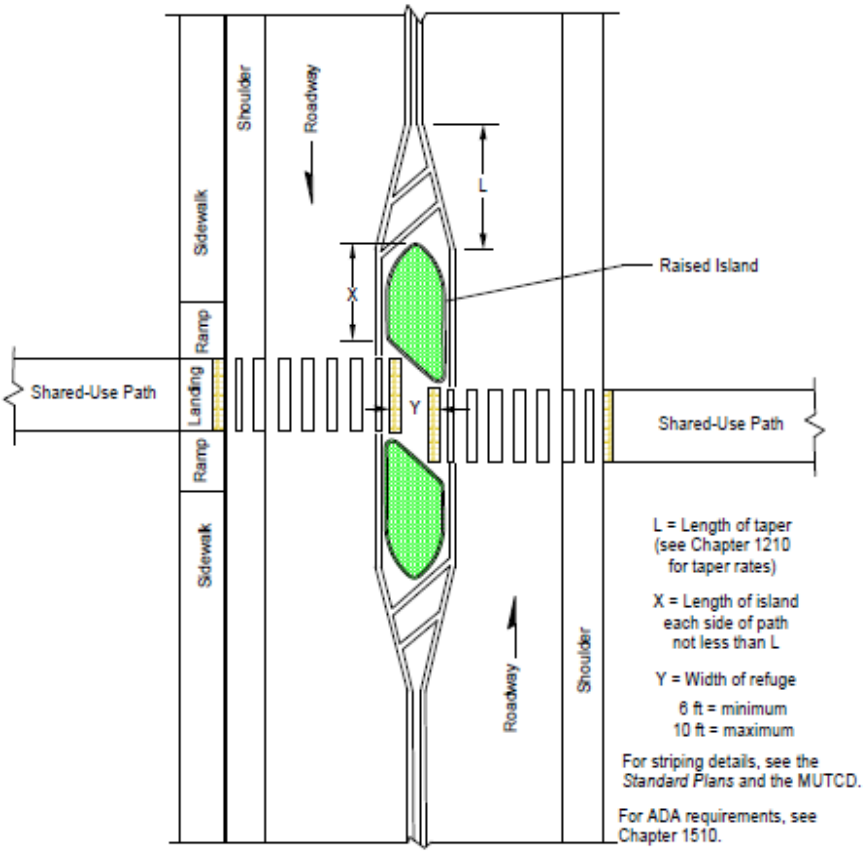
- Signing: Provide sign type, size, and location in accordance with the MUTCD. Place STOP signs as close to the intended stopping point on the path as practicable. Do not place the shared-use path signs where they may confuse motorists or place roadway signs where they may confuse shared-use path users. For additional information on signing, see the MUTCD and Chapter 1020.
- Approach Treatments: Design shared-use path and roadway intersections with level grades, and provide sight distances. Provide advance warning signs and pavement markings that alert and direct path users that there is a crossing (see the MUTCD). Do not use speed bumps or other similar surface obstructions intended to cause bicyclists to slow down. Consider some slowing features such as horizontal curves (see Exhibits 1515-2 and 1515-8). Avoid locating a crossing where there is a steep downgrade where bike speeds could be high.
- Sight Distance: Sight distance is a principal element of roadway and path intersection design. At a minimum, provide stopping sight distance for both the roadway and the path at the crossing. Decision sight distance is desirable for the roadway traffic. Refer to Chapter 1260 for stopping sight distance for the roadway and 1515.04(5) for shared-use path stopping sight distance.
- Curb Ramp Widths: Design curb ramps with a width equal to the shared-use path. Curb ramps and barrier-free passageways are to provide a smooth transition between the shared-use path and the roadway or sidewalk (for pedestrians). Curb ramps at path/ roadway intersections must meet the requirements for curb ramps at a crosswalk. For design requirements, see Chapter 1510, and for curb ramp treatments at roundabouts, see Chapter 1320.
- Refuge Islands or elevated crossings: Consider refuge islands or raised asphalt humps where a shared-use path crosses a roadway when one or more of the following applies:
  - Excessive vehicular traffic and travel speeds
  - Wide roadway crossings
  - High occurrence crossings by the elderly, children, persons with disabilities, or other slow-moving user

The refuge area may either be designed with the storage aligned perpendicularly across the island or be aligned diagonal (as shown in Exhibit 1515-10). The diagonal storage area has the added benefit of directing attention toward oncoming traffic since it is angled toward the direction from which traffic is approaching.

11.3 At Grade Railroad Crossings

Wherever possible, design the crossing at right angles to the rails. For signing and pavement marking for a shared-use path crossing a railroad track, see the MUTCD and the *Standard Plans*. Also, see Chapter 1510 for design of at-grade pedestrian railroad crossings.

Figure 11-9: Roadway Crossing Refuge Area



Note:
This exhibit shows a case where a path intersects a roadway framed with both a sidewalk and a paved shoulder, for the purpose of showing detectible warning surface placements.

SECTION 12 Grade Separation Structures

Provide the same minimum clear width as the approach paved shared-use path plus the graded clear areas.

Carrying full widths across structures has two advantages:

- The clear width provides a minimum horizontal shy distance from the railing or barrier.
- It provides needed maneuvering room to avoid pedestrians and other bicyclists.

For undercrossings and tunnels, provide a minimum vertical clearance of 10 feet for path users from the path pavement to the structure above. This allows access by emergency, patrol, and maintenance vehicles on the shared-use path.

Consult the region Maintenance Office and the HQ Bridge Preservation Office to verify that the planned path width meets their needs. If not, widen to their specifications.

Use expansion joints that accommodate shared-use path users. Expansion joints should be perpendicular to the path and have a maximum gap of 0.5 inch or be covered with a slip resistant plate. All joints must be ADA compliant.

Vertical clearance is the critical height under a structure that will accommodate vehicular and rail traffic based on its design characteristics. (See Chapter 720 for minimum vertical clearance guidance.)

The installation of protective screening is analyzed on a case-by-case basis. Refer to Chapter 720 for guidance.

Figure 11-10: Shared-Use Path Bride and Approach Walls

Note:
On structures, the bridge railing type and height are part of the structure design. Contact the HQ Bridge and Structures Office for additional information.

Figure 11-11: Bridge and Pedestrian Rail

Notes:

- The photo above shows a bridge with a shared-use path separating the users from the roadway. Pedestrian rail is used on the outside edge.
- On structures, the bridge railing type and height are part of the structure design. Contact the HQ Bridge and Structures Office for additional information.

SECTION 13 Signing, Pavement Markings and Illumination

Generally, WSDOT does not provide continuous centerline striping or channelization for user modes on shared-use paths. However, signing and pavement markings can be beneficial to warn shared-use path users of curves, grades, obstructions, and intersections.

Refer to the MUTCD for guidance and directions regarding signing (regulatory, warning, and way finding) and pavement markings. Wayfinding should be used on all trails corridors. The City of Tacoma is using the green and white MUTCD wayfinding sign seen here as a standard to identify destinations of significance.

The *Standard Plans* shows shared-use path pavement markings at obstructions in accordance with the MUTCD and also shows placement of detectible warning surfaces.

For pavement marking around bollards and other obstructions, see Standard Plan M-9.60:
http://www.wsdot.wa.gov/publications/fulltext/standards/english/pdf/m09.60-00_e.pdf

The level of illumination on a shared-use path is dependent on the amount of nighttime use expected and the nature of the area surrounding the facility. If illumination is used, provide illumination in accordance with Chapter 1040. The City of Tacoma has an LED standard for pedestrian level illumination. Lighting may also require cut-off shield to reduce light intrusion on to adjacent homes or properties. The applicant shall submit a lighting plan for review by the City.

Mileage markers should be used in corridors with a distinct beginning and ending in increments of 0.5 miles. The markers should measure distance starting from 0 in each direction. Tacoma's standard will look like this:

Figure 11-12: Mileage Marker

SECTION 14 Restricted Use Controls

This section presents requirements on use of fencing and other treatments to restrict roadway and path users to their domains.

14.1 Fencing

Fencing or other forms of controlling access are generally necessary to ensure compliance of intended use and safety along the path. Shared-use paths constructed as shown in Exhibit 1515-13, likely require fencing. For guidance on fencing controls in the right of way, refer to Division 5 of the *Design Manual*.

Figure 11-13: Shared-Use Path

Shared-Use Path in Limited Access Corridor

14.2 Restriction of Motor Vehicles

Shared-use paths often need some form of physical barrier at roadway intersections to prevent unauthorized motor vehicles from entering.

Bollards have been used by many path owners to prevent unauthorized vehicle access. However, bollards should not be applied indiscriminately, and there are other considerations to bollard installation. Where are they – when are bollards required, when are they allowed?

14.2.1 Landscaped Islands

A preferred method of restricting entry of motor vehicles is to split the entry way into two sections separated by low landscaping, thereby splitting a path into two channels at roadway intersections. This method essentially creates an island in the middle of the path rather than installing a bollard. Such an island could be planted with low- growing, hardy vegetation capable of withstanding the occasional authorized vehicle traveling over it. When splitting a path, employ MUTCD pavement markings and signing, such as is used for bollards and obstructions.

14.2.2 Bollard Considerations

Bollards prevent autos from entering a path but can cause serious injury to unaware trail users. *FHWA* warns against using bollards except in situations where other designs and landscaping options are not possible. Bollards should be considered a last choice. Please see for FHWA guidance on this issue. http://www.fhwa.dot.gov/environment/recreational_trails/guidance/accessibility_guidance/bollards_access.cfm

Typically, one bollard located in the center of the path is sufficient to control motor vehicle access to the path. If more control is needed, the additional

bollards or large rocks should be placed at the edge of the shared-use path.

Install bollards at entrances to shared-use paths to discourage motor vehicles from entering. Do not use bollards to divert or slow path traffic. When locating such installations, stripe an envelope around the bollards and paint and reflectorize them to be visible to path users both day and night. Bollards located on or adjacent to shared-use paths represent an object that needs to be avoided by bicyclists and pedestrians. To increase the potential for appropriate maneuvering to occur, provide designs where the post is clearly visible and recognizable.

When designing the placement and type bollard, the following apply:

- The desirable design is to provide a single bollard with the locking mechanism at the top, installed in the middle of the path.
- If multiple bollard posts are used, a minimum 5 foot spacing between the edge of concrete footings to permit passage of bicycle-towed trailers, wheelchairs, and adult tricycles, with room for bicycle passage without dismounting.
- Provide 4 feet minimum (5 feet desirable) clear width between the edge of concrete footing and edge of path.
- At a minimum, provide stopping sight distance to bollards. An ideal location for bollard placement is in a relatively straight area of the path where the post placement has the stopping sight distance given in Exhibit 1515-14a and 14b. Do not place bollards in difficult-to-see locations (for example, immediately upon entering a tunnel).
- For cases where multiple posts are used longitudinally along the path, locate them at least 20 feet apart, with the first post in line from each direction having stopping sight distance.
- Use a contrasting striping pattern on the post.
- Use reflective materials on the post, such as a band at the top and at the base.
- Design all bollards along a corridor to be uniform in appearance. Frequent cyclists can become familiar with the posts and recognize them easily.
- Provide pavement markings in accordance with the Standard Plans and MUTCD at all bollards on paved paths.
- Use removable bollards (Bollard Type 1) to permit access by emergency and service vehicles.
- Non-removable bollards (Bollard Type 2) may be used where access is not needed.

Refer to the Standard Plans for bollard designs and the Standard Plans and MUTCD for pavement markings on bollards.

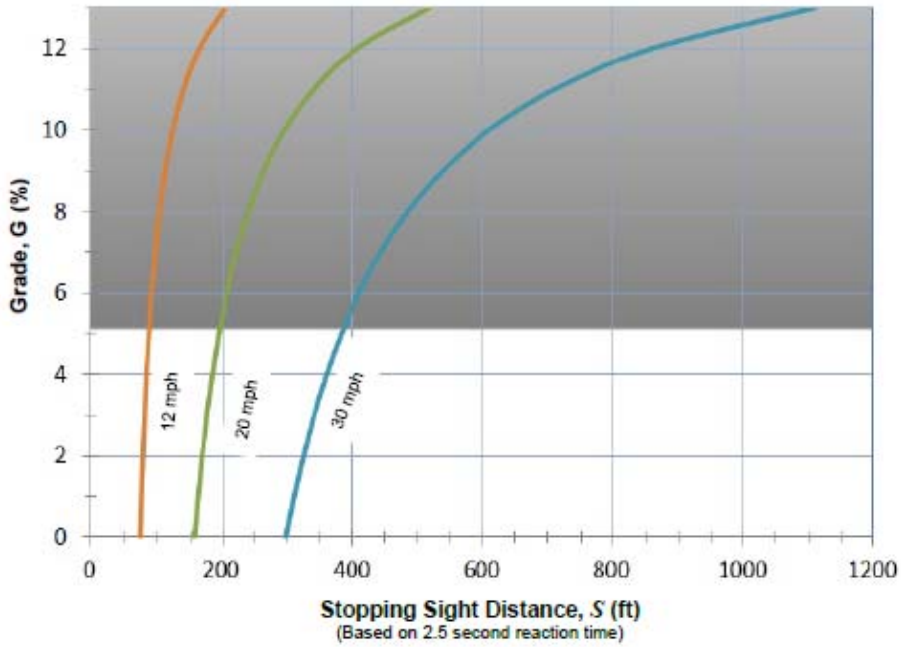
For bollards placed near the roadway, see Chapter 1600 for clear zone requirements.

SECTION 15 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:

www.wsdot.wa.gov/design/projectdev/

Figure 11-14: Stopping Sight Distance for Downgrades



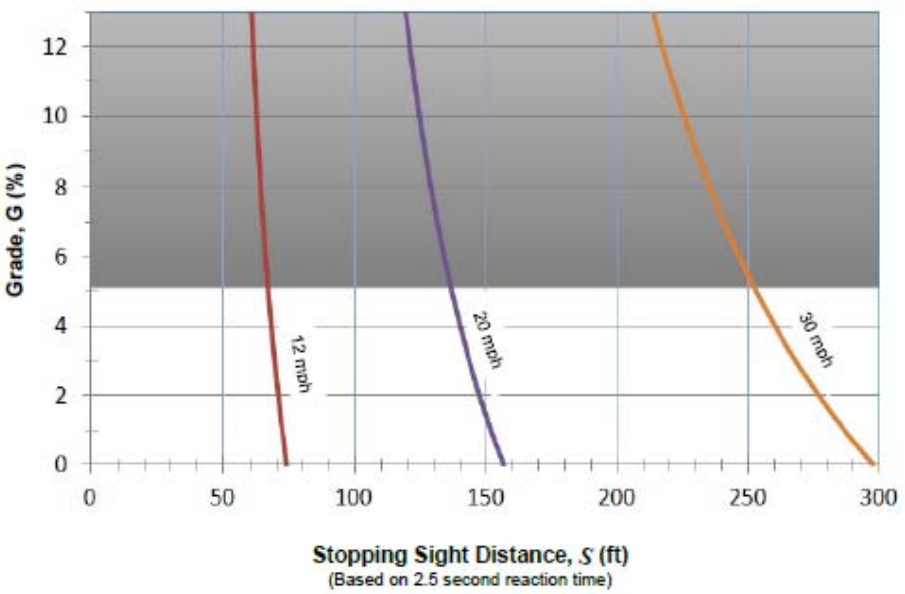
Note: Shaded area represents grades greater than 5%.

$$S = \frac{V^2}{0.30(f - G)} + 3.67V$$

Where:

S = Stopping sight distance (ft)
V = Speed (mph)
f = Coefficient of friction (use 16)
G = Grade (%)

Figure 11-15: Stopping Sight Distance for Downgrades, Cont.



Note: Shaded area represents grades greater than 5%.

$$S = \frac{V^2}{0.30(f - G)} + 3.67V$$

Where:
S = Stopping sight distance (ft)
V = Speed (mph)
f = Coefficient of friction (use 16)
G = Grade (%)

Figure 11-16: Minimum Lengths for Crest Vertical Curves

A (%)	Stopping Sight Distance, S (ft)													
	40	60	80	100	120	140	160	180	200	220	240	260	280	
2	3	3	3	3	3	3	3	3	3	3	30	70	110	150
3	3	3	3	3	3	3	20	60	100	140	180	220	260	300
4	3	3	3	3	15	55	95	135	175	215	256	300	348	400
5	3	3	3	20	60	100	140	180	222	269	320	376	436	500
6	3	3	10	50	90	130	171	216	267	323	384	451	523	600
7	3	3	31	71	111	152	199	252	311	376	448	526	610	700
8	3	8	48	88	128	174	228	288	356	430	512	601	697	800
9	3	20	60	100	144	196	256	324	400	484	576	676	784	900
10	3	30	70	111	160	218	284	360	444	538	640	751	871	1,000
11	3	38	78	122	176	240	313	396	489	592	704	826	958	1,100
12	5	45	85	133	192	261	341	432	533	645	768	901	1,045	1,200
13	11	51	92	144	208	283	370	468	578	699	832	976	1,132	1,300
14	16	56	100	156	224	305	398	504	622	753	896	1,052	1,220	1,400
15	20	60	107	167	240	327	427	540	667	807	960	1,127	1,307	1,500
16	24	64	114	178	256	348	455	576	711	860	1,024	1,202	1,394	1,600
17	27	68	121	189	272	370	484	612	756	914	1,088	1,277	1,481	1,700
18	30	72	128	200	288	392	512	648	800	968	1,152	1,352	1,568	1,800
19	33	76	135	211	304	414	540	684	844	1,022	1,216	1,427	1,655	1,900
20	35	80	142	222	320	436	569	720	889	1,076	1,280	1,502	1,742	2,000
21	37	84	149	233	336	457	597	756	933	1,129	1,344	1,577	1,829	2,100
22	39	88	156	244	352	479	626	792	978	1,183	1,408	1,652	1,916	2,200
23	41	92	164	256	368	501	654	828	1,022	1,237	1,472	1,728	2,004	2,300
24	43	96	171	267	384	523	683	864	1,067	1,291	1,536	1,803	2,091	2,400
25	44	100	178	278	400	544	711	900	1,111	1,344	1,600	1,878	2,178	2,500

Minimum Length of Vertical Curve, L (ft)

$$L = \frac{AS^2}{900} \quad \text{when } S < L$$

$$L = 2S - \frac{900}{A} \quad \text{when } S > L$$

Where:
S = Stopping sight distance (ft)
A = Algebraic difference in grade (%)
L = Minimum vertical curve length (ft

Based on an eye height of 4.5 ft and an object height of 0 ft.

Note:
Below _____ represents $S \leq L$.
Shaded area represents A>10%.

Figure 11-17: Minimum Lateral Clearance

Height of eye: 4.50 ft

Height of object: 0.0 ft

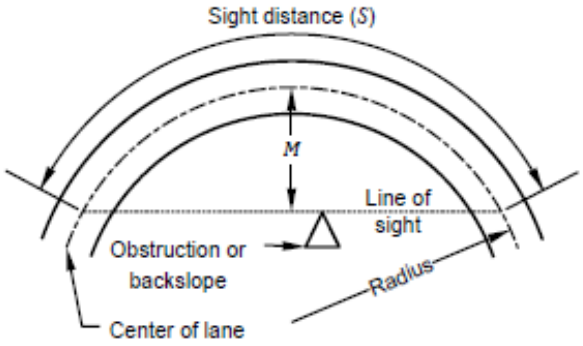
Line of sight at the M distance is normally 2.3 ft above centerline of inside lane at point of obstruction, provided no vertical curve is present in horizontal curve.

$$M = R\left(1 - \cos\frac{S\,28.65}{R}\right)$$

$$S = \frac{R}{28.65}\left[\cos^{-1}\left(\frac{R-M}{R}\right)\right]$$

$S \le$ Length of curve

Angle is expressed in degrees.



Where:

S = Sight distance (ft)

R = Centerline radius of inside lane (ft)

M = Distance from inside lane centerline (ft)

R (ft)	Stopping Sight Distance, S (ft)[1]													
	40	60	80	100	120	140	160	180	200	220	240	260	280	300
25	7.6	15.9												
50	3.9	8.7	15.2	23.0	31.9	41.5								
75	2.7	5.9	10.4	16.1	22.7	30.4	38.8	47.8	57.4	67.2				
95	2.1	4.7	8.3	12.9	18.3	24.6	31.7	39.5	47.9	56.9	66.2	75.9	85.8	
125	1.6	3.6	6.3	9.9	14.1	19.1	24.7	31.0	37.9	45.4	53.3	61.7	70.5	79.7
150	1.3	3.0	5.3	8.3	11.8	16.0	20.8	26.2	32.1	38.6	45.5	52.9	60.7	69.0
175	1.1	2.6	4.6	7.1	10.2	13.8	18.0	22.6	27.8	33.4	39.6	46.1	53.1	60.4
200	1.0	2.2	4.0	6.2	8.9	12.1	15.8	19.9	24.5	29.5	34.9	40.8	47.0	53.7
225	0.9	2.0	3.5	5.5	8.0	10.8	14.1	17.8	21.9	26.4	31.2	36.5	42.2	48.2
250	0.8	1.8	3.2	5.0	7.2	9.7	12.7	16.0	19.7	23.8	28.3	33.0	38.2	43.7
275	0.7	1.6	2.9	4.5	6.5	8.9	11.6	14.6	18.0	21.7	25.8	30.2	34.9	39.9
300	0.7	1.5	2.7	4.2	6.0	8.1	10.6	13.4	16.5	19.9	23.7	27.7	32.1	36.7
350	0.6	1.3	2.3	3.6	5.1	7.0	9.1	11.5	14.2	17.1	20.4	23.9	27.6	31.7
400	0.5	1.1	2.0	3.1	4.5	6.1	8.0	10.1	12.4	15.0	17.9	20.9	24.3	27.8
500	0.4	0.9	1.6	2.5	3.6	4.9	6.4	8.1	10.0	12.1	14.3	16.8	19.5	22.3
600	0.3	0.7	1.3	2.1	3.0	4.1	5.3	6.7	8.3	10.1	12.0	14.0	16.3	18.7
700	0.3	0.6	1.1	1.8	2.6	3.5	4.6	5.8	7.1	8.6	10.3	12.0	14.0	16.0
800	0.2	0.6	1.0	1.6	2.2	3.1	4.0	5.1	6.2	7.6	9.0	10.5	12.2	14.0
900	0.2	0.5	0.9	1.4	2.0	2.7	3.6	4.5	5.5	6.7	8.0	9.4	10.9	12.5
1,000	0.2	0.4	0.8	1.2	1.8	2.4	3.2	4.0	5.0	6.0	7.2	8.4	9.8	11.2

Minimum Lateral Clearance, *M* (ft)

CHAPTER 12
PEDESTRIAN FACILITIES

INTRODUCTION

Pedestrian travel is a vital transportation mode. It is used at some point by nearly everyone and is a critical link to everyday life for many. Designers must be aware of the various physical needs and abilities of pedestrians in order to ensure facilities provide universal access.

Section 504 of the Rehabilitation Act and the ADA of 1990 require pedestrian facilities to be designed and constructed so they are readily accessible to and usable by persons with disabilities. This chapter provides accessibility criteria for the design of pedestrian facilities that meet applicable local, state, and federal standards.

The pedestrian facilities included in a project are determined during the planning phase based on the 6 year Transportation Plan, the Mobility Master Plan, the Curb Ramp Installation Matrix, and the Right-of-Way Restoration Policy.

When developing pedestrian facilities in locations with challenging grades or a limited amount of ROW, designers may face multiple challenges. It is important that designers become familiar with the ADA accessibility criteria in order to appropriately balance intersection design with the often competing needs of pedestrians and other roadway users.

Similar to the roadway infrastructure, pedestrian facilities (and elements) require periodic maintenance in order to prolong the life of the facility and provide continued usability. Title II of the ADA requires that all necessary features be accessible and maintained in operable working condition for use by individuals with disabilities.

SECTION 1 Design Guides and Resources

1.1 Federal/State/Local Laws and Codes

- ADA – 28 Code of Federal Regulations (CFR) Part 35
- 23 CFR Part 652, Pedestrians and Bicycle Accommodations and Projects
- 49 CFR Part 27, Nondiscrimination on the Basis of Disability in Programs or Activities Receiving Federal Financial Assistance (Section 504 of the Rehabilitation Act of 1973 implementing regulations)
- Revised Code of Washington (RCW) 35.68, Sidewalks, gutters, curbs and driveways – All cities and towns
- RCW 35.68.075, Curb ramps for persons with disabilities – Required – Standards and Requirements
- RCW 46.04.160, Crosswalk (definition)
- RCW 46.61, Rules of the Road
- RCW 47.24.020, City streets as part of state highways – Jurisdiction, control
- PROWAG- Public Right-of-Way Accessibility Guidelines
- City of Tacoma Curb Ramp Installation Matrix
- City of Tacoma Right-of-Way Restoration Policy
- City of Tacoma Mobility Master Plan

- City of Tacoma Stormwater Management Manual
- City of Tacoma Complete Streets Guidelines
- City of Tacoma Accessible Pedestrian Signal (APS) Policy
- City of Tacoma Municipal Codes

1.2 Design Guidance

- For buildings and on-site facilities; applies to new construction or alterations: ADA Standards for Accessible Design, U.S. Department of Justice, http://www.access-board.gov/guidelines-and-standards
- For transit, light rail, and similar public transportation facilities: ADA Standards for Transportation Facilities, http://www.access-board.gov/guidelines-and-standards
- Department of Justice/Department of Transportation Joint Technical Assistance on the Title II of the Americans with Disabilities Act Requirements to Provide Curb Ramps when Streets, Roads, or Highways are Altered through Resurfacing
  http://www.ada.gov/doj-fhwa-ta.htm
  http://www.ada.gov/doj-fhwa-ta-glossary.htm
- Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), USDOT, FHWA; as adopted and modified by Chapter 468-95 WAC, www.wsdot.wa.gov/publications/manuals/mutcd.htm
- Revised Draft Guidelines for Accessible Public Rights-of-Way (PROWAG). The current best practices for evaluation and design of pedestrian facilities in the public right of way per the following FHWA Memoranda:
  http://www.fhwa.dot.gov/environment/bikeped/prwaa.htm
  http://www.fhwa.dot.gov/civilrights/memos/ada_memo_clarificationa.htm
  http://www.access-board.gov/guidelines-and-standards
- City of Tacoma Standard Plans

1.3 Supporting Information

- AASHTO's A Policy on Geometric Design of Highways and Streets (Green Book)
- WSDOT's Field Guide for Accessible Public Rights of Way, http://www.wsdot.wa.gov/publications/fulltext/roadside/ada_field_guide.pdf
- AASHTO's Guide for the Planning, Design, and Operation of Pedestrian Facilities provides guidance on the planning, design, and operation of pedestrian facilities along streets and highways. Specifically, the guide focuses on identifying effective measures for accommodating pedestrians on public rights of way.
- Highway Capacity Manual, Transportation Research Board
- Pedestrian Facilities Guidebook: Incorporating Pedestrians into Washington's Transportation System, OTAK, www.wsdot.wa.gov/publications/manuals/fulltext/m0000/pedfacgb.pdf

- FHWA's Pedestrian Facilities Users Guide – Providing Safety and Mobility provides useful information regarding walkable environments, pedestrian crashes and their countermeasures, and engineering improvements for pedestrians: http://drusilla.hsrc.unc.edu/cms/downloads/pedfacility_userguide2002.pdf

- Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way, July 26, 2011, U.S. Access Board. Federal Notice of Proposed Rule Making that gives a preview of potential future revisions to the PROWAG, www.access-board.gov/prowac/nprm.htm

- "Special Report: Accessible Public Rights-of-Way – Planning & Design for Alterations," Public Rights-of-Way Access Advisory Committee, July 2007www.access-board.gov/prowac/alterations/guide.htm

- WSDOT's Understanding Flexibility in Transportation Design – Washington www.wsdot.wa.gov/research/reports/600/638.1.htm

- Washington State Bicycle Facilities and Pedestrian Walkways Plan, www.wsdot.wa.gov/bike/bike_plan.htm

- Terminal Design Manual, Chapter 300 Accessibility, WSDOT, Washington State Ferries Division www.wsdot.wa.gov/publications/manuals/m3082.htm

SECTION 2 Policy

2.1 General

It is the City's policy to provide appropriate pedestrian facilities as an integral part of the transportation system, and that bicycle and pedestrian facilities be given full consideration in the planning and design of new construction and reconstruction ROW projects, except where bicycle and pedestrian use is prohibited.

2.2 Jurisdiction

Proposed projects in public ROW must address ADA compliance as described in this chapter (see Section 3 for ADA requirements by project type). Regardless of which public agency has jurisdiction within the ROW, the public agency that is sponsoring the project is responsible for ensuring ADA compliance is addressed on its project. Should there be any discrepancies in ADA compliance requirements between the public agency that has jurisdiction over the public ROW and the public agency sponsoring the project, the most stringent requirements will be followed.

SECTION 3 ADA Requirements by Project Type

Wherever pedestrian facilities are intended to be a part of the transportation facility, federal regulations (28 CFR Part 35) require that those pedestrian facilities meet ADA guidelines. All new construction or alteration of existing transportation facilities must be designed and constructed to be accessible to and usable by persons with disabilities. FHWA is one of the federal agencies designated by the Department of Justice to ensure compliance with the ADA for transportation projects.

3.1 New Construction Projects

New construction projects including the construction of a new roadway, intersection, or other transportation facility where none existed before shall address and include pedestrians' needs in the project. All pedestrian facilities included in these projects must fully meet the ADA and City of Tacoma accessibility criteria when built.

3.2 Alteration Projects

Any project that affects or could affect the usability of a pedestrian facility is classified as an alteration project. Alteration projects include, but are not limited to, renovation; rehabilitation; reconstruction; historic restoration; resurfacing of circulation paths or vehicular ways; and changes or rearrangement of structural parts or elements of a facility. Where existing elements or spaces are altered, each altered element or space within the limits of the project shall comply with the applicable ADA and City of Tacoma accessibility requirements to the maximum extent feasible.

The following are some examples of project types that are classified as alteration projects and can potentially trigger a variety of ADA requirements:

- HMA overlay or inlay
- Traffic signal installation or retrofit
- Roadway widening
- Realignment of a roadway (vertical or horizontal)
- Sidewalk improvements
- Portland cement concrete panel repair/replacement
- Bridge replacement
- Raised channelization

The following are not considered alterations:

- Spot pavement repair
- Liquid-asphalt sealing, chip seal (BST), or crack sealing
- Lane or crosswalk restriping

If there is uncertainty as to whether a project meets the definition of an alteration project, consult with the City's ADA Coordinator.

The following apply to alteration projects:

- All new pedestrian facilities included in an alteration project that are put in place within an existing developed ROW must meet applicable ADA and City of Tacoma accessibility requirements to the maximum extent feasible.

- All existing pedestrian facilities disturbed by construction of an alteration project must be replaced. The replacement facilities must meet applicable ADA and City of Tacoma accessibility requirements to the maximum extent feasible.

- An alteration project shall not decrease or have the effect of decreasing the accessibility of a pedestrian facility or an accessible connection to an adjacent building or site.

- Within the construction impact zone of an alteration project, any existing connection from a pedestrian access route to a crosswalk (marked or unmarked) that is missing a required curb ramp must have a curb ramp installed that meets applicable accessibility requirements to the maximum extent feasible. Refer to the City of Tacoma's Curb Ramp Installation Matrix (See the City of Tacoma GovME Website) to determine which work requires the construction of curb ramps, and if existing curb ramps require replacement.

- A crosswalk served by a curb ramp must also have an existing curb ramp in place on the receiving end unless there is no curb or sidewalk on that end of the crosswalk (RCW 35.68.075). If there is no existing curb ramp in place on the receiving end, an accessible curb ramp must be provided. This requirement must be met regardless of whether the receiving end of the crosswalk is located within the project's limits.

- Evaluate all existing curb ramps within the construction impact zone of an alteration project to determine whether curb ramp design elements meet the accessibility criteria (see the City of Tacoma's Curb Ramp Installation Matrix- Existing Curb Ramp Evaluation Criteria). Modify existing curb ramps that do not meet the ADA and City of Tacoma accessibility criteria. This may also trigger modification of other adjacent pedestrian facilities to incorporate transitional segments in order to ensure specific elements of a curb ramp will meet the accessibility criteria.

- Evaluate all existing marked and unmarked crosswalks (see Section 8.2 of this Chapter) within the construction impact zone of an alteration project that includes HMA overlay (or inlay) of an existing roadway and does not include reconstruction, realignment, or widening of the roadway for crosswalk accessibility criteria). If it is not possible to meet the applicable ADA and City of Tacoma accessibility requirements for crosswalks, document this in a maximum extent feasible (MEF) memorandum as described below and attach it to the final plan set.

- Within the construction impact zone of an alteration project that includes reconstruction, realignment, or widening of the roadway, evaluate all existing crosswalks (marked or unmarked) to determine whether crosswalk design elements meet the accessibility criteria (see Section 8.2 of this Chapter) for crosswalk accessibility criteria.) Modify crosswalk slopes to meet the applicable ADA and City of Tacoma accessibility requirements.

It may not always be possible to fully meet the applicable ADA and City of Tacoma accessibility requirements during alterations of existing facilities. If such a situation is encountered, consult with the City's ADA Coordinator to develop a workable solution to meet the accessibility requirements, and/or draft a MEF justification. Cost is not to be used as a justification for not meeting the accessibility criteria. Physical terrain or site conditions that would require structural impacts, environmental impacts, or unacceptable impacts to the community in order to achieve full compliance with the accessibility criteria are some of the factors that can be used to determine if the maximum extent feasible has been met. If it is determined to be virtually impossible to meet the accessibility criteria for an element, document the decision in one of the following two ways. The documentation method will depend on the complexity and length of the justification:

- Depending on the non-compliant elements that warrant a short explanation (e.g. curb ramp flare slope on the uphill side) the MEF can be contained within a text box and a leader line extended to the non-compliant element. The MEF must include the following:
  - A description of the scope of work
  - The site specific factors affecting compliance
  - The measures implemented to improve compliance

More complicated issues such as non-compliant cross slopes of crosswalks or curb ramps may require a MEF memorandum. . All MEF memorandums should be reviewed and approved by the City's ADA Coordinator, project manager, or plans examiner.

SECTION 4 Pedestrian Circulation Paths (PCPs)

Pedestrian circulation paths (PCPs) are prepared exterior or interior ways of passage provided for pedestrian travel. They include independent walkways, sidewalks, shared-use paths, and other types of pedestrian facilities. Pedestrian circulation paths can either be immediately adjacent to streets or separated from streets by a buffer. Examples of pedestrian circulation paths are shown below

Provide a smooth finish to vertical surfaces (see Section 5.1.3 Surface of this Chapter) adjacent to a pedestrian circulation path to mitigate potential snagging or abrasive injuries from accidental contact with the surface. Any projections into the pedestrian circulation path must be cane detectable (see Section 4.1.2 Horizontal Encroachment of this Chapter) or extend 4 inches or less into the path.

When relocation of utility poles, signage, and other fixtures is necessary for a project, determine the impact of their new location on all pedestrian circulation paths. Look for opportunities to relocate obstructions, such as existing utility objects, away from the pedestrian circulation path.

Shoulders may serve as a pedestrian facility when sidewalks are not provided. If pedestrian generators, such as bus stops, are present and pedestrian usage is evident, a 4 foot-wide minimum paved shoulder will be required.

Pedestrian Circulation Paths

4.1 Accessibility Criteria for Pedestrian Circulation Paths (PCPs)

The following criteria apply across the entire width of the pedestrian circulation path (PCP), not just within the pedestrian access route (PAR).

4.1.1 Vertical Clearance

The minimum vertical clearance for objects, such as trees and canopies that protrude into or overhang a pedestrian circulation path (PCP) is 80 inches (see PROWAG).

If the minimum vertical clearance cannot be provided, railings or other barriers shall be provided. The leading bottom edge of the railing or barrier shall be located 27 inches maximum above the finished surface for cane detection.

Per the MUTCD, the vertical clearance to the bottom of signs is 7 feet.

4.1.2 Horizontal Encroachment

Protruding objects on pedestrian circulation paths shall not reduce the clear width of the pedestrian access route to less than 4 feet, exclusive of the curb.

If an object must protrude farther than 4 inches into a pedestrian circulation path at a height that is greater than 27 inches and less than 80 inches above the finished surface, then it must be equipped with a warning device such as railing or other barriers that are cane detectable. The minimum clear width of the pedestrian access route must still be provided.

4.1.3 Post-Mounted Objects

Objects mounted on posts, at a height that is greater than 27 inches and less than 80 inches above the finished surface, shall not protrude more than 4 inches into a pedestrian circulation path.

If an object must protrude farther than 4 inches into a pedestrian circulation path at a height that is greater than 27 inches and less than 80 inches above the finished surface, then it must be equipped with a warning device that is detectable by a vision-impaired person who navigates with a cane. The minimum clear width of the pedestrian access route must still be provided.

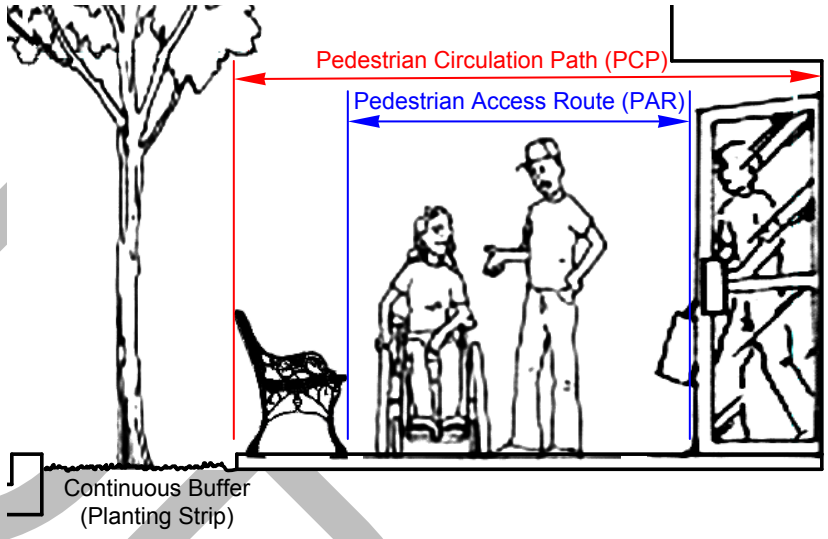
Where a sign or other obstruction on a pedestrian circulation path is mounted on multiple posts, and the clear distance between the posts is greater than 12 inches, the lowest edge of the sign or obstruction shall be either 27 inches maximum or 80 inches minimum above the finished surface.

SECTION 5 Pedestrian Access Routes (PARs)

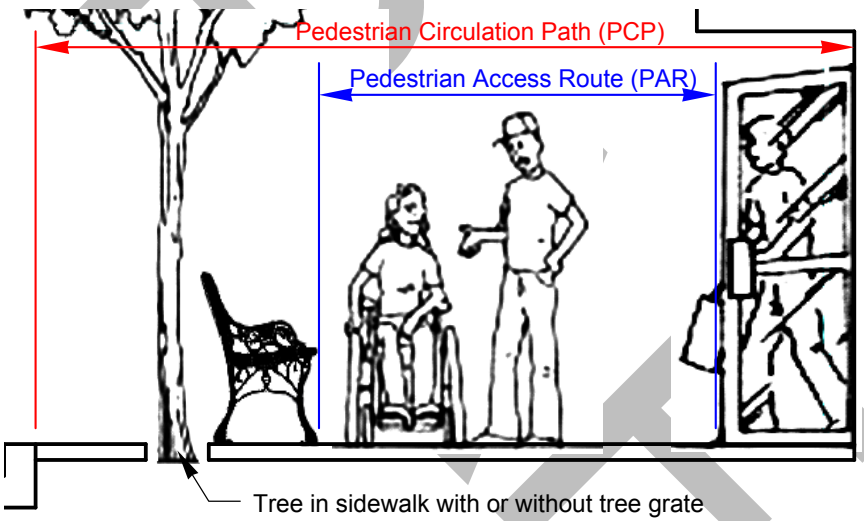
All pedestrian circulation paths (PCPs) are required to contain a continuous pedestrian access route (PAR) (see illustrations below) that connects to all adjacent pedestrian facilities, elements, and spaces that are required to be accessible. PARs consist of one or more of the following pedestrian facilities: walkways/sidewalks, crosswalks, curb ramps (excluding flares), landings, pedestrian overpasses/underpasses, access ramps, elevators, and platform lifts.

Figure 12-1: Relationship between Pedestrian Circulation Paths (PCPs) and Pedestrian Access Routes (PARs)

With Continuous Buffer



Without Continuous Buffer



5.1 Accessibility Criteria for PARs

5.1.1 Clear Width

The minimum continuous and unobstructed clear width of a PAR shall be 7 feet for arterial streets and 5 feet for all other streets, exclusive of the curb width.

Objects are not allowed to protrude into the clear width. For example, objects such as tree branches, vehicle bumpers, mailboxes, sign posts, and tree grates are not allowed to reduce the clear width of the PAR.

Provide wheel stops or a wider sidewalk to remedy the encroachment into the PAR.

5.1.2 Cross Slope and Grade

The cross slope of a PAR 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. For example: design for a maximum 1.5% cross slope (rather than 2% maximum).

Exceptions:

- Midblock crosswalks – The cross slope of the crosswalk and any connected curb ramp is permitted to match street grade.
- Pedestrian Street Crossing without Yield or Stop Control – The cross slope of the crosswalk can be up to 5% maximum.

Where a PAR is contained within the street ROW, its grade shall not exceed the general grade established for the adjacent roadway.

Exception: The maximum grade in a crosswalk (marked or unmarked) is 5%, measured parallel to the direction of pedestrian travel in the crosswalk.

Where a PAR is not contained within the highway right of way, the maximum running slope allowed is 5% unless designed as an access ramp. Reference 1510.15(2) for access ramp accessibility criteria.

For additional criteria when a PAR is supported by a structure, see Section 13 Pedestrian Grade Separations (Structures) of this Chapter.

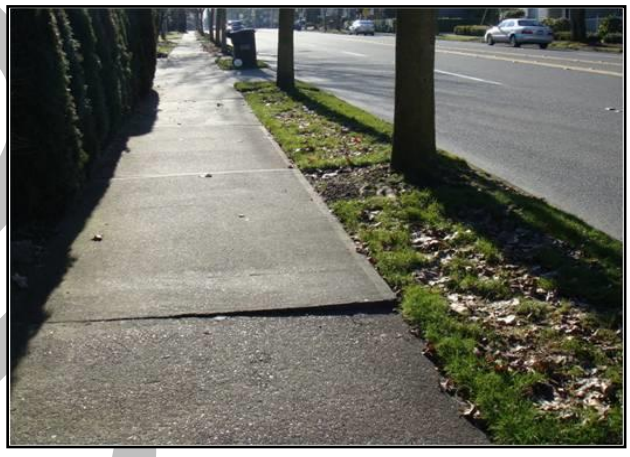
5.1.3 Surface

The surface of the PAR shall be firm, stable, and slip resistant. Use hard surfaces like concrete or asphalt. Crushed gravel is not considered to be a stable, firm surface. Proposals to use permeable pavers will be evaluated on a case-by-case basis for acceptability and maintenance as a walking surface. The PAR surface must meet all ADA and City of Tacoma accessibility requirements.

Grade breaks shall be flush.

Surface discontinuities (see illustrations and picture below) on existing surfaces in the PAR (such as at the joints of settled or upheaved sidewalk panels) may not exceed ½ inch maximum. Vertical discontinuities between ¼ inch and ½ inch maximum shall be beveled at 2H:1V or flatter. Apply the bevel across the entire level change.

No surface discontinuity is allowed at the connection between an existing curb ramp or landing and the gutter. This grade break must be flush.



Surface Discontinuities (Noncompliant)

Gratings, access covers, utility objects, and other appurtenances shall not be located on curb ramps, landings, or gutters within the PAR. Where this is not possible, ensure covers, grates, and lids are designed to be slip resistant and are installed flush with the surrounding surface.

5.1.4 Horizontal Openings

Any sidewalk joints or gratings that are in the PAR shall not permit passage of a sphere more than 0.5 inch in diameter.

Elongated openings shall be placed so that the long dimension is perpendicular to the dominant direction of travel.

Openings for wheel flanges at pedestrian crossings of nonfreight rail track shall be 2.5 inches maximum (3 inches maximum for freight rail track).

For additional requirements when a PAR crosses a railroad, see Section 12 At-Grade Rail Crossings in this Chapter.

SECTION 6 Sidewalks

Sidewalks are one type of pedestrian circulation path (PCP). See Section 4 of this Chapter for PCP accessibility criteria. Plan the design of sidewalks carefully to include a PAR that provides universal access. See Section 5 of this Chapter for PAR accessibility criteria. Wherever appropriate, make sidewalks continuous and provide access to side streets. The most pleasing and comfortable installation for the pedestrian is a sidewalk separated from the traveled way by

a planted buffer. This provides a greater separation between vehicles and pedestrians than curb alone.

6.1 Sidewalk and Buffer Widths

The City of Tacoma minimum standard residential sidewalk width is 5 feet (excluding the curb width and required planting strip). Adjacent to arterials, sidewalk widths shall be a minimum of 7 feet (excluding the curb width and buffer or planting strip), unless specified in the Municipal Code or Design Guidelines. For example, minimum widths for Mixed-Use Centers shall be superseded by the Mixed-Use Center design criteria found in Tacoma Municipal Code 13.06.300. A 10- to 12-foot sidewalk is preferred for high pedestrian traffic and commercial areas. Refer to Chapter 4 Street Design of this manual for additional information.

When a buffer (vegetated as well as approved alternate pavement) is provided, the buffer should be at least 5 feet wide (excluding the curb width). Prior approval must be obtained from the City Engineer or Designee to reduce a buffer width to less than 5 feet.

If trees or shrubs are included in a buffer, prior approval must be obtained from the City Engineer or Designee. Take into account Clear Zone guidelines (see AASHTO Roadside Design Guide and WSDOT Design Manual Chapter 1600). Design subsurface infrastructure (such as structural soils) and select plants whose root systems do not cause sidewalks to buckle or heave. Refer to Chapter 10, Tree and Vegetation Management for additional information.

Shoulders, bike lanes, and on-street parking are not considered buffers, but they do offer the advantage of further separation between vehicles and pedestrians.

Typical Sidewalk Designs

6.2 Sidewalks at Driveways

Provide a PAR where driveways intersect a pedestrian circulation path. The *Standard Plans* show details of driveway designs that provide a PAR. (See Sections 4 and 5 of this Chapter for accessibility criteria.) When a driveway is signalized as part of an intersection, contact the City's ADA Coordinator for guidance on the design of the sidewalk.

SECTION 7 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 PARs to crosswalks (marked or unmarked) where curbs, sidewalks, or goat paths (visual evidence of pedestrian traffic) are present, except where pedestrian crossing is prohibited. See Chapter 4 of the Design Manual for guidance on closed crossings.

7.1 Types of Curb Ramps

Different types of curb ramps can be used: perpendicular, parallel, and combination. Carefully analyze and take into consideration drainage patterns, especially when designing a parallel or combination curb ramp installation. Non-directional curb ramps require prior approval from the City Engineer or designee and justification must be provided.

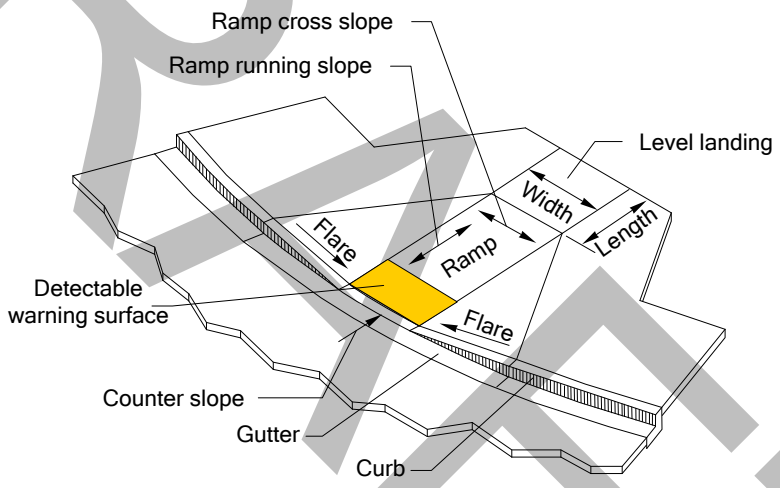
7.1.1 Perpendicular Curb Ramp

Perpendicular curb ramps (see illustration and photo below) 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. The following is a list of design considerations for incorporating perpendicular curb ramps:

- Having the path of travel aligned to cross the gutter grade break at a right angle facilitates usage by individuals with mobility devices.
- The height of the ramp run relative to the gutter elevation may facilitate drainage.
- The height of the ramp run relative to the gutter elevation discourages vehicular traffic from cutting across the corner.
- On small-radius corners, the ramp alignment may be more closely aligned with the alignment of the crosswalk markings, which facilitates direction finding for the visually impaired.
- The ramp run and landing might not fit within available ROW.
- On small-radius corners, the flares may not fit between closely spaced perpendicular curb ramps.

Perpendicular Curb Ramp

Figure 12-2: Perpendicular Curb Ramp Common Elements

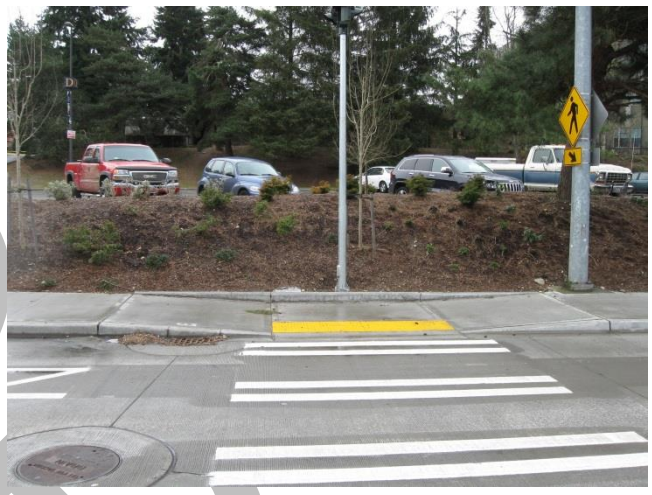


7.1.2 Parallel Curb Ramp

Parallel curb ramps (see illustration and photo below) 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. The following is a list of design considerations for incorporating parallel curb ramps.

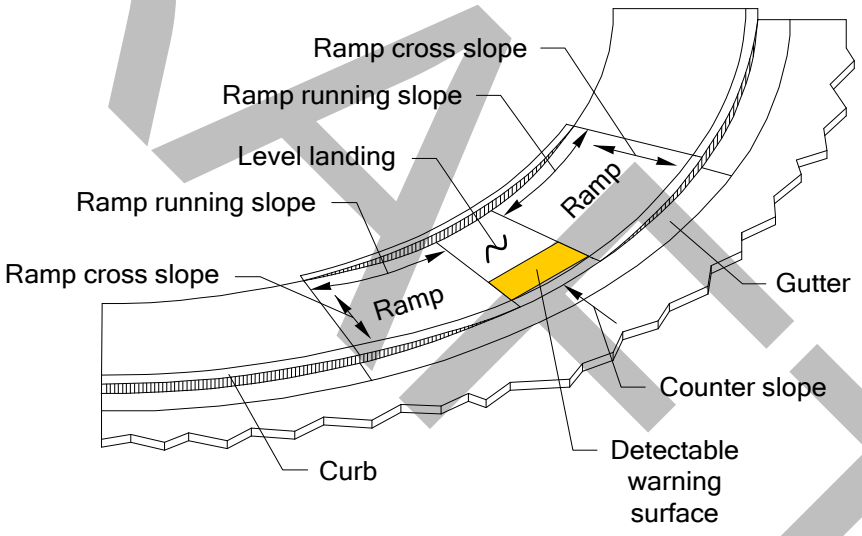
- Requires minimal ROW.
- Allows ramps to be extended to reduce ramp grade within available ROW.
- Provides edges on the side of the ramp that are detectable to vision-impaired pedestrians who navigate with a cane.
- Depending on the style of parallel curb ramp, pedestrian through traffic on the sidewalk may need to negotiate two ramp grades instead of one, possibly making it more difficult to traverse for some.

- The installation of additional drainage features in the upstream gutter line may be necessary to prevent the accumulation of water or debris in the landing at the bottom of the ramp.



Parallel Curb Ramp

Figure 12-3: Parallel Curb Ramp Common Elements



Note: The pedestrian curb shown on the back of the curb ramp is intended to retain material in a cut section and is not required if there is no material to retain due to the nature of the street topography.

7.1.3 Combination Curb Ramp

Combination curb ramps (see illustration below) combine the use of perpendicular and parallel types of curb ramps. Landings may be shared by multiple ramps in this application. Buffer areas and pedestrian curbing that define the pedestrian path of travel are inherent design elements for this type of curb ramp. The following is a list of design considerations for incorporating combination curb ramps:

- Allows the elevation difference between the sidewalk and the gutter line to be transitioned with multiple ramps. This can help achieve compliant ramp running slopes.

- Provides additional locations in the gutter line along the radius where drainage structures can be placed outside the PAR due to the well-defined pedestrian paths of travel.

- Can be constructed within available ROW when the ROW boundary is located at the back of the existing sidewalk, provided sufficient buffer width is available on the roadway side of the sidewalk.

- Provides a way to avoid the relocation of existing features such as utility poles, fire hydrants, and signal poles by incorporating those features into the buffer areas.

- The pedestrian curbing that defines the buffer areas and forms the curb returns for the perpendicular ramp connections facilitates direction finding for a vision-impaired person who navigates with a cane.

- Has a higher construction cost than other curb ramp types due to extensive use of curbing and a larger footprint.

- Due to generally flatter ramp grades and multi-tiered ramp elements, inadequate drainage and accumulation of debris can occur.

Combination Curb Ramps

7.2 Accessibility Criteria for Curb Ramps

The accessibility criteria for PCPs and PARS (see Sections 4 and 5 of this Chapter) also apply to curb ramps unless superseded by the following accessibility criteria specifically for curb ramps.

7.2.1 Clear Width

The clear width of curb ramps and their landings shall be 5 feet minimum, excluding flares.

7.2.2 Running Slope

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 allowed maximum to allow for some tolerance in construction. For example, design 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.

7.2.3 Cross Slope

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 to be less than the allowed maximum to allow for some tolerance in construction. For example, design for a maximum 1.5% cross slope (rather than the 2% maximum).

Instances where curb ramps are at midblock crossings the cross slopes are permitted to match the street grade.

7.2.4 Landing

A level landing is required either at the top of a perpendicular ramp or the bottom of a parallel curb ramp.

Provide a landing that is at least 5 feet minimum length by 5 feet minimum width.

The running and cross slopes of a curb ramp landing shall be 2% maximum.

7.2.5 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 slope of 10% maximum, measured parallel to the back of curb.

Pedestrian curbs are to be used only where there is landscaping. Pedestrian curbs are to be located outside the pedestrian circulation path. Pedestrian curbs may not be used to prevent pedestrians from using street crossings.

7.2.6 Counter Slope

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

7.2.7 Detectable Warning Surfaces

Detectable warning surfaces are required where curb ramps or landings connect to a street or alley and driveways with high traffic volumes. (See the City of Tacoma *Standard Plans* for placement details and other applications.)

Detectable warning surfaces shall contrast visually with the adjacent walkway surface, gutter, or street. Federal yellow is the color used to achieve visual

contrast for curb ramps in the City of Tacoma. .

7.2.8 Surfaces

Surfaces of curb ramps shall be firm, stable, and slip resistant.

Gratings, access covers, utility objects, and other appurtenances shall not be located on curb ramps, landings, or gutters within the pedestrian access route.

7.2.9 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.

7.2.10 Clear Space

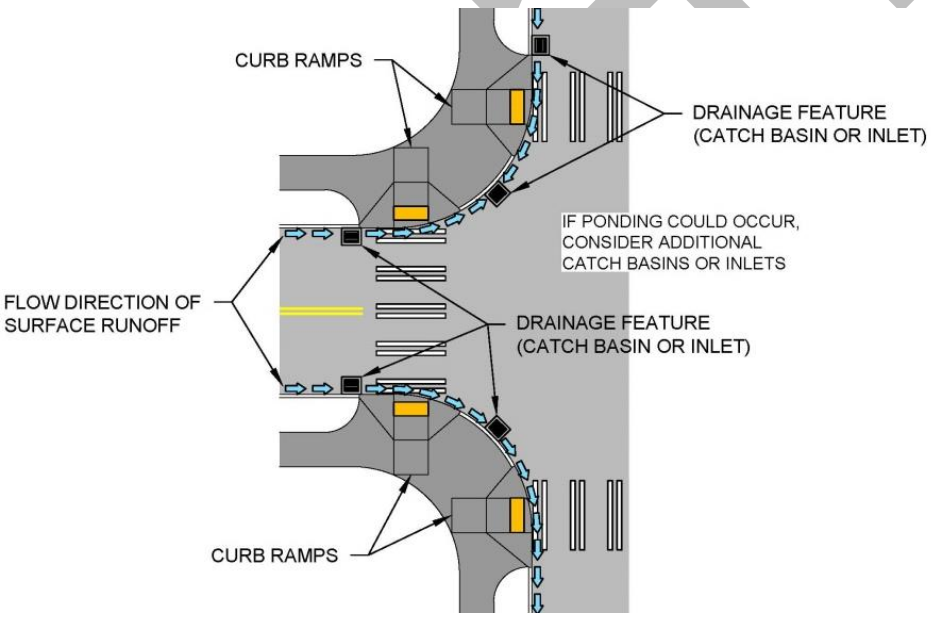
Beyond the curb face where the bottom of a curb ramp or landing meets the gutter, a clear space of 4 feet minimum by 4 feet minimum shall be provided in the roadway that is contained within the width of the crosswalk and located wholly outside the parallel vehicle travel lane.

Note: Clear space is easily achieved when a separate curb ramp is provided, oriented in each direction of pedestrian travel within the width of the crosswalk it serves.

7.3 Curb Ramp Drainage

Surface water runoff from the roadway can flood the lower end of a curb ramp. Provide catch basins or inlets to prevent ponding at the base of curb ramps and landings. Refer to the SWMM for additional information. Figure 12-4 shows examples of drainage structure locations. Verify that drainage structures will not be located in the PAR.

Figure 12-4: Typical Curb Ramp Drainage



SECTION 8 Crosswalks

8.1 Designing Crossing Facilities

Evaluate the following for crossing facilities to address the needs of all user modes:

- Minimization of the turning radii to keep speeds low; (See Chapter 4 for design vehicle guidance.)
- Design crosswalks so they are visible, and connect to the adjacent pedestrian facilities provide proper sight distance (driver to pedestrian; pedestrian to driver);
- Consider feasibility of restricting or prohibiting turns;
- Shortening the crossing distance;
- Use of a raised median/cut-through island for a pedestrian refuge;
- Use of accessible pedestrian signals (APS)
- Use of signing and delineation with approval by the City's Traffic Engineer;
- Designing the position of crosswalks as close as practicable to the intersection traveled way;
- Provision for pedestrian-level lighting;
- Consider proximity and relation of the crosswalk to transit stops; and
- Provision of a PAR that meets the accessibility criteria at all pedestrian crossings.

8.2 Crosswalks at Intersections

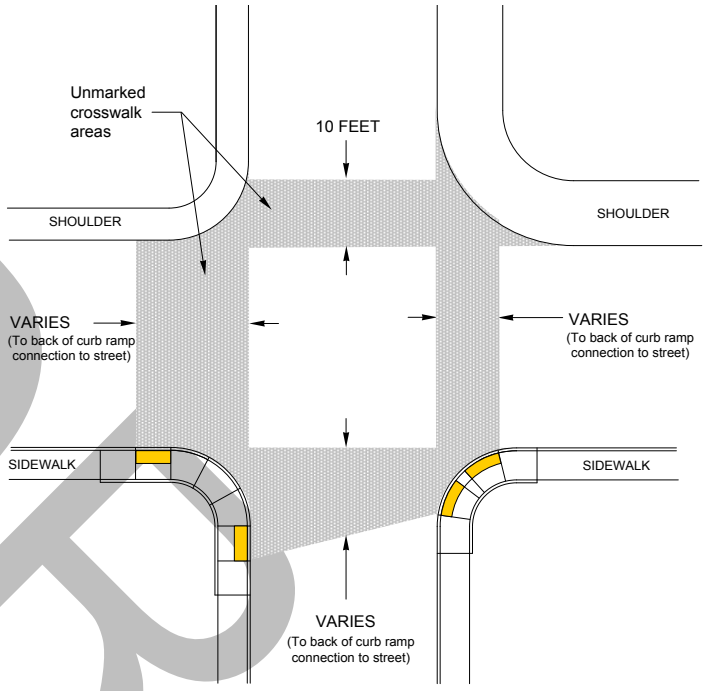
Provide a PAR within marked and unmarked pedestrian crossings. See Section 5 of this Chapter for accessibility criteria for PARs.

Crosswalks (marked or unmarked) are provided on all legs of an intersection, except in rare cases. There are normally three crosswalks at a "T" intersection and four crosswalks at a "four-leg" intersection. For pedestrian route continuity, the minimum number of crosswalks is two at "T" intersections and three at "four-leg" intersections. One example where crosswalks might not be provided on all interaction legs is a location with substantial turn movements that would conflict with a crossing. (See 1510.10(2)(c) for Closed Crossings policy.)

8.2.1 Unmarked Crossings

Legal crosswalks exist at all intersections, whether marked or not, regardless of the number of legs at the intersection. An unmarked crosswalk (see Figure 12-5) is the portion of the roadway behind a prolongation of the curb or edge of the through traffic lane and a prolongation of the farthest sidewalk connection or, in the event there are no sidewalks, between the edge of the through traffic lane and a line 10 feet from there (RCW 46.04.160).

Figure 12-5: Unmarked Crosswalks



8.2.2 Marked Crossings

Marked crosswalks are used at intersections or midblock crossings. They are not to be used indiscriminately. Maintenance agreements and RCW 47.24.020(30) provide jurisdictional authority for decisions to mark crosswalks based on a population threshold of 25,000 so the City shall be involved in the decision to mark a crosswalk.

The City Traffic Engineer makes the final determination on appropriate signing, delineation, and/or other treatments. Standard width for a marked crosswalk is 10 feet although reduced widths (not less than 6 feet) may be considered with justification. The preferred type of marked crosswalk is a longitudinal pattern known as "Continental," which is shown in the Standard Plans. Stop and yield line dimensions and placement must conform to the MUTCD and are shown in the Standard Plans.

Some decorative crosswalk materials (such as colored pavement or bricks) may cause confusion for visually impaired pedestrians and can create discomfort for wheelchair users. Supplement decorative crosswalks with "Standard" style pavement markings to enhance visibility and delineate the crosswalk. Refer to Chapter 8 Channelization & Signing of this manual for additional information. (Also refer to the MUTCD.)

8.2.3 Closed Crossings

Pedestrian crossings shall only be closed for a documented reason such as observed crash concerns or for essential signal operations. If a crossing has been previously closed as indicated by existing signing and ADA facilities are being evaluated, provide an appropriate treatment that is detectable by people

with vision difficulties who navigate with a cane, such as directional pedestrian curbing and removal of ramps at these closed crossing. The City Traffic Engineer is the approval authority for the closing of crossings.

8.3 Midblock Crosswalks

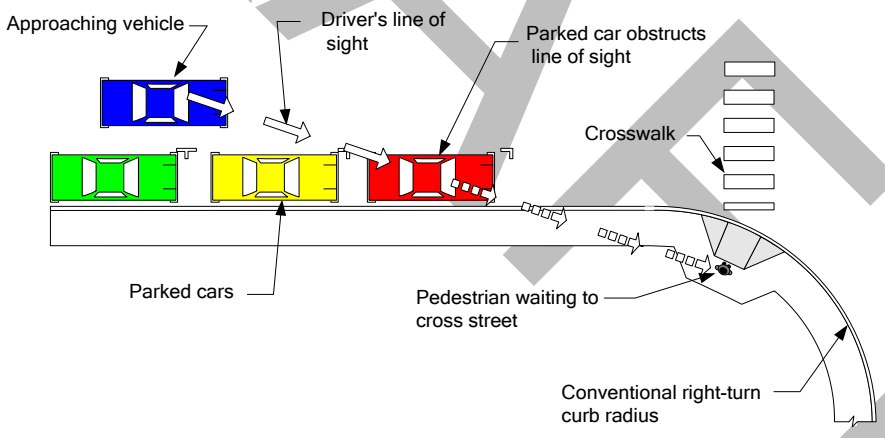
On roadways with pedestrian crossing traffic caused by nearby pedestrian generators, a midblock crossing may be appropriate. See Chapter 8 Channelization & Signing for crosswalk criteria and the Mobility Master Plan Pedestrian and Bicycle Guidelines for marked crosswalk recommendations at unsignalized intersections.

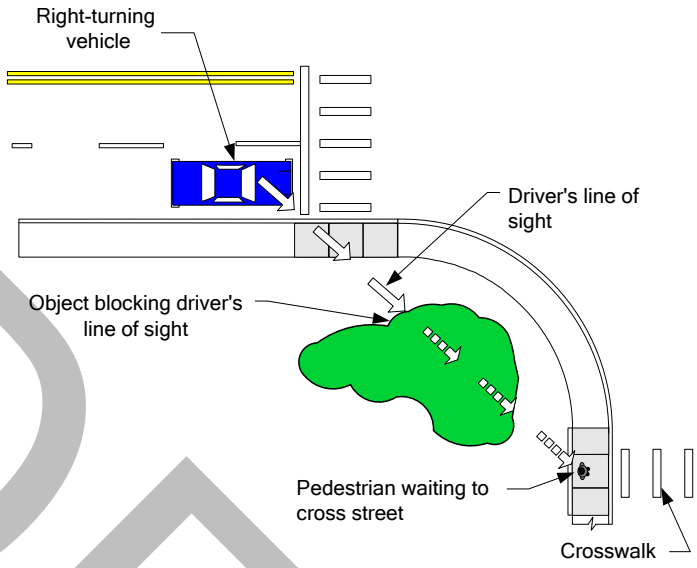
As with marked crosswalks at intersections, the creation and marking of midblock crosswalks shall not be implemented indiscriminately. Engineering judgment of various conditions that would be beneficial or unintended consequences of marking the midblock crossing shall be exercised and documented by the proposing party. The approval authority for any proposed crosswalks is the City Traffic Engineer. If approved, the PAR in the midblock crosswalk can have a cross slope that matches the grade of the roadway in order to meet accessibility criteria.

8.4 Sight Distance at Crosswalks

When locating crosswalks at intersections, it is important to evaluate the sight lines between pedestrians and motorists. Shrubbery, signs, parked cars, and other roadside elements can block motorists' and pedestrians' views of one another. Figure 12-6 illustrates these sight distance concerns.

Figure 12-6: Obstructed Line of Sight at Intersection



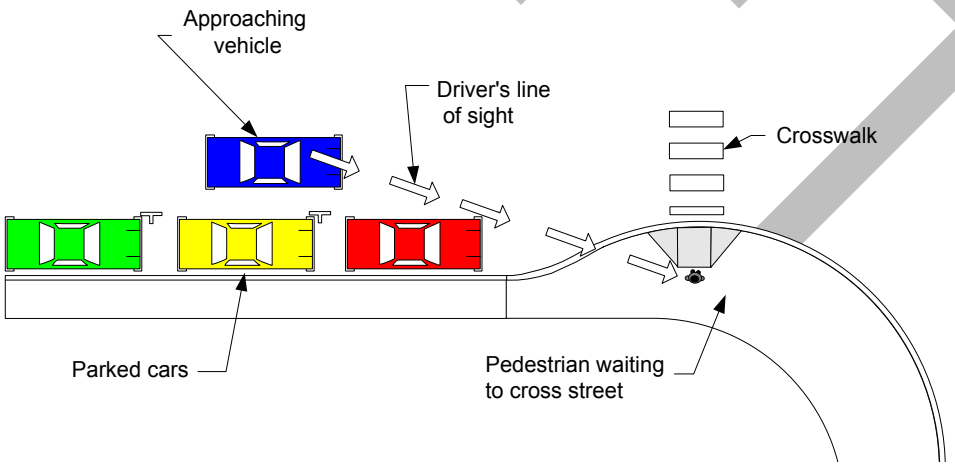


8.5 Curb Extensions

Curb extensions (also known as “curb bulbs” or “bulbouts”) are traffic calming measures that may improve sight distance and reduce pedestrian crossing times, which limit pedestrian exposure to traffic. Installing a curb extension can help reduce the sight distance problem with parked cars that limit driver/pedestrian visibility. Curb extensions may allow for better curb ramp design as well as provide more space for pedestrians. The design of curb extensions may necessitate the removal of parking and/or may make it difficult to accommodate full bicycle lanes. See Chapter 4 for more information.

Extend the curb no farther than the width of the parking lane. The curb extension shall not interfere with the conflicting vehicle travel path. Design the approach nose to ensure adequate setback of vehicles to provide visibility of pedestrians. At intersections with traffic signals, the curb extensions can be used to reduce pedestrian signal timing. Examples of sidewalk curb extensions are shown in Figure 12-7.

Figure 12-7: Improved Line of Sight at Intersection



The right-turn path of the design vehicle is a critical element in determining the size and shape of the curb extension. Sidewalk curb extensions tend to restrict the width of the roadway and can make right turns difficult for large trucks. Ensure the geometry of the curb extension is compatible with the turn path for the prescribed design vehicle (see Standard Plan XXXX). Avoid interrupting bicycle traffic with curb extensions.

Site features such as landscaping, cabinets, poles, benches, planters, bollards, newspaper stands, and sandwich boards should be selected and placed so they do not obstruct the vision of pedestrians or drivers within curb extension areas.

SECTION 9 Raised Medians/Traffic Islands

Wide multilane streets are often difficult for pedestrians to cross, particularly when there are insufficient gaps in vehicular traffic because of the number of vehicles. Consider raised medians and traffic islands with a pedestrian refuge area (see Figure 12-8) on roadways with the following conditions:

- Two-way arterial with intermediate to high speeds (35 mph or greater), moderate to high average daily traffic (ADT), and high pedestrian volumes;
- Significant pedestrian collision history (contact Traffic Engineering for access to collision data);
- Vehicle turn volumes and patterns; and/or
- Complex or irregularly shaped intersections.

Prior approval by the City Engineer or designee will be required for design and installation of proposed raised medians and traffic islands.

A traffic island used for channelized right-turn slip lanes can provide a pedestrian refuge, but the slip lane may promote faster turning speeds. Minimize the turning radius of the slip lane to keep speeds as low as feasible. To reduce conflicts, keep the slip lane as narrow as practicable and design a crosswalk alignment that is at a right angle to the face of curb.

The pedestrian access route through a raised median or traffic island can be either raised with curb ramps or a cut-through type (see Figure 12-8). Curb ramps in medians and islands can add difficulty to the crossing for some users. The curbed edges of cut-throughs can be useful cues to the visually impaired in determining the direction of a crossing, especially on an angled route through a median or island. Design consideration shall include stormwater runoff and maintenance, such as roadway debris (see City of Tacoma Stormwater Management Manual).

9.1 Accessibility Criteria for Raised Medians and Traffic Islands

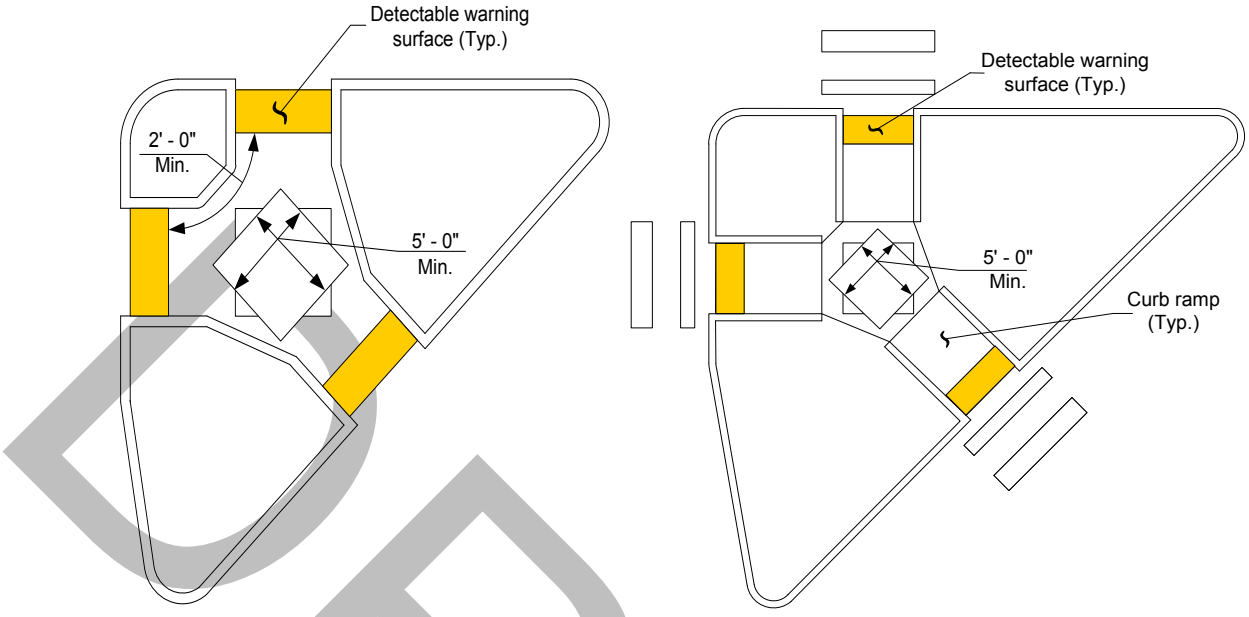
There are many design considerations when deciding whether to ramp up to the grade of the median or island or to create a cut-through median or island matching the roadway grade. These considerations may include the profile grade and cross slope of the road, drainage patterns, and the length or width of the median or island.

The following accessibility criteria apply:

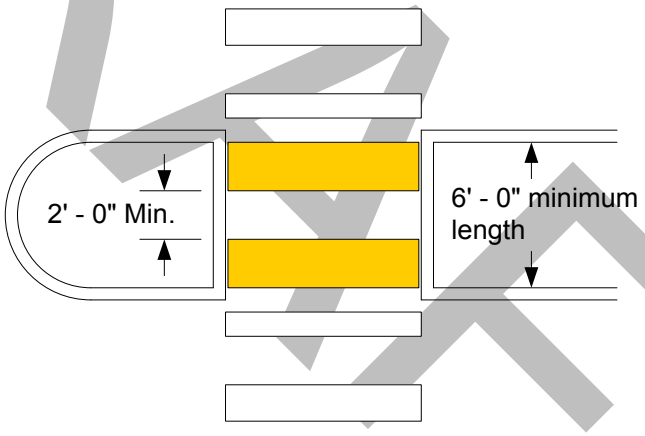
- Each raised median or traffic island shall contain a PAR connecting to each crosswalk (see 1510.07).
- Cut-throughs shall be designed to have a minimum width of 5 feet to ensure a passing space is provided.
- Medians and pedestrian refuge islands shall be 6 feet minimum in length in the direction of pedestrian travel.
- The near edges of sequential detectable warning surfaces are to be separated by 2 feet minimum length in the direction of pedestrian travel.
- Detectable warning surfaces are located at each curb ramp or roadway entrance of a PAR through a raised median or traffic island. The detectable warning surface shall be located at the back of the curb (see Exhibit 1510-22).
- PARs of shared-use paths that go through raised medians or traffic islands shall be the same width as the shared-use path (see Shared-Use Trails Chapter of this Design Manual).

Figure 12-8: Raised Islands with Curb Ramps and Pedestrian Cut-Throughs

Island Cut-Through



Raised Traffic Island with Curb Ramps



Median Island Cut-Through (full width shown)

See the City of Tacoma *Standard Plans* for details.

SECTION 10 Pedestrian Pushbuttons at Signals

When designing pedestrian signals, consider the needs of all pedestrians, including older pedestrians and pedestrians with disabilities who might walk at a significantly slower pace than the average pedestrian. Determine whether there are pedestrian generators in the project vicinity that might attract older people and pedestrians with disabilities, and adjust signal timing accordingly. When pedestrian signals are newly installed, replaced, or significantly modified, include APS pushbuttons and countdown pedestrian displays. For more information about when APS is required, see the City of Tacoma's APS Policy on the GovME website. Accessibility Criteria for All Pedestrian Pushbuttons

10.1 Designing Crossing Facilities

10.1.1 Location Requirements

Not greater than 5 feet from the crosswalk line (extended horizontally) that is farthest from the center of the intersection.

Between 1.5 feet and 10 feet from the edge of the curb, shoulder, or pavement.

Mounting height: 42 inches desirable, 48 inches maximum, 15 inches minimum.

10.1.2 Clear Space Requirements

Grade: 2% maximum running and cross slopes.

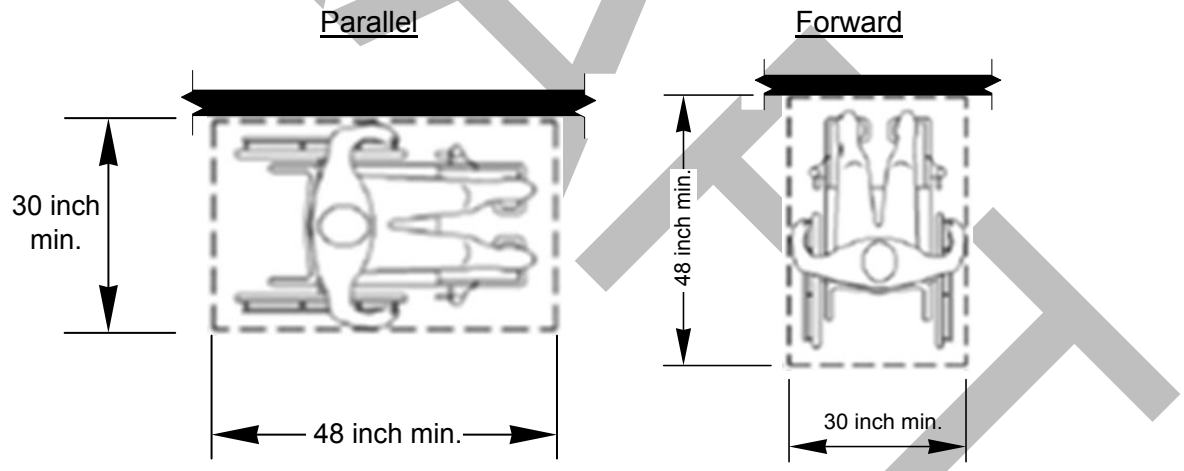
Clear space dimensions: 30 inches minimum width by 48 inches minimum length (see the illustration below).

Clear space is allowed to overlap other PAR elements (i.e., sidewalk/curb ramp landing).

Clear space must be connected to the crosswalk served by the pedestrian pushbutton with a PAR.

Additional maneuvering space may be required if the clear space is constrained on three sides (see PROWAG).

Figure 12-9: Clear Space Parallel and Forward Approach Orientation



Note: A desirable clear space accommodates the full spectrum of wheeled mobility device users approaching the pedestrian pushbutton from multiple directions. Consider providing 36 inches width and up to 84 inches length designed for a parallel approach with the pedestrian pushbutton centered within the length.

10.1.3 Reach Range Requirements

The provided clear space must be within reach range of the pedestrian pushbutton.

For a parallel approach pedestrian pushbutton, the horizontal reach range is 10 inches maximum.

For a forward approach pedestrian pushbutton, the reach range is 0 inches maximum regardless of mounting height. The pushbutton must either be placed at the very edge of the clear space or extend into the clear space while providing knee and toe clearance for a wheeled mobility device user (see PROWAG).

Due to the challenges associated with providing reach range, it is desirable to design clear space for a parallel approach whenever possible.

10.2 APS

Refer to the City of Tacoma's APS Policy on the GovME website for information about when APS are required.

When APS and countdown pedestrian display improvements are made, they shall be made for all locations associated with the system being improved. APS includes audible and vibrotactile indications of the 'WALK' interval. Installation of these devices may require improvements to existing sidewalks and curb ramps to ensure ADA compliance.

Example of Pedestrian Accessible Signal

10.3 Accessibility Criteria for APS

In addition to the general pedestrian pushbutton accessibility criteria described in Section 10.1 of the Chapter, the following criteria apply to APS installations:

- APS pushbuttons shall have a locator tone that operates during the 'DON'T WALK' and the flashing 'DON'T WALK' intervals only.
- APS pushbuttons must have both audible and vibrotactile indications of the 'WALK' interval.

- APS pushbutton controls and signs shall be parallel to the crosswalk served.
- An APS pushbutton shall have a tactile arrow that indicates the crossing direction activated by the pushbutton.
- An APS pushbutton provides high contrast (light-on-dark or dark-on-light) against its background.
- If extended pushbutton press features are available, the APS pushbutton shall be marked with three braille dots forming an equilateral triangle in the center of the pushbutton.
- If additional crossing time is provided by an extended pushbutton press feature, then a sign (R10-32P) from the MUTCD shall be mounted adjacent to or integral with the APS pushbutton.
- If the pedestrian clearance time is sufficient only to cross from the curb or shoulder to a median to wait for the next cycle, then an additional APS pushbutton shall be provided in the median.
- The desirable spacing between the APS pushbuttons is 10 feet minimum (5 feet minimum spacing on medians and islands), if feasible.
- If the spacing between the APS pushbuttons is 10 feet or greater, the audible 'WALK' indication shall be a percussive tone.
- If the spacing between the APS pushbuttons is less than 10 feet, the audible 'WALK' indication shall be a speech walk message, and a speech pushbutton information message shall be provided.

Refer to the MUTCD for further design guidance. Also, consult with City's Traffic Engineer and Chapter 7 for current equipment specifications and additional maintenance requirements.

SECTION 11 On-Street Parking

When designing on-street parking, consider the needs of all users, especially those with mobility issues that are not able to walk long distances. The number of parking stalls required for each project will be considered on a case-by-case basis per the Traffic Engineer or Designee. Disability parking is required to ensure equal access for all users. The number of disability parking spaces required is based on the total number of parking stalls on a block perimeter. Disability parking spaces should be distributed along a block perimeter for easy access to businesses, and each parking space must connect to the PAR. A curb ramp may be needed for each access aisle. Disability parking spaces must be a minimum of 8 feet in width with an 8 foot minimum width access aisle for perpendicular and angle parking. Disability parking spaces must be identified by signs displaying the International Symbol of Accessibility. Refer to the PROWAG for more information.

Passenger Load Zones (which are different than Load Zones) shall have an associated curb ramp to facilitate access for all to/from the sidewalk area and passenger load zone area.

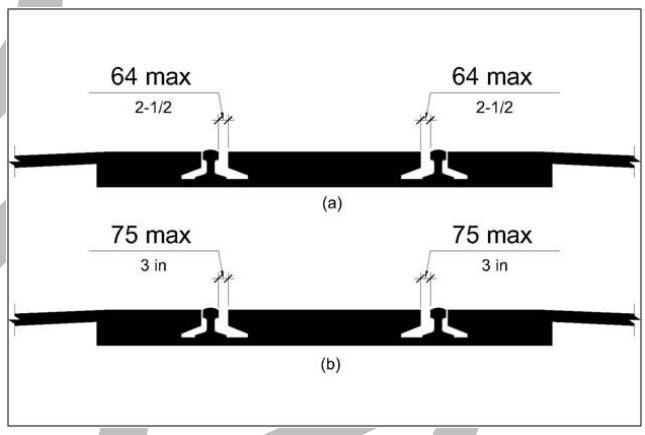
SECTION 12 At-Grade Railroad Crossings

The design of pedestrian facilities that cross railroad tracks (see Figure 12-10) often presents challenges due to the conflicting needs of pedestrians and trains. The flangeway gap allows trains to traverse an intersecting surface (e.g., sidewalk, roadway), but may create a significant

obstacle for a person who uses a wheelchair, crutches, or walking aids for mobility. Flangeway gaps pose a potential hazard to pedestrians who use wheelchairs because the gaps can entrap the wheelchair casters. Whenever practicable, align pedestrian crossings perpendicular to the tracks in order to minimize potential problems related to flangeway gaps. Crossing surfaces may be constructed of asphalt, rubberized materials, or concrete. Concrete materials generally provide the smoothest and most durable crossing surfaces.

Flangeway gaps at pedestrian at-grade rail crossings shall be 2.5-inch maximum on non-freight rail track (see (a) in figure below) and 3-inch maximum on freight rail track (see (b) in figure below).

Figure 12–10: Flangeway Gaps



When detectable warning surfaces are used at railroad crossings, place them according to the MUTCD stop line placement criteria.

There are a number of railroad crossing warning devices intended specifically for pedestrian facilities (see the MUTCD). When selecting warning devices, factors such as train and pedestrian volumes, train speeds, available sight distance, number of tracks, and other site-specific characteristics should be taken into account. Coordinate with the City Traffic Engineer early in the design process so that all relevant factors are considered and an agreement may be reached regarding the design of warning devices and crossing surfaces.

SECTION 13 Pedestrian Grade Separations (Structures)

On the approach to a bridge that has a raised sidewalk, provide a ramp for the transition to the sidewalk from the paved shoulder. A ramp that transitions from a paved shoulder to a sidewalk on a bridge is to have a slope of 5% maximum and be constructed of asphalt or cement concrete. In addition to aiding pedestrian access, the ramp also serves as a roadside safety feature to mitigate the raised blunt end of the concrete sidewalk. If a pedestrian circulation path (such as a raised sidewalk or shared-use path) is located near the bridge, consider eliminating the gap between the bridge sidewalk and the pedestrian circulation path by extending the bridge sidewalk to match into the nearby pedestrian circulation path.

At underpasses where pedestrians are allowed, it is desirable to provide sidewalks and to maintain the full shoulder width. When bridge columns are placed on either side of the roadway, it is preferred to place the walkway between the roadway and the columns for pedestrian visibility and security.

In cases where there is a pedestrian collision history, and the roadway cannot be redesigned to accommodate pedestrians at grade, designers should consider providing a grade-separated pedestrian structure (see Exhibits 1510-28 and 1510-29).

Locate the grade-separated crossing where pedestrians are most likely to cross the roadway. A crossing might not be used if the pedestrian is required to deviate significantly from a more direct route.

It is sometimes necessary to install fencing or other physical barriers to channel the pedestrians to the structure and reduce the possibility of undesired at-grade crossings.

Consider a grade-separated crossing where:

- There is moderate to high pedestrian demand to cross a freeway or expressway.
- There are large numbers of young children, particularly on school routes, who regularly cross high-speed or high-volume roadways.
- The traffic conflicts that would be encountered by pedestrians are considered unacceptable (such as on wide streets with high pedestrian volumes combined with high-speed traffic).
- There are documented collisions or close calls involving pedestrians and vehicles.
- One or more of the conditions stated above exists in conjunction with a well-defined pedestrian origin and destination (such as a residential neighborhood across a busy street from a school).

13.1 Pedestrian Bridges

Pedestrian grade-separation bridges (see Exhibit 1510-28), when justified as part of a project, are generally more effective when the roadway is below the natural ground line, as in a cut section. Elevated grade separations in cut sections, where pedestrians climb stairs or use long approach ramps, tend to be underused. Pedestrian bridges need adequate ROW to accommodate accessible ramp approaches leading up to and off of the structure. The bridge structure must comply with ADA requirements and meet the accessibility criteria for either a pedestrian circulation path (if the grade is 5% or less) or an access ramp (if the grade is greater than 5% but less than or equal to 8.3%), and must include a PAR. See 1510.06 and 1510.07 for pedestrian circulation path and PAR accessibility criteria; see 1510.15(2) for access ramp accessibility criteria.

For the minimum vertical clearance from the bottom of the pedestrian structure to the roadway beneath, see AASHTO. The height of the structure can affect the length of the pedestrian ramp approaches to the structure. When access ramps are not feasible, provide both elevators and stairways.

Provide railings on pedestrian bridges. Protective screening is sometimes desirable to deter pedestrians from throwing objects from an overhead pedestrian structure.

The minimum clear width for pedestrian bridges is 8 feet. Consider a clear width of 14 feet where a pedestrian bridge is enclosed or shared with bicyclists or if maintenance or emergency vehicles will need to access.

13.2 Pedestrian Tunnels

Tunnels are an effective method of providing crossings for roadways located in embankment sections. Well-designed tunnels can be a desirable crossing for pedestrians. When feasible, design the tunnel with a nearly level profile to provide an unobstructed line of sight from portal to portal (see Exhibit 1510-29). People may be reluctant to enter a tunnel with a depressed profile because they are unable to see whether the tunnel is occupied. Law enforcement also has difficulty patrolling depressed profile tunnels.

Provide vandal-resistant daytime and nighttime illumination within the pedestrian tunnel. Installing gloss-finished tile walls and ceilings can enhance light levels within the tunnel. Consult with City's Streetlight Engineer for illumination requirements.

The minimum overhead clearance for a pedestrian tunnel is 10 feet. The minimum width for a pedestrian tunnel is 12 feet. Consider a tunnel width between 14 and 18 feet depending on usage and the length of the tunnel.

Pedestrian tunnels need adequate right of way to accommodate accessible approaches leading to the tunnel structure. The tunnel structure must comply with ADA requirements and meet the accessibility criteria for either a pedestrian circulation path (if the grade is less than or equal to 5%) or an access ramp (if the grade is greater than 5% and less than or equal to 8.3%), and must include a PAR. (See 1510.06 and 1510.07 for pedestrian circulation path and PAR accessibility criteria; see 1510.15(2) for access ramp accessibility criteria.)

SECTION 14 Other Pedestrian Facilities

14.1 Transit Stops and School Bus Stops

The location of transit stops is an important element in providing appropriate pedestrian facilities. Newly constructed transit stops must conform to ADA requirements. Design newly constructed transit stops so that they are connected to the sidewalk, street crossings, and pedestrian circulation paths by pedestrian access routes. A transit stop on one side of a street usually has a counterpart on the opposite side because transit routes normally function in both directions on the same roadway. Provide adequate crossing facilities for pedestrians.

Accessible transit stops include but are not limited to the following elements:

- Transit stops must be connected to the sidewalk, curb ramps, street crossings, and pedestrian circulation paths by PARs.
- All walking surfaces must be firm, stable, and slip resistant. Grass is not considered firm and stable.
- Signage that includes route information. Size of lettering and location must accommodate riders with low vision. Braille may also be used to ensure effective communication for all users.
- Boarding and alighting areas must provide a clear length of 8 feet minimum measured perpendicular to the curb or street edge, and a clear width of 5 feet minimum measured parallel to the curb or street edge.

- The grade of the boarding and alighting area that is parallel to the street shall be the same as the street to the extent practicable. The grade of the boarding and alighting area that is perpendicular to the street shall not be steeper than 2%.

- If a transit shelter is provided, it shall meet all accessibility requirements.

- If trash receptacles are provided, they shall not obstruct the PAR, the clear space within the shelter, or be placed below any signage where the horizontal viewing distance is 6 feet or less. (People with visual impairments must have access to the signage so they can read it from a few inches away if necessary).

All new or relocated bus stops must obtain a Street Occupancy Permit from the City if the action is not addressed with a franchise agreement. When locating a transit stop, the designer shall consult with the City's ADA Coordinator, the City Traffic Engineer, and Pierce Transit staff. Take into account compatibility with the following roadway/traffic characteristics:

- Daily traffic volume
- Traffic speed
- Crossing distance
- Collision history
- Sight distance
- Connectivity to a PAR
- Traffic generator density

If any of these suggests an undesirable location for a pedestrian crossing, consider a controlled crossing or another location for the transit stop for review and approval by the City Traffic Engineer.

When analyzing a transit stop location with high pedestrian collision frequency, take into account the presence of nearby transit stops and opportunities for pedestrians to cross the street in a reasonably safe manner. At-grade midblock pedestrian crossings may be effective at transit stop locations on roadways with lower vehicular volumes. Pedestrian grade separations are appropriate at midblock locations when vehicular traffic volumes prohibit pedestrian crossings at grade.

School bus stops are typically adjacent to sidewalks in urban areas. Determine the number of children using the stop and provide a waiting area that allows the children to wait for the bus. Coordinate with the local school district and the City's Traffic Division. Because of their smaller size, children might be difficult for motorists to see at crossings or stops. Determine whether utility poles, vegetation, and other roadside features interfere with motorists' ability to see the children. When necessary, remove or relocate the obstructions or move the bus stop. Parked vehicles can also block visibility, and parking prohibitions might be advisable near the bus stop. Schools must accommodate students with mobility issues. At least one bus stop at each school must provide an alighting area and be connected to the PAR. Curb ramps may be required to connect

the bus stop to the accessible entrance of the school. Coordinate transit and school bus stop locations with the City Traffic Engineer.

14.2 Access Ramps Serving Transit Stops, Buildings, and Other Facilities

An access ramp provides a PAR from a pedestrian circulation path to a facility such as a transit stop, park and ride lot, pedestrian overcrossing/ undercrossing structure, or building. When the running slope is 5% or less, it can be designed as a pedestrian circulation path that includes a PAR. When the running slope is greater than 5% to a maximum of 8.3%, it must be designed as an access ramp.

Example of an Access Ramp

14.2.1 Accessibility Criteria for Access Ramps

Access ramps are comprised of one or more ramp segments interconnected by level landings. Unless superseded by the following specific accessibility requirements for access ramps, the accessibility requirements for PARs also apply:

- Ramp segments shall have a maximum running slope of 8.3%.
- The cross slope of ramp segments shall be 2% maximum.
- The minimum clear width of ramps is 5 feet; however, it is desirable to match the width of the connecting pedestrian facility.
- The rise for any ramp segment shall be 30 inches maximum.
- A level landing (2% maximum running and cross slopes) shall be provided at the top and bottom of each access ramp segment.
- An access ramp landing's clear width shall be at least as wide as the widest ramp segment leading to the landing.
- An access ramp landing's length shall be 5 feet minimum.

- Access ramps that change direction between ramp segments at landings shall have a level landing 5 feet minimum width by 5 feet minimum length.

- All access ramp segments with a rise greater than 6 inches shall have ADA-compliant handrails (see Section 14.3 of this Chapter for handrail accessibility criteria).

- Provide edge protection complying with one of the two following options on each side of access ramp segments:

  - The surface of the ramp segment and landing shall extend 12 inches minimum beyond the inside face of the handrail.
  - A curb or barrier shall be provided that does not allow the passage of a 4 inch diameter sphere, where any portion of the sphere is within 4 inches of the ramp/landing surface.

14.3 Guards and Handrails for Pedestrian Facilities

Accessible handrails are required on stairs and also on access ramps that have a rise greater than 6 inches (see Section 14.2 of this Chapter for access ramp accessibility criteria). A drop-off/vertical grade separation that is 30 inches or greater adjacent to a pedestrian facility necessitates the need to protect pedestrians from falls and a more robust guard designed for fall protection shall be used. If the drop-off/vertical grade separation is adjacent to either a stairway or an access ramp with a rise greater than 6 inches, then a guard/handrail combination that meets the requirements for both accessibility and fall protection must be used.

14.3.1 Fall Protection Guards

Guards designed for fall protection alone are typically placed adjacent to pedestrian facilities other than stairs or access ramps to prevent pedestrians or bicyclists from falls. The minimum railing height for pedestrian fall protection is 42 inches. For facilities where bicycle traffic is anticipated, such as on a grade-separation structure on a shared-use facility (see Chapter 11), the minimum railing height for bicyclist fall protection is 54 inches.

14.3.2 Accessible Fall Protection Railing

When fall protection is needed adjacent to stairs or an access ramp that has a rise greater than 6 inches, then a combined railing system that meets both the accessibility criteria for handrail outlined in 1510.15(3)(d) and the requirements for fall protection must be used. The minimum railing height for pedestrian fall protection is 42 inches. For facilities where bicycle traffic is anticipated, such as on the approach to a grade-separation structure on a shared-use facility (see Chapter 11), the minimum railing height for bicyclist fall protection is 54 inches.

14.3.3 Accessible Handrail

Accessible handrail meeting the accessibility criteria that is not designed to provide fall protection is to be used adjacent to stairs or access ramps that have a rise greater than 6 inches at locations where robust fall protection is not needed.

14.3.4 Accessibility Criteria for Handrail

The following accessibility criteria apply to all handrail installations provided at stairs and access ramps that have a rise greater than 6 inches:

- Height
  - The top of handrail gripping surfaces shall be 34 inches minimum and 38 inches maximum vertically above walking surfaces, stair nosings, and ramp surfaces.
  - The mounting height of the handrail shall also be at a consistent height.
- Gripping Surface
  - Clearance between handrail gripping surfaces and adjacent surfaces shall be 1.5 inches minimum.
  - Handrail gripping surfaces shall be continuous along their length and shall not be obstructed along their tops or sides.
  - The bottoms of handrail gripping surfaces shall not be obstructed for more than 20% of their length.
  - Where provided, horizontal projections shall be located 1.5 inches minimum below the bottom of the handrail gripping surface.
  - Handrail gripping surfaces with a circular cross section shall have an outside diameter between 1.25 inches minimum and 2 inches maximum.
  - Handrail gripping surfaces with a noncircular cross section shall have a perimeter dimension between 4 inches minimum and 6.25 inches maximum, and a cross section dimension of 2.25 inches maximum.
  - Handrail gripping surfaces and the surfaces adjacent to them shall be free of sharp or abrasive elements and shall have rounded edges.
  - Handrails shall not rotate in their fittings.
- Placement and Continuity
  - Handrails shall be provided on both sides of access ramps and stairs.
  - Handrails shall be continuous within the full length of each access ramp run or stair flight.
  - Inside handrails on switchback or dogleg access ramps and stairs shall be continuous between runs or flights.
- Extensions
  - Access ramp handrails shall extend horizontally above the landing for 12 inches minimum beyond the top and bottom of ramp runs.
  - At the top of a stair flight, handrails shall extend horizontally above the landing for 12 inches minimum beginning directly above the first riser nosing.
  - At the bottom of a stair flight, handrails shall extend at the slope of the stair flight for a horizontal distance at least equal to one tread depth beyond the last riser nosing.
  - Handrail extensions shall return to a wall, guard, or the landing surface, or shall be continuous to the handrail of an adjacent access ramp run or stair flight.
  - Handrail extensions shall not be required for continuous handrails at the inside turn of switchback or dogleg access ramps or stairs.
  -

14.4 Other Pedestrian Facilities, Features, and Elements

This chapter covers the accessibility criteria for the most commonly encountered pedestrian design elements in the public ROW. However, there are ADA requirements that apply to any feature or element for pedestrian use, such as doorways, elevators, stairs, call boxes, and drinking fountains. For accessibility criteria for less commonly encountered pedestrian design elements, consult with the City's ADA Coordinator and the applicable federal guidance document(s).

SECTION 15 Illumination and Signing

Illumination of transit stops, pedestrian crossings and other facilities is an important design consideration because lighting has a major impact on a pedestrian's safety and sense of security. Illumination provided solely for vehicular traffic is not always effective in lighting parallel walkways for pedestrians. Consider pedestrian-level (mounted at a lower level) lighting for pedestrian circulation paths, intersections, and other pedestrian crossing areas. Refer to Chapter 6 for illumination design guidance and requirements.

SECTION 16 Work Zone Pedestrian Accommodation

While Title II of the ADA requires that a public entity maintain its pedestrian facilities in operable working condition, including maintenance of their accessibility features, construction and maintenance activities often temporarily disrupt these facilities. When this occurs, provide access and mobility for pedestrians through and around work zones Temporary traffic control plans that include alternate PARs must be approved prior to the start of construction. Additional Traffic Control Plans must be resubmitted and approved whenever there are changes or disruptions to the PAR.

Detailed guidance on work zone pedestrian accommodation can be found in the City of Tacoma's Alternate Pedestrian Route Quick Reference Guide, Checklist for Pedestrian Access through Construction Zones, WSDOT *Field Guide for Accessible Public Rights of Way*, and the MUTCD.

Some work zone considerations include:

- Separate pedestrians from conflicts with work zone equipment and operations.
- Separate pedestrians from traffic moving through or around the work zone.
- Provide pedestrians with alternate routes that have accessible and convenient travel paths that duplicate, as closely as feasible, the characteristics of the existing pedestrian facilities.

Provide walkways that are clearly marked and pedestrian barriers that are continuous, rigid, and detectable to vision-impaired persons who navigate with a cane. Also, keep:

- The pedestrian head space clear.
- Walkways free from pedestrian hazards such as holes, debris, and abrupt changes in grade or terrain.
- Access along sidewalks clear of obstructions such as construction traffic control signs.
- A minimum clear width path throughout: 4 feet for pedestrians or 10 feet for pedestrians and bicyclists.

- Temporary pedestrian facilities within the work zone must meet accessibility criteria to the maximum extent feasible. See Section 4 and 5 of this Chapter for pedestrian circulation path and PAR accessibility criteria.
- Consider the use of flaggers if pedestrian generators such as schools are in the work zone vicinity. Consider spotters who are prepared to help pedestrians through the work zone.
- Provide for advance public notification of sidewalk closures in the contract special provisions and plans.
- Where transit stops are affected or relocated because of work activity, provide an accessible route to temporary transit stops.

Figure 12-11: Work Zones and Pedestrian Facilities

Meets ADA requirements

Does not meet ADA requirements

13 CHAPTER 13
WATER PLANS

INTRODUCTION

It should be noted that submittal and approval of the water plans is a separate and distinct process from the work order process. Please note that it is the responsibility of the design engineer to coordinate the work order plans and the water plans and verify that no conflicts occur.

When proposed water mains will be located within the ROW, water mains are to be laid to the permanent grade of the street or alley (TMC 10.24.050). Tacoma Water will submit plans to the City Engineer or private design engineer to certify the permanent grade of the street or alley (TMC 10.24.060). In the case when the permanent grade of the street or alley has not been established, Tacoma Water will request that the Department of Public Works or private design engineer establish the permanent grade and alignment of said street or alley. The cost of establishing the permanent grade and alignment of the street or alley shall be borne by the project proponent.

SECTION 1 Initiation of the Process for Design and Approval of Water Plans

Extension of water mains and the installation of fire hydrants may be required where specified by the development conditions; by the City of Tacoma, Department of Public Utilities, Water Division, dba Tacoma Water; or by the International Fire Code with state adopted amendments. The applicant should contact Tacoma Water's Permit Counter at (253) 502-8247 and submit a copy of the site plan to initiate the water plan design and approval process.

Based on the submitted site plan, a preliminary design and pre-design letter will be prepared by Tacoma Water. The pre-design letter will indicate the engineering fees and other requirements the applicant is responsible for, associated with the water main extension.

Water mains can also be installed by Local Improvement Districts. Contact should be made with Tacoma Water at (253) 502-8247 regarding the process by which a water main is designed and constructed under an LID.

Prior to the initiation of the design, the applicant shall remit to the Tacoma Water's Permit Counter the following:

- The design/inspection fee and signed time and material agreement as stated in the "Pre-design" letter. Please note that the fee and agreement alone are not acceptable without sufficient construction plans as noted below:
    - A set of construction plans that have been submitted to the building permit agency for initial review. If in using these plans, errors are found or changes are required, which necessitate a redesign of the water main, the project may be shifted to a later point in the water design queue. The water design will be resumed when the plans are deemed adequate for water design and scheduling of permits. An electronic copy of the plans should also be submitted to aid and expedite the design of the water plans.

SECTION 2 Pre-Construction

Upon approval of the water plans by Tacoma Water and if necessary by the Department of Public Works, Tacoma Water will notify the applicant that the plans and specifications are ready to be picked up.

The applicant shall provide a legal description of the water main easement to Tacoma Water for review and processing. This must be completed and stamped by a Washington State licensed professional land surveyor. The easement must be approved and recorded prior to any construction beginning.

The applicant will select a contractor and supply the contractor's information to Tacoma Water. Tacoma Water will prepare the contract documents and notify the developer when they are ready to be picked up. The developer and contractor will obtain, sign and process the contract documents and return them to Tacoma Water at which time they must be reviewed and approved by the City Attorney's Office.

Concurrently, Tacoma Water will supply to the developer an estimate for cost of inspection, flushing and sampling, and a Time and Material Agreement to cover these items. Upon receipt of the estimated fees, the Time and Material Agreement, and upon approval of the contract documents by the City Attorney's Office, a pre-construction meeting with the contractor will be held.

Please note that construction shall not begin until completion of the pre-construction meeting between the contractor and Tacoma Water.

For proper scheduling, the fees for the installation of water services should be paid prior to the time of the pre-construction meeting.

SECTION 3 Construction

It is the responsibility of the applicant to provide a professional land surveyor registered in the State of Washington to stake the water main for construction in accordance with the approved plans and specifications.

Tacoma Water will provide labor and materials to inspect, flush and sample the water main, including installation and removal of sample stations. It should be noted that if the water main design must be altered after start of construction because of incorrect data furnished by the developer, the construction will stop and will not resume until a redesign fee has been paid to Tacoma Water and plans have been revised and approved.

SECTION 4 Post Construction

Tacoma Water will issue a preliminary acceptance letter after the water main is placed in service.

SECTION 5 Reference Coordinates

Please note that the engineer must reference the project to the Washington State Plane Coordinate System. Contact the Department Public Works at 253.591.5525 for survey coordinate information.

Appendix A

City of Tacoma

Standard Plans

The Standard Plans are no longer included in this volume as they are subject to change and addition throughout the year. The Standard Plans are available online at the City of Tacoma website: www.govme.com . The link is on the left side of the screen under the header "Document Information." Click on "Standard Plans."

Appendix B

City of Tacoma

Bond Estimate Worksheet

Appendix C

City of Tacoma

References

This Design Manual is intended to be utilized in concert with the following documents:

City References

- *Tacoma City Charter*
- *City of Tacoma Municipal Code*
- *City of Tacoma Comprehensive Plan and other adopted policies and design guidelines*
- *City of Tacoma Transportation Master Plan*
- *City of Tacoma Six-Year Transportation Improvement Program*
- *City of Tacoma Streetscape Design*
- *City of Tacoma Curb Ramp Installation Matrix*
- *Ciy of Tacoma Stormwater Management Manual*
- *City of Tacoma Urban Forest Manual*

Design and Construction References

- WSDOT/APWA *Standard Specifications for Road, Bridge and Municipal Construction*
- *City of Tacoma Amendments to the* WSDOT/APWA *Standard Specifications for Road, Bridge and Municipal Construction*
- WSDOT/APWA *Standard Plans*
- WSDOT *Design Manual*
- WSDOT *Traffic Manual*
- WSDOT *Construction Manual*
- *A Policy on Geometric Design of Highways and Streets* - AASHTO
- *Standard Specifications for Highway Bridges* - AASHTO
- *National Association of City Tranportation Officials - NACTO*
- *City and County Design Standards* - WSDOT
- *Local Agency Guidelines* - WSDOT
- *Trip Generation, latest edition, ITE* - Institute of Transportation Engineers
- *Parking Generation, latest edition, ITE* - Institute of Transportation Engineers
- *MUTCD* – Manual on Uniform Traffic Control Devices
- *IES* – Illuminating Engineering Society, RP-8, Recommended Progress for Roadway Lighting.
- Federal Register, American with Disabilities Act (ADA)