City of Tacoma
Right-of-Way Design Manual

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Prepared by
City of Tacoma

CERTIFICATION PAGE

City of Tacoma Right-of-Way Design Manual

I hereby certify that this City of Tacoma Right-of-Way Design Manual was prepared by or under my direct supervision and that to my knowledge and belief was prepared in accordance with the requirements of Chapter 18.43 RCW. I hereby certify that I am a licensed professional engineer under the laws of the State of Washington. The City of Tacoma does not and will not assume liability for the sufficiency, suitability, or performance of street and right-of-way improvements designed in accordance with this Manual. This Manual is stamped and signed in accordance with Section 196-23-020(1) of the Washington Administrative Code and Section 18.43.070 of the Revised Code of Washington.

PUBLIC WORKS DIRECTOR STAMP UPON FINAL

TABLE OF CONTENTS

ABBREVIATIONS / ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AASHTO Policy	American Association of State Highway and Transportation Officials' A Policy on Geometric Design of Highways and Streets
ADA	Americans with Disabilities Act
ANSI	American National Standards Institute
APS	Accessible Pedestrian Signals
APWA	American Public Works Association
BMPs	Best Management Practice
BUG	Backlight, Uplight, Glare
CFR	Code of Federal Regulations
City	City of Tacoma
CSTC	Crushed Surfacing Top Course
CSBC	Crushed Surfacing Base Course
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
GSI	Green Stormwater Infrastructure
HDPE	High Density Polyethylene
HMA	Hot Mix Asphalt
IBC	International Building Code (latest edition)
IFC	International Fire Code (latest edition)
IES	Illuminating Engineering Society (latest edition)
ISA	International Society of Arboriculture
LZ	Lighting Zone
Manual	City of Tacoma Right-of-Way Design Manual
MEF	Maximum Extent Feasible
MoMaP	Mobility Master Plan
MUTCD	Manual on Uniform Traffic Control Devices (latest edition as approved/amended by the State of Washington)
NEMA	National Electrical Manufacturers Association
Orange Book	Department of Ecology Criteria for Sewage Works Design
PAR	Pedestrian Access Route
PCPs	Pedestrian Circulation Paths
PVC	Polyvinyl Chloride
PROWAG	Public Right-of-Way Accessibility Guidelines
RCW	Revised Code of Washington
ROW	Right-of-way
RRFB	Rectangular Rapid Flashing Beacon
SSD	Stopping Sight Distance
SEPA	State Environmental Policy Act
Side Sewer Manual	Side Sewer and Sanitary Sewer Availability Manual (City of Tacoma, latest edition)
SWMM	Stormwater Management Manual (City of Tacoma)
SWPPP	Stormwater Pollution Prevention Plan
TMC	Tacoma Municipal Code (including latest revisions)
TMP	Transportation & Mobility Plan (formerly Transportation Master Plan)
UFM	Urban Forest Manual (City of Tacoma)
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation

1 Chapter 1 Introduction and General Requirements

INTRODUCTION

The City of Tacoma 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, street lighting, traffic signalization, landscaping, Americans with Disabilities Act (ADA) requirements, and channelization. The Manual provides the minimum technical standards required to construct improvements within the City of Tacoma 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 References for a list of the most commonly referenced additional documents that will be necessary for design within the ROW.

Tacoma Municipal Code (TMC) Chapter 10.22 provides the authority to require the use of this Manual for certain projects. Additionally, this Manual allows the City of Tacoma to meet the expectations of RCW 35.78.040 as well as accreditation expectations from the American Public Works Association.

The City of Tacoma (City) has developed this Manual to outline design criteria for City-owned streets and utilities as well as private accessways. The minimum technical standards described in this Manual help ensure public infrastructure is safe, 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 before implementation.

This Manual should be used by the design 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.cityoftacoma.org/designmanual.

The City became the first "Greenroads® Community" in June 2014, through adoption of Resolution No. 38945. This means that the City is committed to developing a policy for the City's roads and other transportation infrastructure in order to be models of environmental, economic, and social stewardship and by setting community goals of sustainable design, construction, and maintenance. See CHAPTER 4 for additional information concerning Greenroads® requirements.

SECTION 1.1 Plans, References, and Specifications

1.1.1. Standard Plans

City Standard Plans (also referred to as standard details) are included by reference in this Manual. Applicants shall reference and use the most recent version of the City Standard Plans when applicable for the work proposed. Standard plans applicable to a project shall be included on the plan set.

If a City Standard Plan does not exist, applicants shall use the most recent version of the WSDOT Standard Plans 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 design engineer’s site specific details.

1.1.2. 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. Applicants shall 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. Reference CHAPTER 2 and CHAPTER 3 for more information on the permitting process and plan format respectively.

The applicant or design 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.
- The City permitting website is a good tool for determining additional regulations that may be imposed by other City departments.

1.1.3. 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.

1.1.4. 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; Work Order General Notes; general or site specific notes referenced on the plan set; other City design manuals or policies; or the design engineer's site specific edits.

SECTION 1.2 Exceptions and Variances to the Standards and Requirements

1.2.1. Exceptions

Exceptions to this Manual may be requested to the City based upon specific project constraints. Alternative designs may be allowed if based on accepted standards of engineering practice and where specific project circumstances do not allow application of the standards and requirements of this Manual. Standards and requirements contained within this Manual may have specific procedures and requirements for requesting and granting exceptions. Contact the City department with jurisdiction over the requirement for information regarding a specific exception request. It will be the responsibility of the design engineer and/or applicant to submit all relevant data, calculations and figures as may be necessary to evaluate a request for exception via a **variance** described below. All approved variances shall be given in writing by the appropriate City department.

1.2.2. Variances

Project Design Engineers who believe they cannot meet City of Tacoma design standards or construction requirements shall submit a variance request using the

available form. (pending link) A variance request should be submitted early in the design process to reduce delays in plan review and avoid significant re-design of the project.

Some variance requests may be granted by review staff to address simple variations encountered during design review. However, a formal request must be submitted by the Design Engineer for significant variations altering code-related requirements. Variance requests must be approved by the Department with Approving Authority and indicated on the variance form. Any design element that deviates from the standard or code requirement must be documented by the Design Engineer and acknowledged or formally approved in writing by the City Engineer or Designee.

Approval of variance requests does not create a precedence.

2 Chapter 2 Right-of-Way/Site Permitting and Local Improvement Districts

INTRODUCTION

This chapter focuses on the City permitting process that private developers must follow for constructing improvements in the City ROW. The alternative to the permitting process is to form a Local Improvement District. A description of the Local Improvement District process can be found in Section 2.8 of this chapter.

SECTION 2.1 Authority and Permits

2.1.1. Permit Required

Tacoma Municipal Code, 2.22.030A and 10.22.030A requires that any proposed improvements within the City ROW require permit(s) and that the City shall approve all plans and associated permit(s). TMC 2.19.030.B.1 also requires permits for onsite construction.

Some of the work covered under this Manual may require multiple City permits, reviews, and approvals. Any questions regarding permits, approvals, and agreements shall be directed to the Planning and Development Services Department at Tacoma Permits or (253) 591-5030.

See TacomaPermits.org for a description of the City of Tacoma Permit types and references to associated City codes and requirements.

2.1.2. Provisions for Permit

The person, firm or corporation to whom the permit is issued shall conform to the City's general special provisions and design standards following vesting protocols, if applicable, 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.

2.1.3. Applicable Permits and the Design Manual

The City separates the construction of the facilities and infrastructure into two separate categories consistent with the Right-of-Way and Site improvements: public (off-site) improvements and private (onsite) improvements. Projects generally include a public and private improvement component; therefore, both a Site Development Permit and a ROW Permit will be required and can be combined for review. The applicant should always consider their desire for phased construction when preparing their design submittals. Any phased design approval must stand on its own as an issued permit. For additional detailed information regarding applicable permits see the online Tip Sheets.

Although there are often multiple permits required, Right-of-Way and Site Development Permits are mechanisms used by the City for the review, approval, and inspection of privately designed plans for the construction of both private and City-owned infrastructure. City owned infrastructure must be designed in accordance with this manual and all other City design standards, inclusive of applicable codes and regulations.

City-owned infrastructure includes, but is not limited to, dry utilities, water, wastewater and stormwater infrastructure, streets, pedestrian pathways, street lighting, traffic signals, and other traffic control devices and associated appurtenances. Privately owned

infrastructure include, but is not limited to, private stormwater facilities and system laterals, private wastewater pump systems and laterals (side sewers), paving, private accessways, private streets improvements (such as sidewalks and driveways) and associated appurtenances.

2.1.4. Applying for a Right-of-Way and/or Site Development Permit

See Figure 2-1 for a flowchart describing the permitting process.

To start the permitting process, an applicant shall submit the following electronically to the Planning and Development Services Department:

- Signed SDEV and/or Work Order Complete Application Submittal Guidance Form
- A complete electronic application. All correspondence from the City will be sent to the individual listed as the contact person on the form.
- A detailed/engineered plan set as defined by applicable Manuals and Tip Sheets and Guidance document. This plan set must be standalone and independently convey the scope of work for the off-site and on-site work without further explanation.
- An itemize cost estimate for project work in bid item format.
- A copy of the Conditions of Improvement, if available. This may be a Hearing Examiner's report, recorded plat, concomitant agreement, short plat report or recorded short plat, a letter from the Site Development Group staff or a list of requirements placed on a commercial building permit application, as applicable.
- Payment of all applicable permit fees.

2.1.5. Permit Review

Plans submitted for permit are reviewed by City subject matter experts. Staff work with the development engineer and applicant to ensure the project meets City design standards, through interpretation of this manual, City code, other City design resources and best available technology. As necessary, City staff may impose additional off-site improvement requirements as discussed in Section 2.2 below.

2.1.6. Performance 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 Tip Sheet G-220 provides additional information regarding performance bonds for work within the ROW.

- 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 improvements or the remaining required improvements per TMC 13.04.090 or TMC 13.04.100.

- Bonding for Previously Platted Property: Lots on previously platted property will require a bond for the required improvements prior to approval of the ROW Construction/Work Order Permit plans.

SECTION 2.2 Off-site Improvements Required for Private Development

Off-site (public right-of-way) improvements are defined and required by TMC 2.22.040 and/or as required by land use actions. Although a maximum level of off-site improvements may be imposed by project type as shown in Table 2.22.1, this limitation shall not apply to any additional requirements imposed by a SEPA, Conditional Use Permit, Traffic Study , or other conditioning documents. . Nor does it absolve the property owner of the responsibility to repair any damaged or defective sidewalk. Additional improvements to ensure a safe traveled way may be required during construction.

2.2.1. Half Street Improvements

Half street improvements are half of a complete public street section located adjacent to the proposed on-site project parcel(s) frontage.. Half street improvements are assessed for the parcel frontage(s)s.

Half street improvements are required when the current frontage does not meet City standards for a complete street cross section per the City of Tacoma Comprehensive Plan, or pavement section per Standard Plans. For example, frontages that are undeveloped, underdeveloped, oil-mat and/or gravel must update the street section. For specific half street design detail, refer to Chapter 4.

2.2.1.1. Existing Half Street

Improvements to an existing half-street are required if the subject property frontage for the subject property is adjacent to a temporary travel lane. The existing temporary improvement shall be removed to the centerline and a full street section per PD-01(2) shall be installed. Associated improvements include, but are not limited to, curb and gutter, sidewalk, street trees, landscaping, street lights, curb ramps, driveways, storm system and utilities. Additionally, the existing temporary street prism shall be expanded to the required full street width defined in Chapter 4, subsection 4.4.1.

Half-street improvements shall include removing and replacing existing driveway aprons that do not meet current ADA requirements consistent with Chapter 4, subsection 4.6.6 - Driveways. Half-Street improvements shall address sidewalk obstructions in the half-street area, including, but not limited to, replacing existing sidewalk areas containing an ADA obstruction.

Additionally, the City Engineer may determine existing improvements within the Half-Street do not conform to current City standards **and** require improvement, upgrade, modification, or re-construction. In making this determination, the City Engineer will consider the proportionality of the required work to the potential impacts of the project, pedestrian and vehicular safety, ADA requirements, consistency and conformity with adjacent existing and planned improvements, and other factors as deemed relevant by the City Engineer. As part of this determination, the City Engineer may require existing

driveway access(es) that do not meet current standards to be removed, relocated, and modified.

2.2.2. Curb Ramps

Per RCW46.61.240, a legal crosswalk exists at every intersection of public streets, unless it is otherwise signed. Whenever streets, sidewalks, or curbs are constructed or altered, a curb ramp may be required, consistent with the Curb Ramp Installation Matrix, including if existing non-compliant curb ramps exist. Curb ramps may be required even if sidewalks do not currently exist along a corridor as part of off-site improvements for the corner impacted and the receiving ramps. Curb ramp improvements typically impact corner lots and large developments. Where accessibility to transit is required as part of SEPA or as a parking reduction condition, the designer may need to consider additional curb ramp improvements as part of the project.

Additional treatments, such as beacons, signage, curb extensions, traffic diverters, pedestrian refuge islands, or crosswalk marking may be required in order to enhance safety on higher speed or volume roads.

2.2.3. Alley Improvements

Gravel alleys shall be paved along the project frontage and shall continue pavement beyond the frontage, to connect to the nearest existing pavement section. Grade and alignment transitions shall be provided from adjacent lots from property line and extended to the alley. A driveway approach may be required as part of the off-site improvements.

Mid-block improvements may be required where the existing alley is underdeveloped. For commercial/multi-family/industrial projects the alley will be required to be improved at least to one paved street, as determined by the City Engineer. Stormwater management shall be considered when a determination to pave an alley is made which may result in a longer pavement length, storm extension or other stormwater improvements. The alley approach will be replaced if deemed damaged or defective and no longer meets current standards.

SECTION 2.3 ROW Condition Assessment and Restoration

Per TMC2.22.040.B.4.d restoration is required where a site has existing improvements such as, but not limited to, sidewalks, curbs, gutter, and paving, these improvements shall be replaced if they are broken, damaged or hazardous. TMC10.14.100, known as the abutters duty, stipulates “All driveway paving, planting strip paving, drainage structures, or any other improvements within the space between the property line and the roadway shall be maintained in a safe and usable condition at the expense of the owner of the abutting property. The condition of the existing improvements shall be assessed as part of all building and site permit actions and required public (off-site) improvements will be determined during the permitting process.

2.3.1. Pavement Condition Assessment and Restoration

The most current city street GIS layers contain the pavement condition index, which along with the current Right-of-Way Restoration Policy and Standard Details for patches and street restoration, can be used to evaluate street condition and the existing street

section. In some areas, additional, pot holing may be used to determine the existing street section.

Surface restoration limits are subject to the Right-of-Way Restoration Policy. Patches shall be consolidated as required based on the pavement condition of the road and the following:

If a project removes street pavement in two (2) or more locations within 75 feet of each other, measured longitudinally or transversely from any cut back zone, the project shall restore the street by incorporating the work in a single patch per the Standard Plans. If a project excavates and removes the street pavement in four (4) or more locations within 300 feet of each location, measured longitudinally or transversely from any cut back zone, the project shall restore the roadway by incorporating the work in a single patch per the Standard Plans.

Some existing streets will require reconstruction if they do not meet the approved design standards and associated geometry. For more information on pavement restoration refer to the Standard Details and Chapter 4, Section 4.7 – Pavement Design.

Five-Year Moratorium

Except for repairs that are necessary for the protection of the public's health and safety, excavations in newly constructed streets will not be allowed for a period of five years following substantial completion of the project.

Variance requests shall be submitted when a project proposes a cut in a street section with a current Five-Year Moratorium. Pavement patches will not be allowed and the full width of the disturbed infrastructure shall be restored to new condition between the property lines of the subject property.

2.3.2. Sidewalk Condition Assessment and Restoration

Sidewalks shall be assessed per this section and repaired or installed in accordance with TMC 10.18 – Sidewalks – Construction, Reconstruction and Repair and TMC 10.20 – Sidewalks – Repairs Pursuant to Agreement, Chapter 4 of this manual and the City Standard Details. .

2.3.2.1. Damaged, Defective and Hazardous

Damaged, defective and/or hazardous sidewalk shall be removed and replaced to the nearest expansion joints consistent with the sidewalk standard detail and as required per Table 2.1 below and if If in the view of the City, the damage creates a concern for safe pedestrian passage.

The compliance evaluation criteria is defined in TMC Title 2, 9 and 10, as well as, the Public Right-of-Way Accessibility Guidelines (PROWAG) guidelines. When evaluating per PROWAG, the guidance states sidewalk must not have:

- Horizontal or vertical displacement greater than ¼ inch (6.4 mm) maximum,
    - Where the displacement results from tree root intrusion, various techniques can be utilized to mitigate the tree root, while potential protecting the tree and the new

future walk. A good resource is Seattle's Trees and Sidewalks Operations Plan in addition to consulting an arborist.

- Movement of any piece of the sidewalk with ordinary foot pressure.
- A width less than requirements as defined in Chapter 4, subsection 4.4.6 – Mobility Facilities.
- In addition to the above or any combination of 2 of below:
  - A cross slope of greater than 2%,
  - A running slope greater than the adjacent street,
  - Cumulative cracking, connecting edges of the sidewalk (not including expansion joints) that creates more than 3 distinct pieces within any single 15 foot panel , even if the individual cracks do not exceed the ¼ displacement criteria.
  - Excessive exposed aggregate, resulting in either not enough friction when moisture is present, or too much roughness for a wheelchair. A minimum coefficient of 0.6 is required This value is typically used for manufactures of lids to be used in the ROW. A drag test with a known weight and calculated surface friction factor could be used by an applicant.

$\mu_{sidewalk} = \mu_{calculated} - \mu_w$

$\mu = \frac{F_d}{W}$ Where

$\mu_{calculated}$ = friction factor,

F_d = Drag force parallel to the surface

W= known weight.

Table 2.1 - Damaged and Defective Sidewalk Replacement Standards

Damaged and Defective Criterion	**Over 50% of the sidewalk along the development frontage needs replacement**	**Less than or equal to 50% of the sidewalk along the development frontage needs replacement**
> 50 feet in total length along the development frontage needs replacement	Replace the entire length of the development frontage sidewalk to current sidewalk standards	Meet current sidewalk standards for the sections of sidewalk being replaced that are greater than 50' in length and match the width of the widest adjacent sidewalk for smaller segments
≤ 50 feet in total length along the development frontage needs replacement	Replaced sidewalk section will match the width of the widest adjacent sidewalk	Replaced sidewalk section will match the width of the widest adjacent sidewalk

2.3.2.2. Installation and Restoration

Sidewalk that is required to be installed or replaced must be constructed consistent with SU-04, SU-04A, SU-04B(1) and SU-04B(2). Special consideration and specifications shall be determined for replacement of sidewalk stamped, with specially color dye, of historic significance or other special materials. For specific design information regarding sidewalks, curb ramps and crosswalks, see Chapter 8.

2.3.2.3. Curb Condition

Curb condition shall be evaluated based on the same cracks and displacement criteria for sidewalks, however, curbing shall be replaced to the nearest expansion joinst, if it is cracked through completely. Additionally, if the curbing is creating a ponding situation, it shall be corrected so as to not impede stormwater conveyance.

SECTION 2.4 Applicant/Contractor Responsibilities

2.4.1. Pre-Construction Meeting

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

2.4.2. Obtaining a Permit for Construction

Upon approval of the plans, paying all permit fees, and holding the pre-construction meeting, a contractor satisfying the following criteria may use the approved plans to obtain the ROW Construction/Work Order 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 2.5 of this chapter, if applicable.

2.4.3. Applicant Responsibilities

- Comply with all applicable city, state, and federal requirements.
- If applicable, obtain a performance bond for the value of work as outlined in Section 2.5 of this chapter.

SECTION 2.5 Bonding Requirements

2.5.1. ROW Bond

The contractor shall deliver to the City, prior to the issuance of the permit, a street obstruction/ROW 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).

2.5.2. Performance Bond

The applicant or contractor shall deliver a separate bond to the City, prior to the issuance of a ROW Construction/Work Order 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 2.6 Construction and Inspection

The TMC allows the City to inspect all proposed work. Failure to comply with the provisions set forth in this Manual or the approved plans may result in a stop work order, requirements for removal and replacement of unacceptable work, seizure of bond, or other penalties as established by ordinance

2.6.1. 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 shall 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 City Inspection staff.

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; City General Special Provisions; and Stormwater Management Manual (SWMM). Material and performance tests (e.g., compaction, compression tests for concrete, soil reports, etc.) shall be performed at no cost to the City.

SECTION 2.7 Closure of the ROW Construction/Work Order Permit and Site Development Permit

2.7.1. Construction Deficiency List Items

Prior to final acceptance, the City 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.

2.7.2. Record Drawings

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

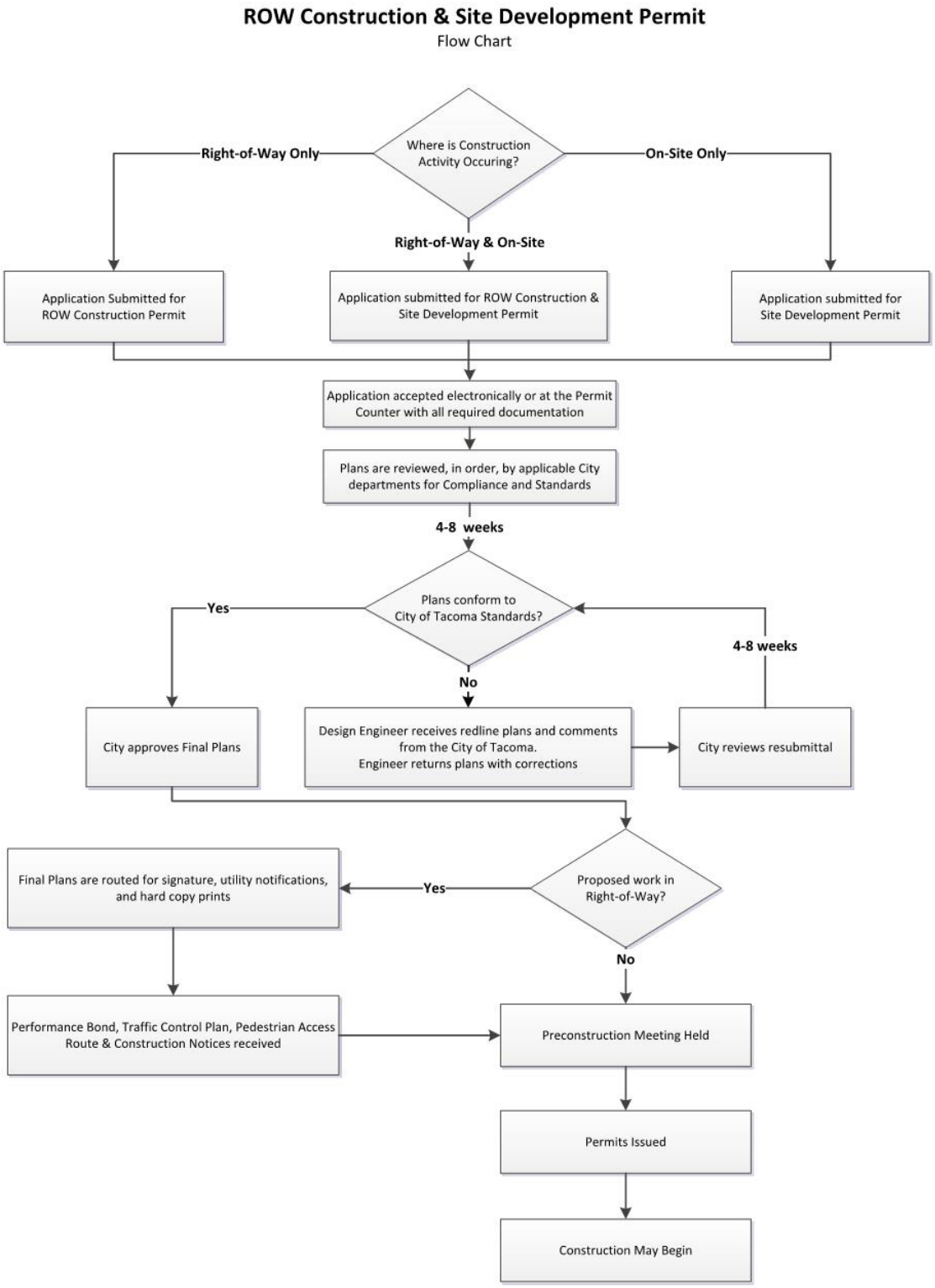
2.7.3. Permit Closeout

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.

2.7.4. Permit Expiration

If after permit approval construction does not begin and remain active within 180 days then the plan approval and permit expires for the ROW Construction/Work Order Permit. The applicant will need to reapply and start the permitting process over. The ROW Construction/Work Order Permit will be closed and the account settled accordingly prior to issuance of a new permit for the work.

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



SECTION 2.8 Local Improvement Districts

One alternative to the ROW Construction/Work Order Permit and Site Development Permit process is to form a Local Improvement District. The following is a summary of the Local Improvement District process and provides answers to some common questions. The Local Improvement Districts Policy was updated as outlined in Resolution No. 37659. Contact the Local Improvement District Administrator at (253) 591-5522 for additional information concerning the Local Improvement District process.

2.8.1. 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 complete. A Local Improvement District requires support from 50 percent or more of the abutting properties willing to sign an advisory survey. Upon receipt by the Public Works Department 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.

2.8.2. Starting a Local Improvement District

An individual interested in a Local Improvement District should contact either the administrator at (253) 591-5522 or a representative at (253) 591-5338 and request a 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 gauge 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.

2.8.3. Advisory Survey

The advisory survey is a non-binding request to the City Council where property owners representing at least 50 percent 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.

2.8.4. 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 completion of the formation hearing, 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 of the improvements. 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 advisory survey to the City.

2.8.5. 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 roll and 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; or

2. Pay off part of the assessment during the interest-free window and pay the balance owed over a defined number of years.

2.8.6. 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 the Local Improvement District administrator at (253) 591-5522 or representative at (253) 591-5338.

3 Chapter 3 Site Development Permit and Right-of-Way Construction Plan Format

INTRODUCTION

This chapter does not address design criteria but rather provides the design engineer with guidance and minimum standards for the development of the construction plans. Design criteria can be found in other applicable chapters of this Manual.

The design engineer should also reference the City's Site Development Permit and Right of Way (ROW) Construction/Work Order Tip Sheets. The Tip Sheets have been developed to provide the design engineer with representative information identifying the depth of detail required for submitting a set of construction plans to the City for review.

SECTION 3.1 General Requirements

Use this chapter in conjunction with the checklist provided through the City's pre-application services as a guideline for the minimum acceptable standards by which a set of drawings shall be submitted.

SECTION 3.2 Plans for ROW Construction/Work Order and Site Development Permits

In order to provide a stand-alone plan set that can be used to construct the improvements, all site specific notes and details shall be included on the plan set.

3.2.1. Capital Delivery Projects

Typically, City Capital Delivery projects do not follow the ROW Construction/Work Order Permit and Site Development Permit processes. Capital Delivery projects located within the ROW shall follow the permit process specific to the City Department that is responsible for the project. All contractors working within City ROW must have a valid ROW bond and be permitted to work in the ROW. For Capital Projects, performance bonds are dictated by the awarded City contract.

3.2.2. Private Development Projects

Private Development projects are responsible to submit for appropriate permits per Chapter 2 of this manual. All contractor's working within the city right-of-way must have an active ROW bond. Additionally, a performance bond will be required for all work order permits.

SECTION 3.3 General Format

3.3.1. Title Block, Border and Sheet No.

All Work Order plans, for work within the right of way, shall bear a City standard title block; available on the City's website under Standard Plans. The title block must contain the signed and dated seal of a Professional Engineer licensed in Washington State. The date represents the date of signature by the Professional Engineer and not the revision date of the drawings. The date and signature must be applied to the stamp area and certifies the Engineer of Record's approval of the drawings. Electronic signatures can be applied, but must not interfere with the Electronic Document Standards of a flattened document.

The work order design, upon re-submittal with redlines at the end of construction, will represent a City record drawing after final acceptance of the work.

When an applicant desires a combined plan review of the off-site (public) and on-site work, the plans shall clearly demonstrate the work that applies to the off-site and on-site work in both the use of the City border, sheet numbering with a "W" for the work order (W-XX) and depicted in the sheet index. The City title block and border shall not be used for private development drawings. The applicant should give serious consideration to phasing of permits for construction in setting up the drawings as each permit issued must have a Cover Sheet, with sheet index, and a Temporary Erosion and Sediment Control Plan.

3.3.2. Sheet Size, Scale, and Basic Format

- Sheet size shall be 22 inches by 34 inches. The overall plan view should be no smaller than 1"=100' (horizontal). Recommended scales for individual sheets are 1"=20' (horizontal) or 1"=5' (vertical). Architect's scale will not be accepted.

- The plans for improvements within the ROW shall contain a plan and profile view with the street names clearly labeled in both. The stationing in the plan view shall 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 Standard Plans DR-02.

SECTION 3.4 Professional Land Surveyor Required

The design engineer shall submit Site Development and ROW Construction/Work Order drawings based upon a preliminary survey prepared by a professional surveyor licensed in Washington State. Survey beyond the project limits may be required for projects that are required to consider future extensions or as necessary to ensure proper design of grades, alignment, and transitions.

3.4.1. ROW Construction/Work Order Permit Preliminary Survey

The preliminary survey for ROW Construction/Work Order Permits shall be an accurate survey showing all existing topography and all ROW elements which might be affected by the project work. Alternatives may be considered on a case by case basis with the approval of the City Engineer.

3.4.2. Monumentation

All existing structures and new improvements shall be tied into the City's monumentation system. The City of Tacoma maintains a list of survey monuments and benchmarks for use within the City limits. These monuments are a key element in supporting successful construction within the City of Tacoma and should be preserved at all costs. Survey monuments shall be placed or replaced in accordance with WAC 332-120 (Survey Monuments – Removal or Destruction), and RCW 58-09.120 and per good practice in land surveying.

Unless approved otherwise by the City Engineer or their designee, ground disturbing activities within 25 feet of an existing survey monument requires securing of a permit from the Department of Natural Resources in advance of those activities. All existing survey monuments that are disturbed, lost, or destroyed during construction shall be replaced by a registered land surveyor registered in the State of Washington at the expense of the responsible party. Any monuments set shall be permanently marked with the certificate number of the Professional Land Surveyor (PLS) setting it (which shall be the same PLS that prepares and certifies the associated monument recording information). Monuments shall be replaced per City of Tacoma Standard Plan SU-01 or SU-02.

Per Title 2.22.040.A.2 - where City of Tacoma monuments are not within 2500 feet of required off-site improvements, as measured along the street grid, a new City monument will be established at the nearest intersection to the project.

Monuments are required along the centerline of improvement of all new or reconstructed streets. Monuments shall be placed at intersections, points of curvature (PC), and points of tangency (PT). New monuments to be constructed shall be shown and identified, by type, description and station of each monument on the plans. The survey required to get to the construction station line, from City monumentation, shall be clearly shown on the plans, including lengths and bearings. Line breaks may be used for longer transits, but must clearly identify the intersection (location) of each monument.

3.4.3. Horizontal and Vertical Control and Datums

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 lengths, and the stationing of all monuments. All monuments must be labeled with a description of the monument (e.g., “surface brass mon.”, “mon. in case”, etc.)

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 design engineer must verify that the temporary benchmark is on the correct datum.

The City requires 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.

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 (NGVD 29).

In rare instances, requiring prior City approval, a project site may be designed on a separate datum, typically specific to other government agency requirements. A clear station equation shall be provided for conversion to City datums on each sheet. All work orders shall be designed on City datum.

3.4.4. Additional Items to be Identified on Plans

The designer should refer to tacomapermits.org for relevant design tipsheets and guidance for permit submittals. The Site Development Complete Application Submittal Guidance Form provides an extensive list of items to be considered for each project site design. The Work Order Complete Application Submittal Guidance Form provides an extensive list of items to be considered for the public right of way infrastructure (off-site) design.

3.4.5. Drawing Clarity

To increase drawing clarity, the designer should ensure use of appropriate: line weight, font size, text overlap, shading, consistent with good drafting practice. Existing features shall be shaded back on all design sheets. All existing and proposed line types and symbols shall be indicated in a legend. In cases where a line type or drawing feature is not delineated in a proposed or existing legend, it shall be noted/labeled on the plan.

The use of the color red is reserved for City review and approval. The use of color on submittals should only be used to enhance plan clarity and cannot be substituted for appropriate labeling and line weights. The designer shall assume plans will be reproduced in black and white and at half-scale.

Plan redundancy shall be minimized when possible. For example, items noted to be removed shall be indicated on a demolition plan and then removed on all following plan sheets.

Plan information needs to be consistent between the work order and site development permits including necessary overlap to determine tie-in/catch points and project phasing.

Phased projects must show the temporary improvements necessary for interim phasing, such as sidewalk transitions, temporary paving.

Projects shall be constructed per plan, additional clarity during design may be requested to assist the City inspector. Projects shall be constructed based on the information presented on the approved plans, not inferred or left to the contractor to figure out. Ultimately, the project design should be capable of achieving final inspection without a field revision.

SECTION 3.5 Street Plans

3.5.1. Plan View

The plan view shall clearly show the street, utility, and any other work to be constructed under the Site Development Permit or ROW Construction/Work Order 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, and the ending station and offset.

Station offsets from the construction station lines shall be provided on the plans. Dimensions to show proper separation shall be provided along each utility alignment. These dimensions shall be provided once for each change in separation, with at least one dimension provided per sheet.

3.5.2. Profile

Gutter (flowline) elevations shall be shown on street, accessway, 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 plans which show pavement elevations within intersections (see Section 3.7 of this chapter). Street, alley, accessway and sewer, storm and utility improvements should be shown in plan and profile view.

The profile view shall show and label each grade, vertical curve, point of vertical curvature, point of vertical intersection, point of vertical tangency, grade break, and top of curb/gutter elevations. The gutter elevations, left and right, shall 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.

3.5.3. 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 Figure 3-2 for an informational sketch showing the definition of a cut and fill “catch point.”

3.5.4. Private Accessways

Private accessways, although not owned and maintained by the City, are reviewed and inspected by the City as part of the Site Development and ROW Construction/Work Order Permits for conformance with the development conditions. The format for identifying private accessways shall be consistent with CHAPTER 4.

3.5.5. Illumination

See CHAPTER 5 for plan requirements as applicable to illumination.

3.5.6. Traffic Signalization

See CHAPTER 6 for plan requirements as applicable to traffic signalization.

3.5.7. Channelization and Signing

Reference CHAPTER 7 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 7.

SECTION 3.6 Stormwater and Wastewater Sewer Plans

See Chapter 11 for public stormwater and wastewater design.

3.6.1. Mainlines, Maintenance Holes, and Catch Basins

The plans shall clearly identify the pipe ownership (public/private) 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.

3.6.2. Wastewater Sewer Laterals (Side Sewers)

The location of all proposed wastewater sewer laterals and their connection to the City wastewater system shall be clearly shown on the plan (station location of each end of the lateral). When extending the City wastewater system, side sewers shall be constructed for all properties that could be served by the wastewater sewer extension to the maximum extent feasible. Side sewers shall be constructed per the Side Sewer and Sanitary Sewer Availability Manual.

. Private connections to the wastewater sewer lateral require separate side sewer connection permits. Refer to the City of Tacoma Side Sewer and Sanitary Sewer Availability Manual for additional information on side sewers.

3.6.3. Private Utilities

Private utilities and their connections to the public system, if applicable, 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 on work order plans. Private connections to public utilities require separate permits (for example, a stormwater connection permit is required before connecting private stormwater systems to the City stormwater mainline). The dimension of each utility from the monument line or construction centerline should be identified in the plan view and where applicable in the profile.

3.6.4. Stormwater and Wastewater Facilities

Stormwater and wastewater facilities shall be shown and denoted as public or private on the plan set for Site Development and ROW Construction/Work Order Permits, based on the identified maintenance responsibilities. The City of Tacoma SWMM provides design criteria for stormwater facilities City of Tacoma Side Sewer and Sanitary Sewer Availability Manual provides design criteria for wastewater system Additional information for the design for stormwater and wastewater facilities can be found in Chapter 11.

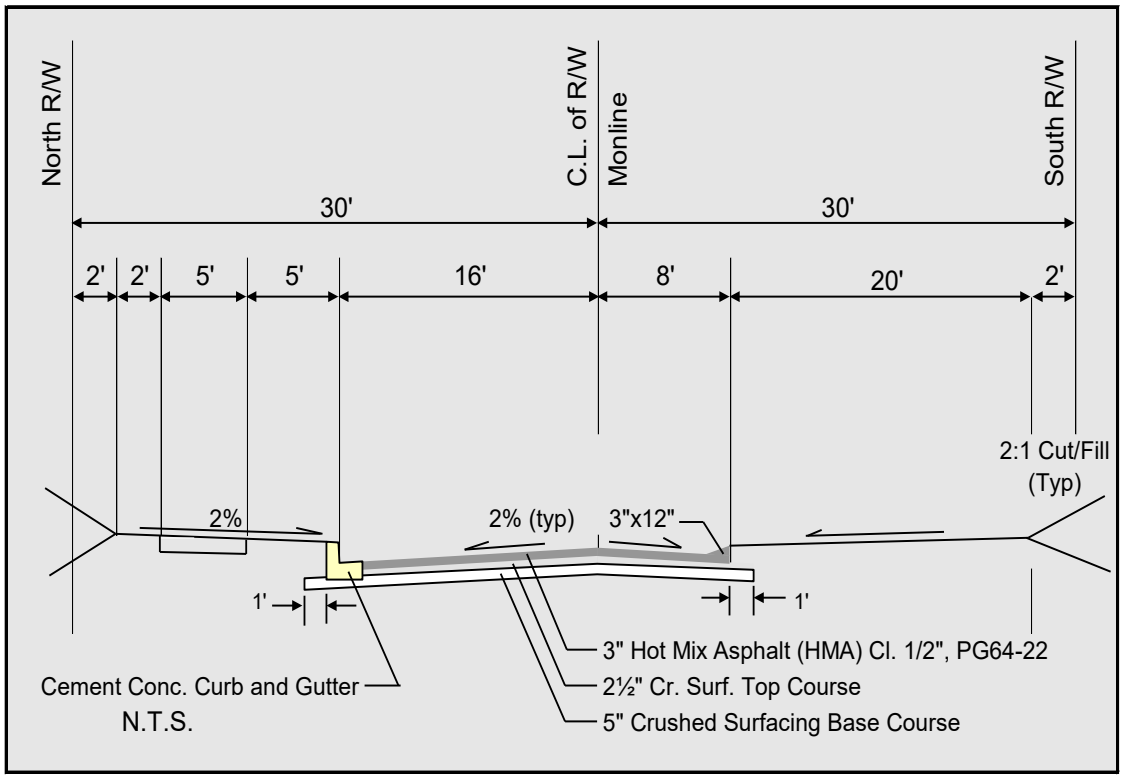
SECTION 3.7 Details

3.7.1. 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 construction alignment stations shall be shown for each section. The section shall include improvements to be constructed within the ROW or public easement. 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.

Figure 3-1: Typical Half Street Section



3.7.2. Cross Sections

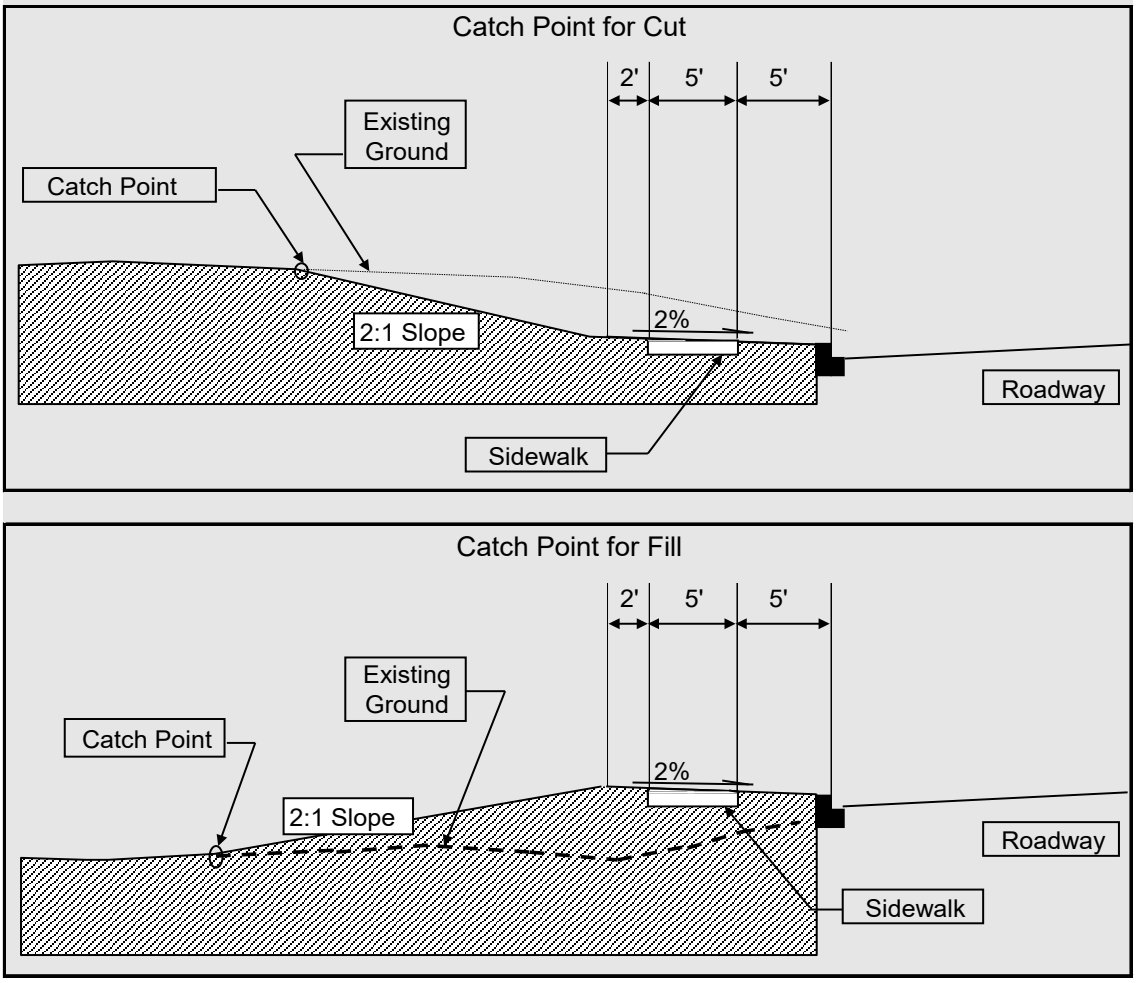
Cross sections at regular intervals may be required in areas where street widening is proposed to verify that the meet line is adequately designed. Cross sections are an aid in the design review and may either be shown on the plan or submitted separately. Cross sections should be shown with the corresponding 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. The cross section shall not be used in place of a profile where clear catch point elevations at the right-of-way or adjacent property are necessary do to show grade changes. In addition, corresponding cross slope grades for each change in grade shall be shown. See Figure 3-2 for a sample cross section.

3.7.3. 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.

Curb ramps shall be provided in separate detail, see CHAPTER 4 for requirements.

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



3.7.4. Additional Notes and Details for the Site Development and ROW Construction/Work Order 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 and Work Order General Notes.

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 (BMPs) (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 SWPPP Checklist are provided in the City of Tacoma SWMM, Volume 2. Please see CHAPTER 13 for additional comments regarding grading, excavation, and erosion control.

4 Chapter 4 Street Design

INTRODUCTION

The City strives to create a transportation system that promotes and supports Complete Streets and other City policies and objectives such as Vision Zero; transportation choices; environmental sustainability; serves and supports economic development; and equitably and efficiently serves all neighborhoods and business districts of the City. In support of these goals, this chapter covers design criteria and guidelines concerning the geometric design elements that must be considered in the location and design of various types of roadways, which includes all elements in the right-of-way (ROW).

SECTION 4.1 Street Types

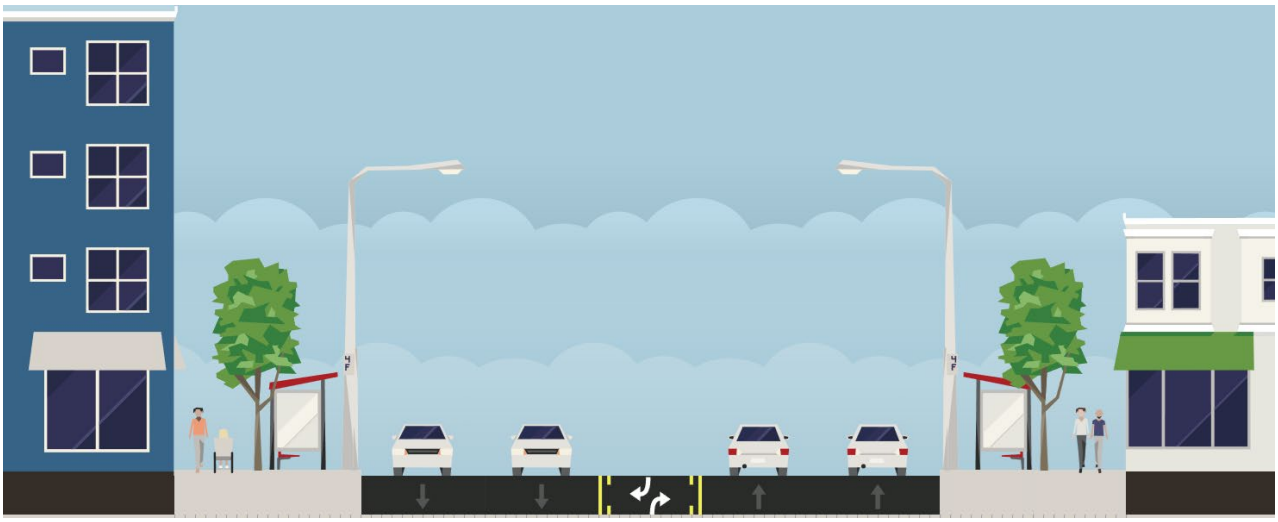
4.1.1. Arterials

Streets designated as arterials (Principal, Minor, Collector, and Non-classified) per the Tacoma Municipal Code (Title 11) are designed to move traffic between locations within the region and to access the freeways. Design emphasis is placed on providing movement of inter-city rather than intra-city traffic. Direct access to multi-family, commercial and industrial land uses is permitted, but managed to improve safety and reduce congestion. Direct access to single family residential land uses is not allowed unless there is no other access point available. In general, parking is not allowed on arterial streets except in certain areas of the Downtown Sub Area and other areas where parking is not prohibited due to specific circumstances. The designation of each Arterial streets is contained in section 11.05.490 of the Tacoma Municipal Code; it is additionally shown in the Tacoma DART map. The functional difference between each classification is as follows:

- Arterial streets provide for the safe and efficient movement of people and goods and have varying levels of access control to support the given classification's functional expectations.
    - Principal arterials accommodate higher volumes of traffic for extended distances throughout the City and have a high level of access control.
    - Minor arterials are similar to principal arterials but are not expected to accommodate as much use and therefore permit more access options than principal arterials.
    - Collector arterials connect commercial, industrial, and residential areas to other arterials of all types and have some restrictions on access control.
    - Non-classified arterials have features, or an intended function, that do not align with, or span various elements of, the other classifications.

In the City of Tacoma, most arterials have already been established and the designer is required to match existing permanent street alignments. In these scenarios, the designer should first determine the required sidewalk and amenity zone widths. Sidewalks will generally be 7-feet or 10-feet (not including the amenity zone) as determined by the applicable land use zoning and any applicable sub-area plan (see Section 4.4.7). When designing arterials, bike lane requirements should also be checked; these are contained in the City of Tacoma Transportation Master Plan.

Figure 4-1 – Typical Arterial Street



Placeholder Graphic using licensed content from "Streetmix" (https://streetmix.net/)

4.1.2. Local Streets (Non-Arterials)

Local streets provide direct access to abutting land uses and are designed to convey non-arterial traffic, including active transportation modes, to higher classification streets. A local street network usually does not accommodate through traffic and includes a series of short, interconnected streets and cul-de-sacs. Local streets are not intended to serve heavy truck traffic. Local streets are intended to have sidewalks to support active transportation modes. Typically, local streets allow for on-street parking and do not have lane striping. Private streets may resemble public local streets and information about their requirements are discussed in Section 4.6.

The typical local street is configured as shown Figure 4-2.

Figure 4-2 – Typical Local Street

Placeholder Graphic using licensed content from "Streetmix" (https://streetmix.net/)

4.1.3. Dead-End Streets

Dead-end public or private streets shall not be allowed without approval of the City Engineer or designee.

To promote connectivity, streets shall connect with nearby existing streets except in cases when topography, land ownership, or other factors make this infeasible for a properly designed street. In cases when it is not feasible to connect streets, but it is feasible to establish an active transportation connection, then an accessible pathway within public right-of-way shall be constructed.

In accordance with TMC 13.04.190, dead-end street or segment shall not be longer than 500 feet. Any dead-end street or street segment in excess of 150 feet in length (measured from the nearest flow line of the street perpendicular to the proposed dead-end street/street segment) shall terminate in either a turn-around or a cul-de-sac (see below). A cul-de-sac design shall be the default means for addressing the dead-end street, unless the City Engineer or their designee determines a future street extension could be possible. However, any dead-end street with four or fewer lots accessing the dead-end portion of the street may instead construct a hammerhead or branch turn-around subject to approval by the City Engineer or their designee. See Table 4.1 to determine which street end treatment is required.

Table 4.1- Required Dead-End Street Treatment

Street/Street Segment Length	**Less than 150 ft**			**150-500 ft**	
Lots	**1-2**	**3-4**	**5+**	**1-4**	**5+**
Treatment	Nothing Required	Turn-around or cul-de-sac	Cul-de-sac (Private streets shall meet public street design)	Turn-around or cul-de-sac	Cul-de-sac
Width	<pending coordination with Home in Tacoma requirements>				

4.1.3.1. Cul-de-sacs

Where a dead-end street is deemed necessary, cul-de-sacs shall be constructed for the street or accessway serving five or more residential lots. Cul-de-sacs are primarily constructed as permanent improvements in City right-of-way where the future extension of the street is not likely. When appropriate for the City street and multi-modal network, the typical cul-de-sac design will include a through connection for pedestrians and bicycles. Additional right-of-way dedication/acquisition may be required for cul-de-sac design aspects.

Cul-de-sacs shall be designed to meet or exceed 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 to accept stormwater runoff with an approved design. A standard curb or mountable curb may be used to define the inner island. Sidewalks shall be provided around the outer perimeter of the cul-de-sac.

4.1.3.2. Turn-arounds

Turn-arounds discussed herein shall meet all requirements, including the International Fire Code (IFC), unless otherwise authorized by the City Engineer or their designee. Where sufficient right-of-way can be provided, for public streets serving 3 to 4 lots, a standard hammerhead turn-around shall be used as shown in Figure 4-3. A minimum width of 70 feet is required for a hammerhead turn-around, which may require additional right-of-way dedication. For private accessways serving 3 to 4 lots either a hammerhead or branch turn-around shall be constructed as shown in Figure 4-3 or 4-4.

Figure 4-3: Example of Hammerhead Turn-around

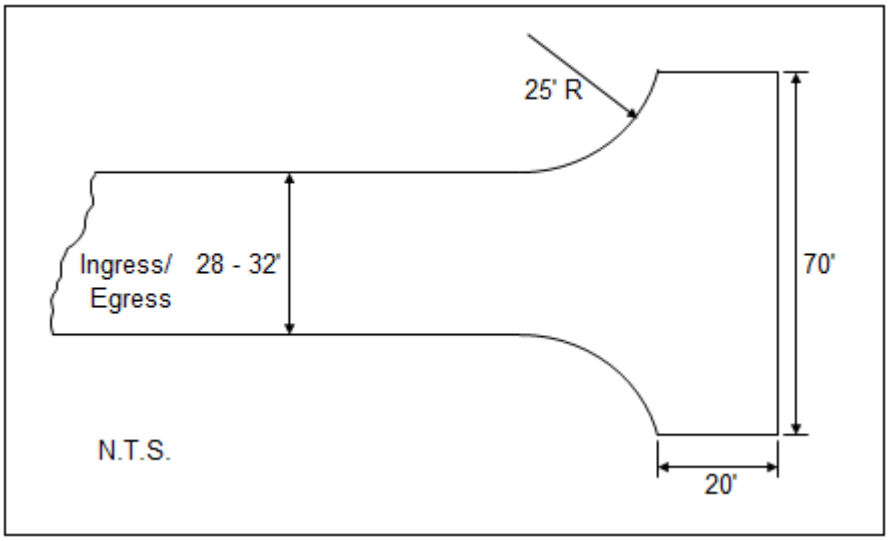
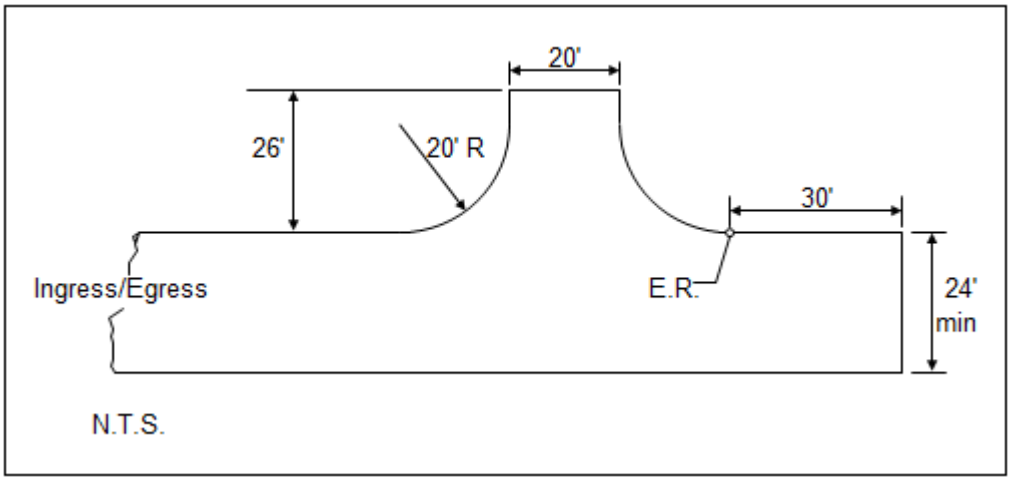


Figure 4-4: Example of Branch Turn-around



4.1.4. End of Street Provisions

End of street provisions—specifically dead-ends (with no turn-around) and the applicable leg(s) of a turn-around design—shall have reflective markings/markers conforming to the MUTCD and City Standard Plan SU-13 or SU-35 (the latter generally being used in locations with untraversable areas beyond the barricade and/or where pedestrian access beyond the barricade is undesired). 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 with reflective markings/markers may be utilized (see WSDOT/APWA Standard Plan C-8). Barricades or posts may not be required where a private driveway accesses the dead-end street through the end of the street or turn-around.

No parking signage shall be provided as directed by the City Engineer or designee for all end of street areas and treatments except cul-de-sacs.

SECTION 4.2 Basis for Geometric Design

4.2.1. Design Fundamentals

The overall parameters and objectives presented and discussed in the previous section need to be integrated with engineering and technical fundamentals to ensure the design of the right-of-way elements are safe, accessible, multimodal, constructable, and meeting their intended purpose. The geometric design of streets starts with three core topics as discussed in the subsections below. The determination of the design details pertaining to geometric design shall rely on referenced the City-specific policies, rules, codes, plans and other City design resources (such as the Transportation Master Plan) and, at a minimum, the following industry sources and the best practices they convey:

American Association of State Highway and Transportation Officials' (AASHTO) Guidance

- A Policy on Geometric Design of Highways and Streets ("AASHTO Policy")
  - The AASHTO Policy contains a multitude of design parameters for highways and local streets
  - Although the AASHTO Policy provides recommendations and guidance, its information is not considered standards, although City review of designs that deviated, without sound engineering reasoning, from its recommendations will be especially scrutinized
  - The latest edition of the AASHTO Policy can be purchased directly from the Association's website
- Roadside Design Guide
- Guidelines for Geometric Design of Low-Volume Roads
- Guide for the Development of Bicycle Facilities
- Guide for the Planning, Design, and Operation of Pedestrian Facilities
- Highway Safety Manual

NACTO Design Guidance (herein referred to as "NACTO")

National-level guidance (officially endorsed by the City of Tacoma, WSDOT, many other State DOTs, and many other cities across the nation) focused on the unique needs of urban areas and the multitude of street users with the objective to support street designs that are safer, more livable, and more economically vibrant.

- Various NACTO design guidance is available online from NACTO's website:
  - Urban Street Design Guide
  - Urban Bikeway Design Guide
  - Designing for All Ages & Abilities
  - Don't Give Up at the Intersection
  - Transit Street Design Guide

WSDOT Design Manuals (herein referred to as "WSDOT")

- WSDOT Local Agencies Guidelines (LAG) Manual
  - This document provides policies and standards for local agencies to follow when using Federal Highway Administration (FHWA) funds for transportation projects and/or when involving federally-classified roadways or roadways within the City of Tacoma that are part of the National Highway System
  - The Manual is available online from WSDOT's website
- WSDOT Design Manual
- WSDOT Active Transportation Programs Design Guide
- WSDOT Roadside Manual

All streets shall be designed to safely accommodate all modes and users, as supported by potential area-specific subarea plans/street design guidelines and the above resources (or similar). Multi-modal design features are integral to the design and relate to pedestrians, bicycles, transit, managed lanes, commercial traffic, and general vehicular traffic. All designs will have unique components, and some of those elements may not have a direct resource for addressing or may have conflicting guidance from available resources. In those cases, the designer is expected to rely on their engineering judgment and/or the most stringent guidance to support a certain design that prioritizes modal safety, and the City will expect to be part of that process and ultimately review (and be able to accept) documentation to explain any deviations from the typical design approach or deliverable.

Design calculations shall be provided as part of any submittal and deviations will require an approved exception/variance.

4.2.2. Design Vehicle

The determination of a design vehicle influences the ultimate design characteristics of a street. The design vehicles in the table below are intended as a guide. On planned bike routes (see the Transportation Master Plan); streets with documented safety issues; and pedestrian priority streets; smaller design vehicles may be appropriate.

According to WSDOT's Active Transportation Programs Design Guide, "The ***design*** vehicle is the largest typical vehicle or the vehicle that requires the most space to complete a maneuver that will commonly use the street." Additionally, "The ***accommodated*** vehicle is the largest vehicle or the vehicle that requires the most space to complete a maneuver that will rarely use the street. In addition to using all the first lane and part of the second lane of the receiving street, expect that this vehicle may use mountable elements and may enter the lane adjacent to its lane of origin.

Increasingly, in addition to the design and accommodated vehicles, design guidance is also considering how best to design intersections to manage the speeds of smaller vehicles and protect vulnerable road users. According to NACTO:
"The *Managed Vehicle* is the most common vehicle to use the street. It is typically smaller than the design vehicle which means it is capable of higher, more dangerous speeds. In most urban streets, the managed vehicle is a personal vehicle or taxi."

Table 4.2 – Design Vehicle by Street Classification

Street Classification	Design Vehicle(s)	Accommodated Vehicle(s)
Principal Arterial	WB-40 and BUS-40	WB-62
Minor Arterial	WB-40 and BUS-40	WB-62
Collector Arterial	SU-30 and Refuse truck	WB-40, S-Bus-36, Fire Apparatus
Non-classified Arterial	SU-30 and Refuse truck	WB-40,S-Bus-36, Fire Apparatus
Residential (Non-Arterial)	DL-23 and Refuse truck	SU-30, S-Bus-36*, Fire Apparatus
Alley/Court	Pickup Truck and DL-23	SU-30 and Refuse truck
Heavy Haul Industrial Corridor	WB-50	WB-67

* Check with School District to verify location is on a bus route.

The designer shall also investigate if special maneuverability requirements (or a larger design vehicle) are warranted for the specific project location as related to transit or school bus routes, primary emergency response routes, and roadways serving freight traffic or heavy truck operations. Where a larger design vehicle is selected, additional treatments to enhance pedestrian and bicyclist safety are likely to be required.

Turning Movements

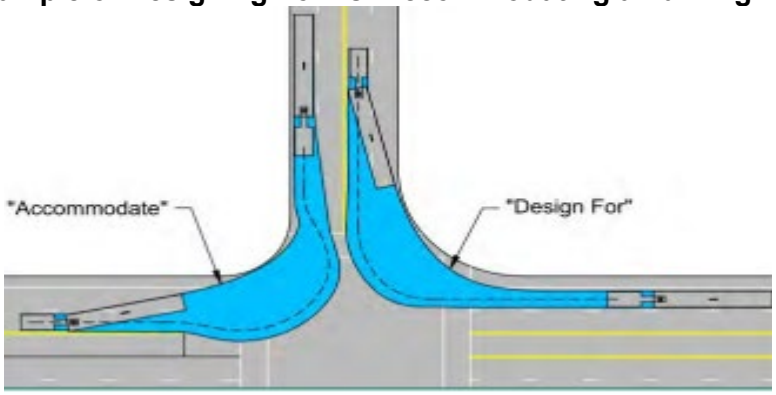
The vehicle to design or accommodate for will be further defined by turning movements and street types (e.g., arterial, non-arterial). There is a strong correlation between curb radii and roadway safety at intersections, particularly for pedestrians and bicyclists. To maximize safety, designers shall select the minimum feasible corner radii (and other associated design features) that align with the guidance discussed below (as taken from WSDOT's Active Transportation Programs Design Guide).

> "Consider that the geometry of the physical street corner may not represent the effective turning radius available to vehicular traffic. Parking lanes, shoulders, bike lanes, and other features that offset the travel lane from the physical curb line or painted edge lines along non-curbed roadways may allow effective turning radii that are much larger than the physical corner radii designed at a corner."
>
> "In addition to using all the first lane and part of the second lane of the receiving street, expect that this vehicle may use mountable elements and may enter the lane adjacent to its lane of origin."

A street design can also include certain intersection features such as strategic stop bar placement; mountable or visual elements that may be usable by larger vehicles while encouraging slower speeds by smaller vehicles; or other design features to manage the speeds of vehicles most commonly in use while designing for and accommodating less frequent vehicle types. Refer to figure 4-5 as an aid to differentiate between Design For and Accommodate.

For design vehicles, design for an intended turning speed of 5-10 mph. For accommodated vehicles, design for an intended turning speed of 1-5 mph.

Figure 4-5 – Example of Designing For vs. Accommodating a Turning Vehicle Type



- **Non-Arterial Turning Movement**
  When designing for a turning movement onto a residential (non-arterial) street, it may be acceptable for the design vehicle to use all the intended receiving portion of the street, but may also encroach into the opposite direction of travel on the receiving street. In this

instance additional signage may be required to operationalize the designers intent. Under no circumstance is it allowable for the design vehicle to encroach upon the sidewalk, curb ramps, or into legal on-street parking areas (unless otherwise signed). Additionally, for non-arterial intersections that include a traffic circle, the complete routing path of intended movements (or emergency vehicle use of unintended movements) shall accommodate the largest expected vehicle using the area (e.g., school bus or certain fire apparatus) which may exceed typical design vehicle expectations.

- **Arterial Turning Movement**
  When designing for a turning movement onto an arterial street, it may be acceptable for the design vehicle to use all the intended receiving lane of the street, including the second lane in the same direction of travel, if available, so long as the vehicle is able to properly return to its legal receiving lane. If there is no second lane, the design vehicle must turn into the single receiving lane without encroaching into the opposite direction of travel. Under no circumstance is it allowable for the design vehicle to encroach upon the sidewalk, curb ramps, or into legal on-street parking areas (unless otherwise signed). Arterial intersections that utilize roundabout control have particular design features to address the typically expected vehicle and to accommodate other larger vehicles that use the intersection on occasion.

  For an accommodated vehicle there are ways to allow for turning movements without excessively large curb radii, such as: encroaching into an adjacent unoccupied lane of travel in the same direction, if not in conflict may temporarily encroach into an opposing lane of travel, and the vehicle may use street elements designed to be mountable or traversable for occasional use.

4.2.3. Design Speeds

Speed of road users plays a role in the likelihood and severity of crashes. Since drivers can achieve higher, more discrepant speeds compared to other road users, speed control mechanisms should be used that influence driver behavior and lower operating speeds. The design speed is selected based on the type of street and location of that street within the urban context. 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 respect to the City's Transportation & Mobility Plan and other influential City policies and objectives. In general, or when no official determination has been established, design speeds can be initially estimated per Table 4.3.

Table 4.3 – Design Speeds by Street Classification

Street Classification	Anticipated Design Speeds
Principal Arterial	25-35 mph
Minor Arterial	25-30 mph
Collector Arterial	25-30 mph
Non-classified Arterial	25-30 mph
Residential (Non-Arterial)	20 mph
Alley/Court	10 mph

The design engineer shall contact the City's Transportation Division for assistance in determining or confirming the appropriate design speed when the project scope includes the design of any arterial. Any and all deviations from the expected design speed must be approved by the Transportation Division and be based on justification provided by the design engineer consistent with the Design Manual's Variance Request. Private roads/accesses are ultimately on private property and should be designed to be appropriate to the on-site conditions.

All streets shall be designed for consistent and safe traffic speeds and for the safety of all users and travel modes. The designated speed limit for Tacoma's residential (non-arterial) streets is 20 mph which corresponds to a 20 mph standard design speed. Alleys shall be designed using a standard 10 mph design speed. The existing speed limit for given arterials in Tacoma varies and is on the City's Vision Zero website (with the values based on TMC 11.05). New design speeds may impact existing posted speed limits, requiring code updates and related Council approval.

4.2.4. Sight Distance

A driver's ability to see ahead is needed for safe and efficient operation of a vehicle on a street. The designer shall design project features that allow for sight distances of sufficient lengths that drivers can control the operation of their vehicles to avoid striking an unexpected object in the traveled way (i.e., stopping sight distance) when traveling at the posted speed limit and to avoid adverse interactions with other roadway users when entering or exiting the traveled way (i.e., intersection or entering sight distance). Aspects of sight distance are: (1) the stopping sight distance needed for stopping along the travel way, which are applicable on all roads and streets; and (2) the intersection/entering sight distance needed for decisions at more complex locations, like intersections. The design of a street's alignment and profile to ensure adequate sight distances are available and to satisfy the applicable design criteria are described in the AASHTO Policy.

4.2.4.1. Stopping Sight Distance

Stopping sight distance (SSD) is a minimum design basis and is comprised of the sum of two distances: (1) the distance traversed by the vehicle from the instant the driver sights an object necessitating a stop to the instant the brakes are applied, and (2) the resulting distance for the vehicle to come to a stop, based on the vehicle characteristics and roadway conditions, from the instant the brake application begins. These are referred to as brake reaction distance and braking distance, respectively.

When designing for streets, the designer shall refer to AASHTO Policy for recommended SSD design values as the minimally acceptable design basis. Preferably, designs should also consider the need for potentially increased sight distances when related to intersection/entering vehicle situations (see next subsection).

When designing bike facilities and shared use paths - the stopping sight distance of both vehicles and bicyclists shall be considered in order to reduce conflicts and enhance safety. Designers should reference best practices - including NACTO and WSDOT - for guidance.

4.2.4.2. Intersection/Entering Sight Distance

Intersection sight distances shall meet or exceed the recommendations of the AASHTO Policy (Chapter 9.5). The design engineer shall evaluate the sight distance for each of the applicable intersection control cases and traffic movement combinations presented in the AASHTO Policy, including intersection (entering) sight distance and stopping sight distance (as described in the subsection above).

Uncontrolled Intersections

The "uncontrolled" intersection of two non-arterial streets (even those with traffic circles) means they have no yield signs, stop signs or traffic signals. The vehicle driver/bicyclist approaching an uncontrolled intersection must be able to see a potential conflicting road user at a point when they have sufficient time to brake as necessary (including conceivably stopping) before reaching the intersection/conflicting road user.

Controlled Intersections

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

4.2.5. Geometric Design Guidelines

In order of decreasing hierarchy, the designer shall comply with the following directives as they pertain to permanent and temporary improvements defined in 4.2.5.1:

- The geometric design of the improvements shall conform to this chapter and the design shall align with the alignment and elevation of any existing adjacent permanent improvements.

- The geometric design of the 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.

- The geometric design of the 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.

4.2.5.1. Permanent and Temporary Improvements

The City classifies a permanent street section as consisting of a standard local or arterial street section (as defined in section 4.4 under standard detail PD-01) with associated full width design, roadway alignment, and approved designed pavement section. ***Permanent improvements*** typically include the final full depth paved street alignment including concrete sidewalk(s), established amenity zones, and concrete curbs that define the permanent street section widths. Alternative designs for Green Stormwater Infrastructure (GSI) Improvements and Low Impact Development may be considered with the approval of the City Engineer.

Temporary improvements are those street improvements that may be constructed along a non-standard alignment, at a non-standard width, and contain features that will be replaced at a later date as part of a future project. Temporary Improvements shall better or maintain the existing conditions and shall be designed and constructed to facilitate future Permanent Improvements. Temporary Improvements shall be used for transitions from Permanent Improvements to an existing roadway or alley that does not have Permanent Improvements. Temporary street improvements typically utilize asphalt wedge curb instead of concrete curb and may or may not include sidewalk. 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 (CSTC). Temporary Improvements shall provide dust and erosion control measures, improve air and water quality, and safety enhancements. Temporary street improvements shall meet all requirements of, and provide mitigation per, the SWMM.

Both permanent and temporary improvements shall conform to the geometric guidelines outlined above in Section 4.2.5, as applicable. 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 or permanent improvements that changes the existing infrastructure. 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 of Tacoma's Right-of-Way Restoration Policy). Transitions from Permanent Improvements to the existing conditions may require a transition to the taper length requirements for pedestrians or roadways. These transitions/tapers shall be constructed as a Temporary Improvement.

4.2.5.2. Half Street Improvements

As required from Chapter 2, half street improvements shall include both permanent and temporary improvements, along a parcel frontage. Half street improvements shall include construction of the following permanent elements, but not limited to: paved street, sidewalks, curb/gutter, street landscaping, street lighting system, storm drainage, and conduit for City telecommunications. Permanent improvements on the subject parcel frontage shall be designed per the street type described in Section 4.1. Half street improvements require full improvement of the pavement section within the right-of-way adjacent to the frontage along with the improvements necessary to tie into the existing conditions. A typical street section for a 32-foot street width is shown in Figure 3-1 of Chapter 3. Also, see this Chapter 4 for additional street sections design requirements.

Half street improvements shall include temporary improvements to the street side opposite the subject parcel frontage, as follows: temporary curbing, shoulders, clear zones, guardrail, slope treatments, and drainage accommodations to assure proper drainage, bank stability, and traffic safety. The temporary pavement shall be extended to

ensure a minimum of 2 lanes of travel per Table 4-5. The width extension from the crown or centerline is typically 8 to 10 feet.

- Half-street improvements shall include removing and replacing, deficient pavement section, and existing driveway aprons that do not meet current ADA requirements consistent with subsection 4.6.6 - Driveways.

- Half-Street improvements shall include addressing sidewalk obstructions in the half-street area, including, but not limited to, replacing existing sidewalk areas that are an ADA obstruction.

- If a half-street terminates in a dead-end then an appropriate turn-around shall be constructed with consideration of the ability to extend the road in the future.

- Where half-streets are connected to existing streets, lane markings transition tapers are required in accordance with AASHTO where edges of pavement do not match, also refer to intersection Approach Configuration per subsection 4.5.2. Pavement transition tapers shall be constructed per subsection 4.3.6.

- All public utility improvements required for the project and service connections in the right-of-way shall be installed during the half-street construction. The half-street will be designed to provide drainage for the constructed portion of the street and to connect to the existing storm drain systems (where present), or be designed to allow for connection of the system to future planned storm drain systems.

- Temporary paved sections shall consist of a minimum 2 inches of asphalt and 2 inches of crushed surfacing top course unless the design requires a thicker street section as dictated by a traffic impact study and/or geotechnical analysis provided by the design engineer if required by the City Engineer.

- Right-of-way dedication may be required to provide the needed street and sidewalk width to support the project. Additional right-of-way dedication may be required as determined by the City Engineer.

SECTION 4.3 Street Geometry

4.3.1. Horizontal Curves

Calculations supporting the design of roadway curves shall be included in the plans.

The designer shall refer to the AASHTO Policy for determination of minimum acceptable horizontal curves. The vehicle speed shall be the design speed as discussed in Section 4.2 of this chapter.

Horizontal curves shall be designed to provide the minimum radii required for vehicles to safely negotiate a turn without leaving their driving lane and shall in no case violate minimum sight distance requirements.

Non-arterial streets shall be designed with a standard street cross-section where feasible (reference Section 4.4 of this chapter). Generally, the allowable maximum cross-slope for a horizontal curve is 5 percent. Where necessary and justified a 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 sub-section. No arterial streets shall be designed for speeds greater than 40 mph, unless it can be demonstrated that there is a unique circumstance necessitating a higher design speed and that the design is in accordance with preceding sections of this chapter and the recommendations from the AASHTO Policy.

4.3.2. Vertical Curves

Vertical curves are required where a change in vertical alignment equals or exceeds a 1% algebraic grade difference. Crest vertical curves shall be designed to provide the required minimum stopping sight distance for the streets design speed. Sag vertical curve lengths shall be designed to provide headlight sight distance equal to or greater than the design speed stopping sight distance. All vertical curves must be symmetrical, parabolic, and conform to AASHTO Policy (especially “Guidelines for Geometric Design of Low-Volume Roads” when applicable).

Grade breaks of more than 1% are allowed if there is not adequate space for a full-length vertical curve. Further information is found in the Street Grade Breaks sub-section farther below. Non-conforming design aspects must be approved by a variance through the City Engineer or their representative.

4.3.3. Vertical (Longitudinal) Grades

Maximum and minimum vertical grades are defined in this sub-section. Design of maximum allowable grades shall address the following (also see Table 4.4):

- Improvements to existing roads and streets, and new roads that are severely constrained by existing topography shall be designed to have the lowest feasible grades, and shall be reviewed on a case-by-case basis.
- Permeable pavements shall not exceed 6 percent. Subgrade for Permeable Pavements shall not exceed 3 percent without subsurface detention structures (i.e., terracing, per Section 4.7).

- Under special circumstances for grades over 15 percent the pavement surface shall be concrete.
- Replacement of existing asphalt streets in excess of 20 percent will not be permitted without redesign to a conforming grade unless otherwise approved by the City Engineer.
- Variances to the maximum allowable vertical street grades of all streets, alleys, and courts shall not be granted unless it can be demonstrated that the public benefits for the variance significantly outweigh any potential detriments. Variances shall be approved by the City Engineer or designee.

Design of minimum allowable grades shall address the following (also see Table 4.4):

- Permeable streets shall maintain a 0.5 percent minimum longitudinal grade. Gutters are strongly discouraged for permeable streets and will be considered only on a case-by-case basis. If gutters are approved, overflow infiltration galleries will be required to navigate gutter drainage into the reservoir course.
- Streets with alternative drainage systems such as bioretention or swales may not require a longitudinal grade, these will be reviewed and approved on a case-by-case basis by the City Engineer or designee.

Table 4.4 Maximum and Minimum Vertical Grade Requirements

	Principal & Minor Arterials	Collector & Non-classified Arterials	Local and Private Streets	Alleys & Courts
Maximum Vertical Grade	6% (Grades over 5% require variance from the City)	8% (Grades over 5% require variance from the City)	10% (may be increased up to 15% without a variance only when all other geometric design requirements are met)	10% (may be increased up to 15% without a variance only when all other geometric design requirements are met)
Minimum Vertical Grade	0.5%*	0.5%*	0.5%*	0.5%* or 1%

* Assumes Concrete Curb and Gutter

Variances for the street grades may trigger the additional following design considerations, as determined by the City Engineer or designee:

- Increased Travel Lane Widths
- Enhanced Paving Section
- Incorporation of Separated Shared-Use Path
- Incorporation of Medians/Access Control
- Enhanced Intersection/Signal Improvements

4.3.3.1. Crest Vertical Curves

The design engineer shall refer to the AASHTO Policy for recommendations related to the design of crest vertical curves. Designing for the greatest possible stopping sight distance should be considered (refer back to Section 4.2). If the recommended minimum design cannot be achieved per given conditions or scenario, such as tying temporary improvements into an existing street, then the designer shall inform and work with the City to determine an acceptable design. Regardless, the supporting design

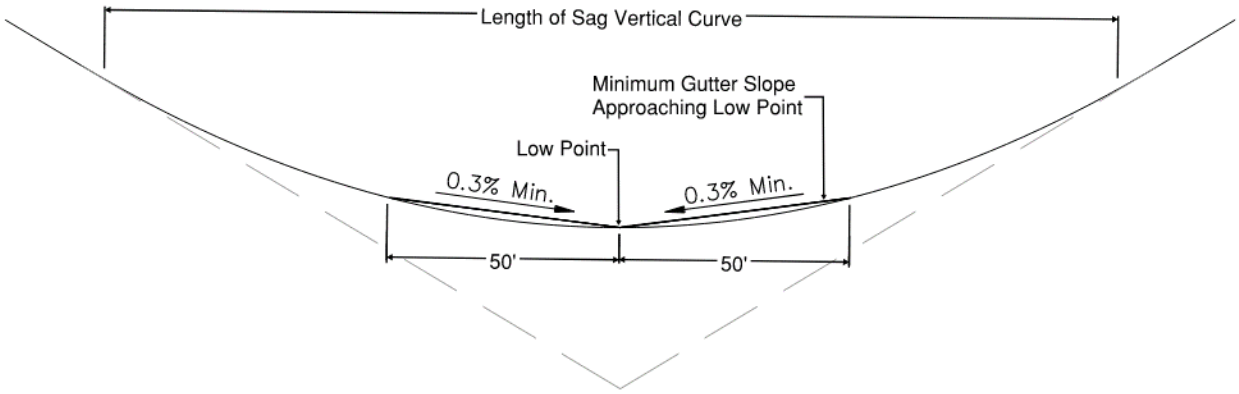
calculations/values (“K-value” at a minimum) shall be displayed on the drawings containing the relevant design.

4.3.3.2. Sag Vertical Curves

The design engineer shall refer to the AASHTO Policy for recommendations related to the design of sag vertical curves. Designing for the greatest possible stopping sight distance should be considered (refer back to Section 4.2). To provide adequate drainage in sag vertical curves, a minimum slope of 0.3% shall be maintained within 50 ft of the low point of the curve. The supporting design calculations/values (“K-value” at a minimum) shall be displayed on the drawings containing the relevant design.

Where cost or topographic conditions justify an alternate to the above recommendations, reduction in the length of a sag vertical curve may be considered. In order to be considered for City approval, the area must also have adequate fixed source lighting (street lighting) already in place or as a part of the project (see Chapter 5) and the design files provided in advance for review. 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. The City allows for a 1 percent maximum grade break in place of a vertical curve (crest or sag). Grade breaks are not allowed at the point of vertical curvature or the point of vertical tangency 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. See below Figure 4-6 for an example and Figure 4-7:

Figure 4-6 – Sag Vertical Curve Low Point Design

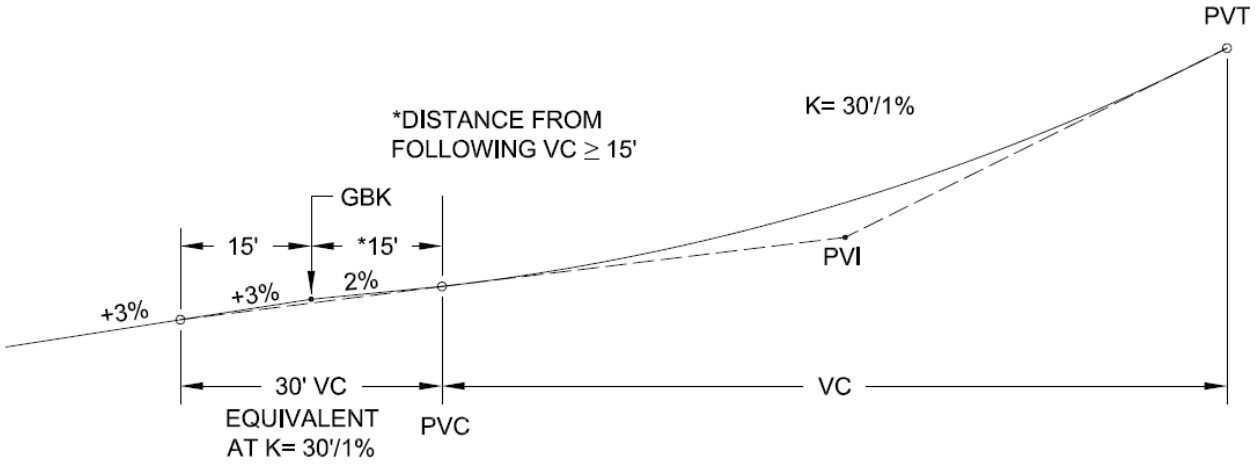


4.3.3.3. Street Grade Breaks

If designing a crest vertical curve with a 35 mph design speed the distance needed to make the grade or “K-value” is 29 based on the AASHTO Policy. For ease of calculation and supposing a better crest curve fits, use a K-value of 30. Then, for a 1 percent grade break the vertical curve equivalent would be 30 feet in length. Consider also that for a 30 foot vertical curve an equivalent 1 percent 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 percent crest grade breaks is 30 feet. Likewise, a 1 percent crest grade break could not be located within 15 feet of the beginning or end of a vertical curve.

Figure 4-7: Minimum Distance for Grade Break Design in Example Above



Key:
PVC = point of vertical curvature
PVT = point of vertical tangency
VC = vertical curve
GBK = grade break
K = distance to needed to meet grade

4.3.4. Cross Slopes

Street cross slopes shall be a minimum of 2% and no more than 5%. Under special circumstances, cross slopes can be reduced with approval from the City Engineer or designee. Streets constructed with permeable pavement may be reduced to 1%. Superelevation design shall be per AASHTO Policy. Information concerning cross slopes (and crowns) for intersecting streets is discussed in Sub-section 4.4.3.

4.3.5. Flowlines

Concrete gutter grades shall not be less than 0.5% for concrete gutters with an absolute minimum of 0.3% when approved by the City Engineer per FHWA and AASHTO Policy guidance.

Standard construction practice dictates that asphalt gutters cannot be placed at grades less than 1% and be expected to maintain positive drainage. Therefore, where asphalt gutters are constructed, a 1% minimum longitudinal grade shall be provided. Asphalt gutters at less than 1% may be allowed with justification at the approval of the City Engineer or designee.

4.3.6. Street Tapers

All tapers narrowing the street or shifting the travel way shall be in conformance with the Manual on Uniform Traffic Control Devices (MUTCD). The designer shall refer to the MUTCD, Part 3 Markings for guidance and provide the supporting calculations on the design drawings

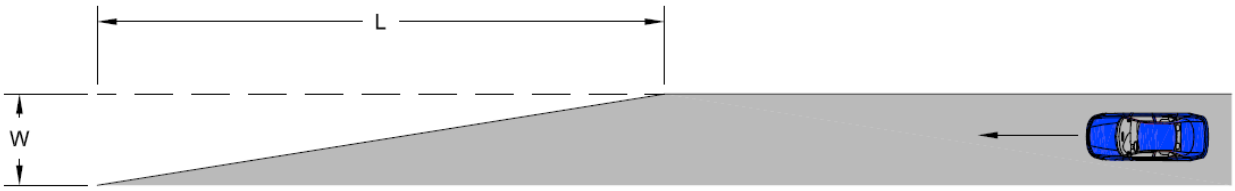
containing the taper. According to the MUTCD, the minimum allowable taper, for narrowing, shall conform to the following formula for the posted speed limit (see also Figure 4-8 which does not present other traffic control elements that may be required):

L (minimum) = $W(S^2)/60$ Less than 45 mph
L (minimum) = WS 45 mph or greater

Where:

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

Figure 4-8: Street Taper Length



Tapers that transition into wider street space (e.g., adding a through lane) can abide by a shorter taper rate of 10 feet of length for every 1 foot of width that is being widened, in extenuating circumstances, as approved by the City Engineer or designee.

SECTION 4.4 Street Cross-Section

4.4.1. Street Width

Selecting appropriate street cross-sections helps advance safety and multimodal access within the transportation network. To determine an appropriate street cross-section, design engineers shall follow the steps below:

1. Determine the required sidewalk and amenity zone widths. See Mobility Facilities 4.4.6 for more details.
2. Check for planned bike facilities, transit routes, freight routes, and emergency service routes in the City's Transportation and Mobility Plan (www.cityoftacoma.org/tmp).
3. Cross-reference design location with City plans for, or already existing facilities, related to Green Stormwater Infrastructure (GSI)/Low Impact Development designs (also see the City's Stormwater Management Manual).
4. Incorporating the above; develop a street cross-section layout using the following sub-sections' content as a guide.

4.4.2. Lane Types & Widths

Lane types are established by the intended intermodal usages. Lane widths are between the centers of striping, or striping pattern, or between striping and the face of curb/edge of street.

4.4.2.1. Arterial Streets

Vehicular Lanes

- Through lanes: 11 feet minimum; 12 feet max
  - 10-foot lane widths may be considered/permitted in some cases.
- Turn lanes: 10-foot minimum
  - Refer to Section 4.6 of this chapter for guidance on medians versus two-way left-turn lanes, parking, and bike lanes
- Lane widths are also used in establishing the restoration limits when determining the wheel paths for a typical lane. A wheel path constitutes half of a vehicle lane or all of a bike lane.

On-Street Parking (also see sub-section 4.4.3 below)

- Parallel Parking: 7 to 8 feet (for typical vehicle use, up to 8.5 feet for larger width (freight) vehicles)
  - Parallel parking lane/spaces are typically unmarked—also see more detailed information, separately/below, about regulated use of parking lanes
  - Angle Parking: 16 feet (measured perpendicular to curb/edge of roadway)
    - Angle parking (with markings), which requires at least 16 feet, may also be considered/permitted in some cases.
    - Additional sidewalk/amenity zone space must be confirmed available, or provided, to account for vehicle overhang. When angle parking is being

considered, back-in angle parking shall be considered first unless there are site conditions that require front-in angle parking.

Bike Facilities

- Bike Lanes: 6 to 7 feet (5 feet may be allowed in limited circumstances with prior approval of the City Engineer or designee)
  - Buffer/Separation:
    - If parking separates bike lanes and through lanes:
      - 3 feet minimum between parking and bike lane if striped buffer with vertical delineators
      - 4 feet minimum if raised concrete curbing
    - If bike lane and vehicular lane are adjacent:
      - Buffered bike lanes: 2 foot minimum. Whenever bike lanes are included on a corridor, buffers should be added as space allows presuming appropriate widths have been provided for other roadway features.
      - Separated bike lanes: The required width and type of separation will depend on the street characteristics. The minimum level of separation is a 1-foot low-profile curbing with vertical delineators while higher speed/volume streets will require more robust separation.

4.4.2.2. Non-Arterial Streets

The City standard minimum non-arterial/residential street width for permanent improvements as part of new construction is 28 feet which typically can accommodate parking on both sides. On residential streets, nondelineated on-street parking is permitted to extend into the travel lane on either side to effectively narrow the traveled way to less than a full lane of travel in each direction.

The City Engineer or designee may consider different widths based on site-specific considerations, the specific street design, Green Stormwater Infrastructure (GSI)/Low Impact Development designs, and/or existing improvements that may dictate the alignment of the curb. The design engineer shall consider the existing improvements, including trees and landscaping, public art, historic features, and other pertinent features in the area which may influence the design of the street section accordingly (see Sub-section 4.4.8).

Many residential streets are existing or planned neighborhood greenways, also known as bike boulevards. These are priority routes for people walking, biking and rolling and are required to include additional traffic calming; volume management strategies such as, but not limited to, traffic diverters; pedestrian safety and accessibility enhancements; bicycle sharrows and wayfinding; and arterial crossing improvements.

4.4.2.3. On-Street Parking and Passenger/Other Load Zones

On-street parking and load zones may be required by the City and are a couple of many potential uses within the overall right-of-way. The space between a lane of travel and the existing or proposed curb/edge of street is often referred to as the parking lane. The needs and benefits from a parking lane and potential restrictions of its use shall be

considered with respect to other potential uses for the right-of-way space to encourage active transportation, space activation, and general livability enhancements.

On-Street Parking

When needed for public benefit and the street space can accommodate, parking lanes should have a minimum width of 7 feet (and generally no more than 8 feet for typical vehicle types) for parallel parking. Resulting parking spaces should be 20 feet in length, generally unmarked, but individual space lengths may vary depending on overall parking lane length and other constraints on permitted parking. Parking spaces angled at 60 degrees (from the curb face), which require space delineation, should be a minimum of 9 feet in width (as measured perpendicularly between parking space stripes) and 16 feet in depth (as measured perpendicularly from the face of curb). Additional sidewalk/amenity zone space must be confirmed available, or provided, to account for vehicle overhang (~3 feet). Modifications to existing angled parking or the consideration of introducing new angled parking must evaluate the feasibility and benefits of converting/providing back-in angle parking spaces as opposed to head-in angle parking spacing.

When new or altered on-street parking is provided that is designated by signs, pavement markings or meters, an allocation of ADA parking spaces will be required in accordance with the Public Right-of-Way Accessibility Guidelines (PROWAG). The number of required ADA parking spaces is specified in PROWAG and is based on the total number parking spaces on a block perimeter (public ADA parking spaces cannot be counted towards the number of required accessible on-site requirements). The City may require additional ADA parking spaces in order to adequately serve businesses, housing complexes, and public transportation. The City may also require more of the ADA parking spaces on a block perimeter to be placed on the streets with the flatter grades to ensure ADA parking is accessible and usable by people with mobility issues. Refer to Standard Plans SU-36A through SU-36E.

To promote defined legal parking extents, curb extensions/bulbouts and/or some form of delineating no parking areas (per state law), known as “daylighting,” shall be considered to mitigate the potential negative impacts from illegal parking close to intersections, crosswalks, and driveways (see Section 4.5 for more information about curb extensions/bulbouts).

Passenger Loading Zones

Passenger loading zones provide dedicated and accessible spaces for passenger pick-up and drop-off. A regulatory sign restricting the use of the space must be included along with pavement markings detailed in City Standard Plans. Passenger loading zones are restricted to a 3-minute duration as imposed by Tacoma Municipal Code to maximize the turnover and availability of the space. Passenger loading zones must include adjacent access aisle at the same level as the vehicle space wherever it is technically feasible. Sidewalks shall be at the same level as the loading space/access aisle or provide a ramped access to the sidewalk elevation. Passenger loading zones must comply with PROWAG and with City of Tacoma Standards (SU-36A through SU-36E). Passenger load zones may be required to ensure equal access to housing, public transportation, and businesses.

Other Loading Zones

There are two other loading zones (non-restricted use type and those only intended for trucks) defined in Tacoma Municipal Code which provide a time-limited space for loading

and unloading activities. A regulatory sign specific to the type of load zone must be included to restrict the use of the space. A yellow painted curb should also be considered to increase the visibility of the zone and to help define its length as detailed in City Standard Plans. These types of loading zones are restricted to 30-minute time durations per Tacoma Municipal Code for times of day (as specified on the sign) when the spaces are most needed for loading uses. These shorter time limits help to promote greater turnover and availability than time-regulated or unrestricted on-street parking. Loading zones should be considered in areas where high parking utilization or constrained parking supply during a portion of the day could impact the normal operation of adjacent land-uses. The length of these loading zones shall be greater than a typical parking space (i.e., 25-30 feet for parallel parking area and with City approval for angle parking areas) to accommodate a range of delivery vehicles or uses. These loading zones are not required to be ADA accessible, but in some cases the provision of a ramp to the sidewalk should be considered to assist with loading and unloading activities.

4.4.3. Cross Section Details

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

Non-arterial streets and arterial streets with a design speed of 40 mph or less shall be designed with a standard street cross section where feasible. Typically, the allowable maximum cross-slope is 5 percent. Superelevation design shall be per AASHTO Policy.

The City standard street cross section consists of a typical crown portion 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 4-6 provides guidance for which cross section is most appropriate based on typical street widths and the difference in the gutter elevations.

Table 4-6: Type of Cross Section

Typical Street Width	Difference in Gutter Elevations	Type of Cross Section
32* 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 less than 32 feet, and cross slopes should be designed from 2 to 3 percent where feasible.

Table 4-7 provides guidance for the design of a typical crown cross section. The centerline elevation is determined by averaging the gutter elevations and adding the centerline adjustment. The quarter point elevation is determined by subtracting the quarter point adjustment from the previously determined centerline elevation.

Table 4-7: 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. Cross sections shall be provided for transitions in road widths or warp changes in addition to the profile.

These requirements are illustrated in Figure 4-9 and Figure 4-10.

Figure 4-9: Crown and Cross Slope Conditions for Street Widths of 32 to 44 Feet

THE STANDARD HEIGHT OF PAVEMENT CROWNS FOR VARIOUS STREET WIDTHS, VARIOUS WARPS (DIFFERENCES IN ELEVATIONS OF OPPOSITE GUTTERS) AND MAXIMUM WARPS SHALL BE AS FOLLOWS:

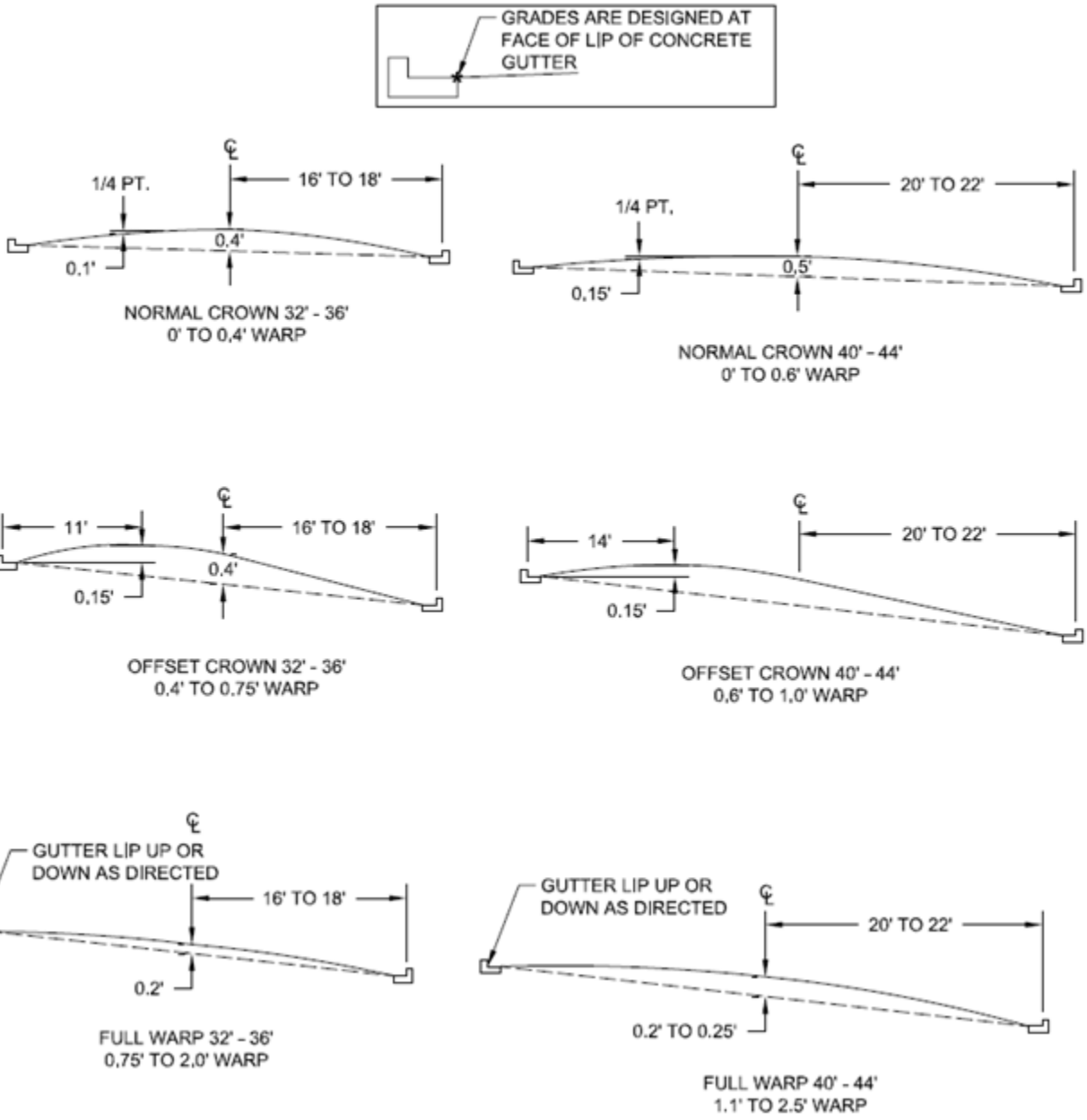
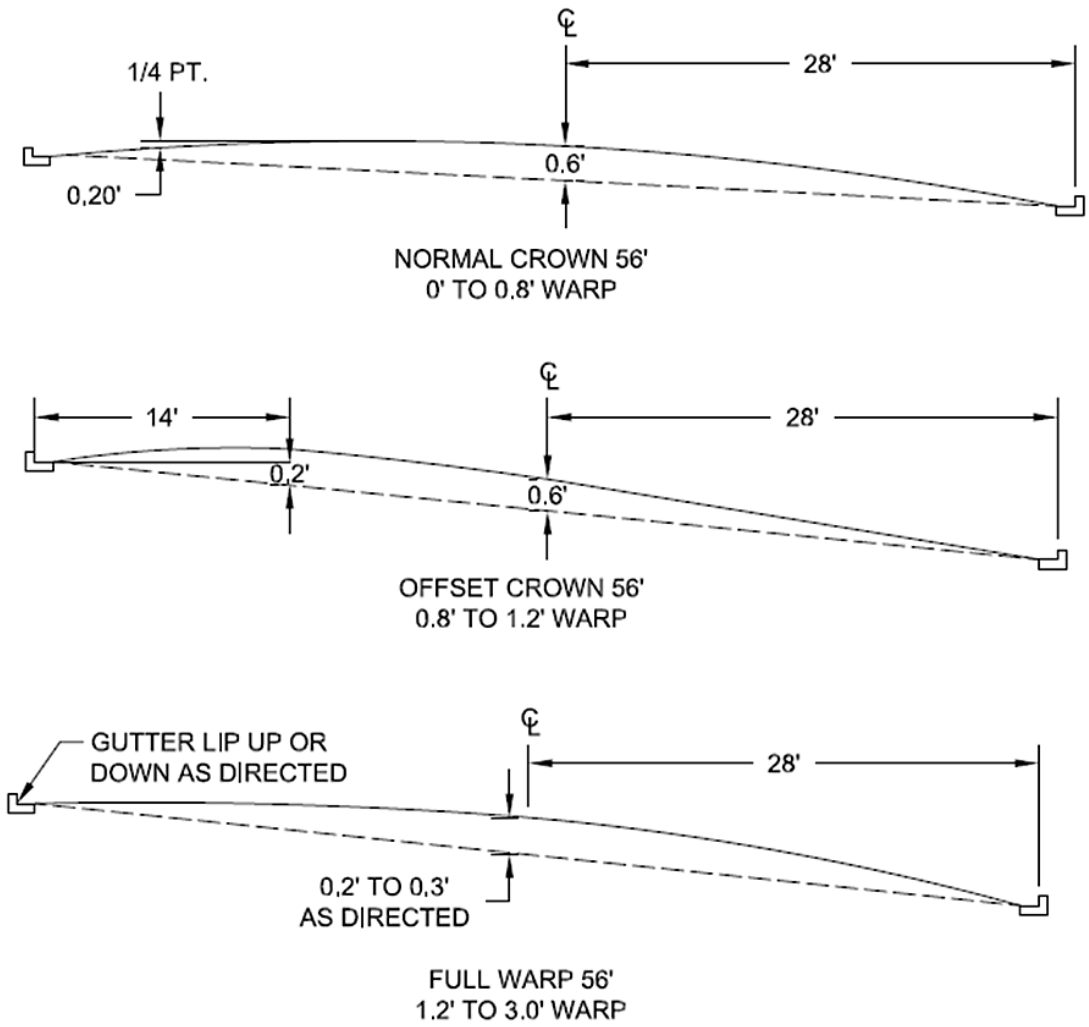


Figure 4-10: Crown and Cross Slope Conditions for Street Widths of 56 Feet



VARIATIONS FROM THE ABOVE ARE TO BE APPROVED BY THE CITY ENGINEER. WHEN WARPS EXCEED THE MAXIMUM LISTED, THEY ARE TO BE LIMITED TO TRANSITIONS FROM THE STANDARD SECTIONS TO A STEEP SLOPE OF AN INTERSECTING STREET.

THE PARABOLIC CROWN WILL OFFSET THE HIGH POINT FROM THE CENTERLINE OF THE STREET ON CERTAIN WARPED STREETS. IT SHALL BE REQUIRED THAT THIS POINT BE STAKED IN THE FIELD TO INSURE SUFFICIENT TRANSVERSAL DRAINAGE. THIS HIGH POINT SHALL BE A MINIMUM OF 1 PERCENT TRANSVERSE GRADE ABOVE THE GUTTER OR CONCRETE GUTTER LIP AND THE LOCATIONS (OFFSET FROM CENTERLINE) SHOULD BE ADJUSTED TO FIT THE SPREAD WIDTH OF THE ASPHALT MACHINES USED OR CONCRETE SCREED LINE.

ALL WARPS (TRANSVERSE GRADE ALL IN ONE DIRECTION) SHALL HAVE REDUCED CROWN, AS INDICATED ABOVE, SO AS TO MAINTAIN A MINIMUM OF THE 1 PERCENT TRANSVERSE GRADE ACROSS THE HIGHER AND FLATTER PORTION OF THE PAVEMENT. MAXIMUM WARPS SHALL BE AVOIDED WHENEVER POSSIBLE.

4.4.4. Curbs

Concrete curbs, including those with and without gutter pans serve any or all of the following purposes: drainage control, street edge delineation, aesthetics, delineation of pedestrian walkways, reduction of maintenance operations, and assistance in orderly roadside development.

4.4.4.1. Concrete Curb and Gutter

Cement concrete curb and gutter is the City standard curb. It shall be constructed per City Standard Plan SU-03, unless otherwise approved by the City Engineer or designee.

A 6-inch reveal is required for curbs per SU-03, unless part of transitioning slopes such as pedestrian curbs and curb ramps. Existing curbs greater/less than 6-inches in height will be considered damaged and defective and must be removed and replaced with curb and gutter as part of any new development or reconstruction, unless a variance is approved by the City Engineer or designee. This removal may require additional street grading to maintain an acceptable street cross section, including future compliant sidewalk and a consistent gutter line that does not trap water.

Construction of the concrete curb and gutter in an existing street shall require a minimum of 4 feet from face of curb to ensure adequate vibratory compaction (i.e., no plate wacker) of the base and asphalt without bridging. Additional distance may be required to ensure the joint is not within a wheel path.

Other concrete curb types shown in the City Standard Plan SU-03 series may be used in specific instances and may 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, meaning the gutter does not convey water. Lip-down gutters may also be required in the design of intersections, on-street parking stalls, bus turnouts, etc. The use of lip-down gutters shall be approved by the City Engineer.

Alternative curb or gutter-less street edging may be appropriate for Green Stormwater Infrastructure (GSI) designs and shall be approved by the City Engineer or designee. Permeable streets shall be designed with cement concrete traffic curb. See Section **4.7** of this chapter for more information.

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 (253) 591-5220. The City shall retain possession of such materials if they are salvaged/removed.

All curb and gutter shall direct stormwater flow into the stormwater system which might include a catch basin, curb cut, or other facility (see Section 4.3 for allowable grades). Additional catch basins, extension of the curb and gutter, and/or wedge curb may be required to ensure stormwater is conveyed appropriately. Combination inlets per WSDOT Standard Plan B-25.20 shall be installed when feasible; when replacing catch basins or catch basin frame and grates; or installing new catch basins.

Cement concrete curb and gutter flowline grades shall not be less than 0.5 percent with an absolute minimum of 0.3 percent when approved by the City Engineer. Unless otherwise approved by the City Engineer, curbs with no gutter pan shall be designed to a minimum of 1.0 percent except for permeable pavements which can be reduced to 0.5 percent.

4.4.4.2. Hot Mix Asphalt (HMA) Wedge Curb

For temporary streets or when approved by the City Engineer, new asphalt pavement shall include an asphalt wedge curb. Modified edge protection may also be required by design.

An asphalt wedge curb consists of a 3-inch high by 12-inch wide edge of the asphalt pavement section per City Standard Plan SU-03A. 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 high by 18-inch wide asphalt wedge curb shall be used per City Standard Plan SU-03A.

Construction of the asphalt wedge curb in an existing street shall require 3 feet from flowline of curb to ensure adequate vibratory compaction of the base and asphalt without bridging. Additional distance may be required to ensure the joint is not within a wheel path.

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 wedge curb shall direct stormwater flow into the stormwater system which might include a catch basin, curb cut, or other facility. Additional catch basins or extension of the wedge curb may be required beyond the identified project and/or frontage improvements to ensure stormwater is conveyed appropriately.

4.4.5. Clear Zone – Lateral Separation

When street edge treatments or barriers are not used to delineate the street edgeways, a clear zone is needed as defined in WSDOT and AASHTO Design Guidelines. Generally, the clear zone between the travel lane and fixed objects should be a minimum of 10 feet for 35 MPH or lower speed streets. However, a clear zone is allowed to be reduced to 2-feet from the face of a vertical curb. The engineer shall refer to the design guidelines for specific situations.

4.4.6. Mobility Facilities

Pedestrian safety, accessibility, and mobility is vital to Tacoma's multimodal transportation system. Pedestrians are the City's top priority as presented in the Transportation Master Plan's Green Transportation Hierarchy Principles. Designers must be aware of the various needs and abilities of pedestrians to ensure facilities provide universal access. All pedestrian facilities, as outlined in this section, shall be in compliance with all federal, state and local requirements, the design guidelines outlined in this chapter and Chapter 8.

As part of the City of Tacoma Comprehensive Plan, the City has subareas in which right-of-way elements have additional design considerations. Subarea Plans supplement Tacoma policies to focus on specific needs relevant to the Subarea.

These design principles are typically related to pedestrian-supportive infrastructure including sidewalks, curb ramps, accessible pedestrian signals and shared use paths, but can also influence overall street design elements.

The most up to date information for these Subarea Plans is available at www.cityoftacoma.org. A brief summary of the various subarea plans at the time of publication are included below.

- South Downtown Subarea Plan – The southern half of the downtown core, bordered by the downtown commercial core to the north, Martin Luther King Jr district to the west, industrial lands to the east and residential neighborhoods to the south.

- North Downtown Subarea Plan – Includes downtown commercial core and extends north to include Wright Park, the St. Helens neighborhood and the Stadium District.

- Tacoma Mall Subarea Plan – Bordered on the eastern side by Interstate 5, and a large cemetery and steep hill to the south, natural bluff areas to the north and west.

- Hilltop Subarea Plan – Located along the western edge of downtown Tacoma, centered on Martin Luther King (MLK) Jr Way and spans from Division Avenue to South 27th Street. This Subarea is a gateway into downtown and the Brewery District from neighborhoods to the west.

4.4.6.1. Sidewalk, Amenity and Recovery Zones

Sidewalks provide pedestrian accessible routes (PAR), and shall be concrete, or an approved equal, and free of obstructions. All new amenities such as utilities, benches, fencing, and sidewalk cafes shall be placed outside of the PAR so as not to interfere with the access and safety of pedestrians who are walking or rolling. Refer to Standard Plans SU-04 and SU-06 for additional details.

Amenity zones shall typically be placed in the space between the back of curb and the sidewalk and provide a buffer between people walking/rolling and vehicles. These zones may be hardscaped or vegetated areas with space for trees and concrete pads for bicycle parking, bus stops, and utilities. See Chapter 4 Section 4.9 for additional design requirements.

The recovery zone is typically defined as the space between the back of sidewalk (i.e., the edge farthest from the curb/roadway) and private property, or the space adjacent to shared-use paths. See Chapter 8 for additional design requirements. The recovery zone adjacent to sidewalks shall be a minimum of 2 feet in width unless it is technically infeasible. For example, in Downtown and Mixed-Use Centers, the recovery zone may need to be reduced or eliminated to meet the minimum widths for sidewalk and amenity zones as shown in Table 4.8, 4.9, & 4.10 below. Where the recovery zone is eliminated, an expansion joint shall be provided for demarcation at the property line.

4.4.6.2. Sidewalk and Amenity Zone Widths

Required sidewalk and amenity zone widths vary based on the land use, street classification and relevant site details such as whether the area is located in a mixed-use center, if bus stops are being upgraded, and if additional space is needed in the amenity zone for utilities.

Sidewalk: Sidewalks shall be paved and free of obstructions. See SU-04 and SU-06 for additional details. Sidewalk and amenity zone width requirements (see below) shall be met when new sections of sidewalk are constructed. The widths below (see Tables 4.8, 4.9, 4.10) are minimums, when additional space is available – designers should look for opportunities to enhance the pedestrian experience through wider sidewalks and/or amenity zones. Guidance on which to prioritize first is provided in the tables below. Where sidewalks are greater than 7 feet in width, directional curb ramps may be limited to 7 feet wide. When elements of the pedestrian access route like curb ramps and driveways are constructed, they shall meet sidewalk width requirements for new sidewalk in the area and taper back to existing.

Sidewalk and Amenity Zone Tapers: New sidewalk and amenity zone widths must extend to the projection of the property line and then taper back to existing widths. The sidewalk taper rate shall be 5:1 or 5 feet of length for every 1 foot of horizontal deflection. The City Engineer may approve exceptions to this taper rate based on unique site constraints.

Pedestrian Accessible Route: The pedestrian accessible route (PAR) must be kept safe and accessible for all users. Painted concrete and bricks or stamps that may cause vibrations for people using mobility devices are not allowed in the PAR.

Schools: Sidewalks along school frontages must be a minimum of 7 feet – and wider where the standards below apply.

Bus Stops: Additional sidewalk width is required at bus stop and other passenger loading areas. See standard details SU-38 and SU-39. The designer shall coordinate with Pierce Transit (and/or Sound Transit as applicable) on the location and design of bus stops.

Angled Parking: Where angled parking is present, there must be a minimum of 3 feet amenity zone or the sidewalk must be widened at least an additional 3 feet beyond the minimum standards below to accommodate vehicle overhang.

Special Circumstances: The Transportation Master Plan and Subarea Plans may identify corridor plans that are over and above the minimum requirements below. For example – some corridors include a planned shared use path. These documents must be consulted prior to design to ensure consistency with the plan.

Special features: Special consideration and specifications shall be determined for replacement of sidewalk. For example preservation of historic makers marks and special colored concrete for sidewalks and curb ramps is required in some historic districts (See SU-40 and District Specific Standard Plans. For specific design information regarding sidewalks, curb ramps and crosswalks, see Chapter 8.

Variances: Alternate sections may be proposed to avoid impacts to mature trees, utilities or other unique circumstances. In some cases, there is not sufficient right-of-way

to accommodate the sidewalk, amenity zone, and recovery zone width. Safety and accessibility for pedestrians shall be the top priority in constrained environments. Hardscaping the amenity zone is one strategy to maximize the space available for pedestrian travel. In those cases, tree wells can be provided to meet street tree requirements, Variances require approval of the City Engineer per Chapter 1 section 1.2.

4.4.7. Requirements for New Sidewalk Construction or Alterations

When new construction or alterations require development improvements, including sidewalks, or new sidewalk is being built, the following must be provided:

- Where no sidewalk currently exists: the new sidewalk must meet current standards.

- Where sidewalk currently exists that is not damaged or defective: the entire sidewalk length shall meet current sidewalk width requirements unless the total sidewalk length along the frontage is less than 50’ in length, in which case the replaced sidewalk shall, at a minimum, match the widest adjacent existing width.

- The abutting property owner has an obligation to maintain and repair damaged and defective sidewalk, per chapter 2 and TMC 8.30, 8.31, 9.20, 12.09. Permit actions requiring off-site improvements under TMC2.22.040 shall require the project designer to address any damaged or defective sidewalk as part of the project.

Downtown

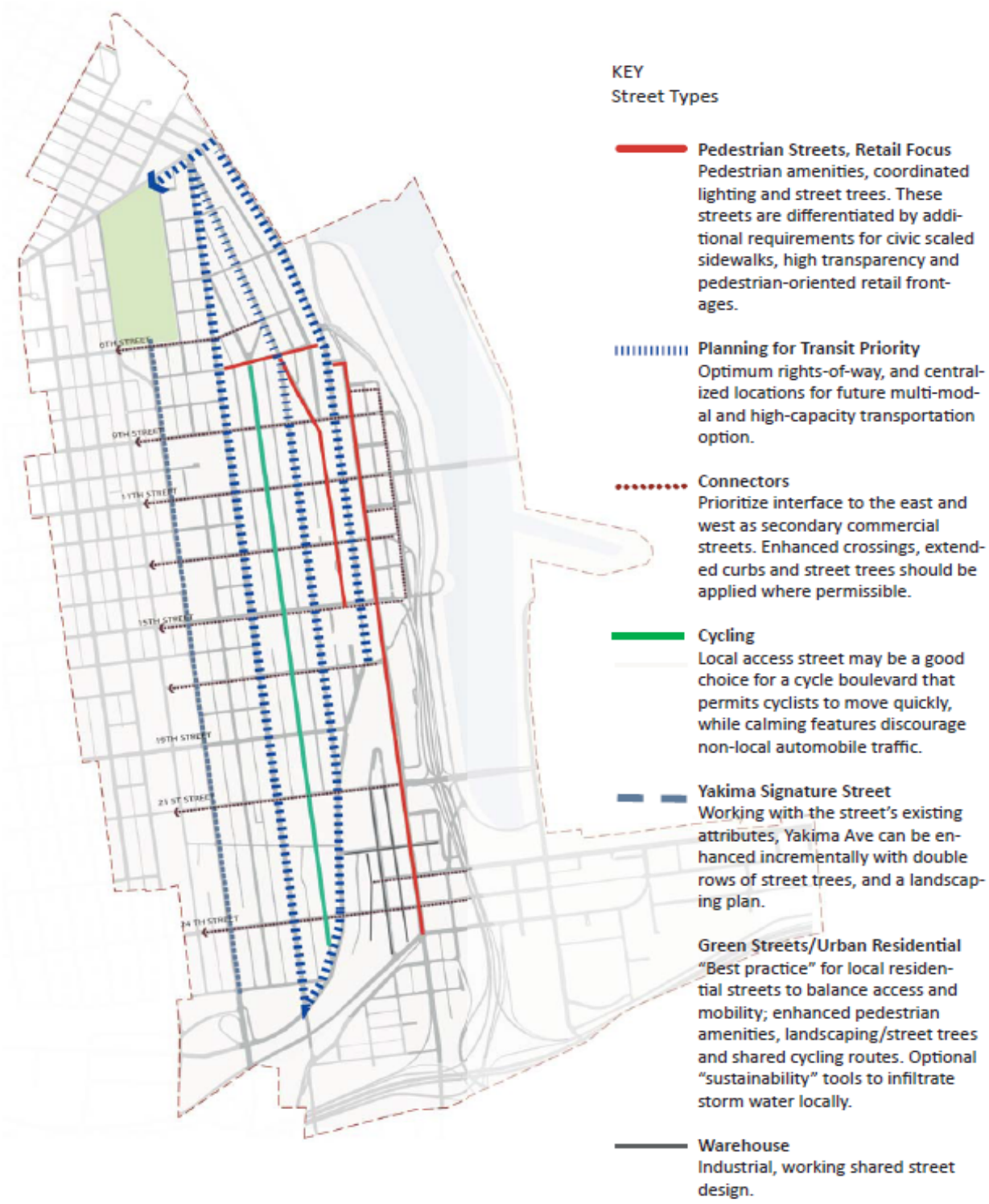
On streets within downtown Tacoma, specific sidewalk and amenity zone widths are called out by street in the Downtown Element of the Comprehensive Plan (see Figure 4-11 and Table 4.8). In all circumstances, a minimum 7 feet of sidewalk width shall be provided for unobstructed pedestrian passage.

Table 4.8 - Within Downtown Tacoma

Street Type[1]	Min. Sidewalk Width (ft)	Min. Amenity Zone (ft)	If extra ROW – add space to:	Typical Amenity Zone Design (may vary based on site usage)
Pedestrian, retail streets	10	5	Sidewalk	Hardscape – with trees
Transit priority	10	5	Sidewalk	Hardscape – with trees
Connector	7	4	Amenity Zone	Hardscape – with trees
Fawcett Ave Bike Boulevard	10	8	Sidewalk	Planting Strip – with concrete bike parking & bus stops
Urban residential	7	5	Amenity Zone	Planting Strip – with concrete bike parking & bus stops
Green streets	7	13	Amenity Zone	See Comp Plan Downtown Element 4.4 (DT-76) for GSI elements on green streets
Yakima Avenue	7	8	Amenity Zone	Planting Strip – with concrete bike parking & bus stops
Warehouse District	7	4	Sidewalk	Hardscape – with trees, Accommodating angled parking is a priority
Courts with sidewalks	5[3]	0	Sidewalk	Typically no amenity zone, Hardscape with plantings where present.
Dome District Pedestrian Streets[2]	10	6	Sidewalk	Hardscape with trees
Hilltop Neighborhood Pedestrian Streets[2]	10	6	Sidewalk	Consider land use and adjacent conditions
Stadium District Pedestrian Streets[2]	10	6	Sidewalk	Consider land use and adjacent conditions

1. See the map in Figure 4-11 for the street type
2. For pedestrian streets, in the Dome, Stadium, Hilltop Neighborhood Districts see TMC 13.06.010.D.4.
3. Some Downtown courts may not have sufficient right-of-way for sidewalks and function more like a typical alley with narrower right-of-way. Courts with on-street parking and/or 40' right-of-way widths should include sidewalk on at least one side, with a preference for the side with established parking or the downhill side.

Figure 4-11 : Downtown Area (pending new drawing)



Mixed-Use Center (Outside of Downtown)

For high pedestrian activity areas, wider sidewalk and amenity zones shall be provided in accordance with Table 4.9.

Table 4.9 - Within Mixed-Use Centers (Outside of Downtown)

Street Type	Minimum Sidewalk Width (ft)	Minimum Amenity Zone (ft)	If extra ROW – add space to:	Typical Amenity Zone Design (may vary based on site usage)
Designated Pedestrian Streets[1]	10	6	Amenity zone	Planting Strip – with concrete bike parking & bus stops
All other streets	7	5	Amenity zone	Planting Strip – with concrete bike parking & bus stops

[1] On streets designated as pedestrian streets or primary pedestrian streets in TMC 13.06 and 13.06A respectively.

Note: The Tacoma Mall Sub-Area Plan contains typical cross sections for many of the designated pedestrian streets. These should be treated as guidance for the ultimate vision of the street use. Where the sidewalk width in these sections conflict with the table above, the widths in the table shall take precedence.

Outside of Mixed-Use Centers and Downtown

For streets outside of mixed-use centers and downtown, the following widths shall be provided in accordance with Table 4.10.

Table 4.10 - Outside of Mixed-Use Centers and Downtown

Street Type	Minimum Sidewalk Width (ft)	Minimum Amenity Zone (ft)	If extra ROW – add space to:	Typical Amenity Zone Design (may vary based on site usage)
Arterials	7	5	Amenity zone	Planting Strip – with concrete bike parking & bus stops
Residential Streets[1]	5	5	Amenity zone	Planting Strip – with concrete bike parking & bus stops

[1] Sidewalks along school frontages on school walk routes shall be a minimum of 7 feet, even if on a residential street.

4.4.7.1. Recovery Zone to Private Property with Cut and Fill

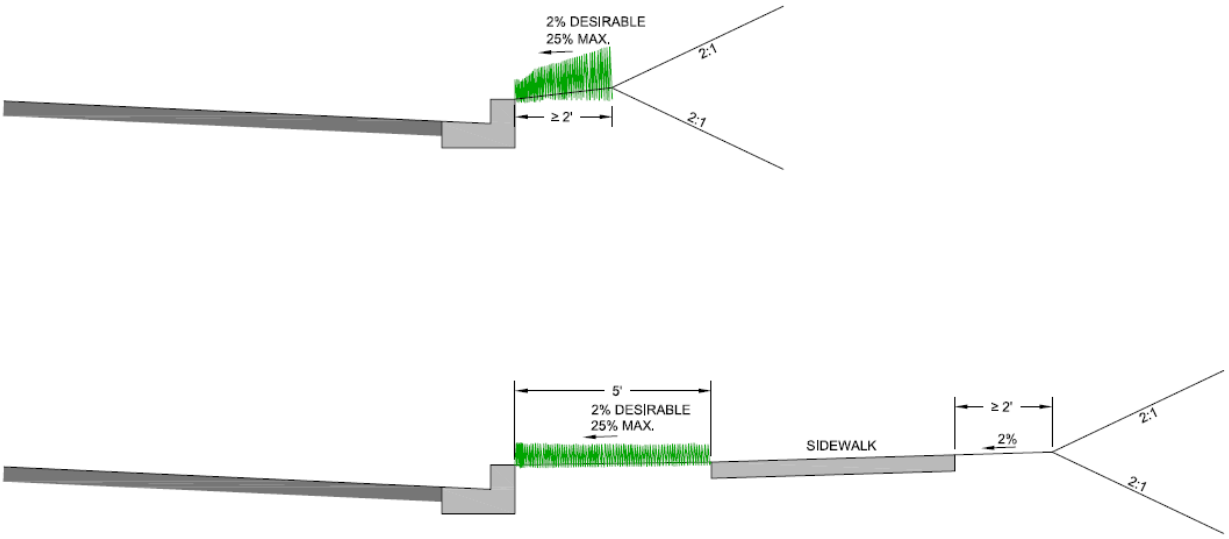
Cut and fill slopes shall be no steeper than 50% unless otherwise approved. When varying from this standard, geotechnical information may be required to support the request and including retaining wall design for walls greater than four feet.

The toe of the fill or the top of the cut (toe/top of slope) shall be a minimum of 2 feet behind the back of the sidewalk. 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 not foreseeable in the City's determination, the toe/top of slope shall be a minimum of 2 feet behind the back of the new curb. This 24 inch transition zone shall be sloped at 2 percent.

Where on-street parking is provided or intended, a maximum slope of 2% shall be provided shall be provided in the amenity zone. This is to allow for door swings and easy access to the sidewalk from parking.

Where no on-street parking is provided or intended, a maximum slope of 25 percent will be accepted for the amenity zone and transitions behind the curb where necessary to meet grade at ROW. Special designs differing from these typical cases can be proposed, and shall be evaluated on a case-by-case basis. Figure 4-12 illustrates the grade transitions and the cut and fill slopes between the curb and ROW line.

Figure 4-12: Grade Transitions and Maximum Cut and Fill Slopes to ROW (pending update to show percentages instead of ratios for slopes)



SECTION 4.5 Street Intersections

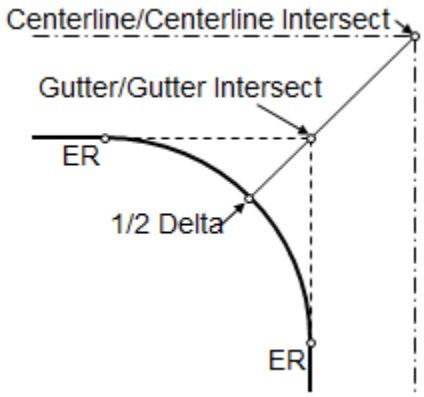
This section applies to intersections involving public streets. This section excludes alleys, courts, driveways, and private accessways which are discussed in Section 4.1 and Section 4.6. Sight distance and design speed requirements are discussed in Section 4.2.

4.5.1. Intersection Profiles and Drainage

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

- Grades shall match at the center of intersections for equal classification streets. At intersections of differing classification streets, the crown shall be carried through the intersection for the higher classification.
- Vehicle paths for applicable design vehicles shall be assessed with proper turning templates (software) and for whether the design vehicle (and target turning speed) is to be accommodated or designed-for at the location. Intersections shall safely and comfortably accommodate all users and modes per the guidance and references presented within this Manual.
- Intersection grades shall not exceed 5 percent, but where existing steep topography is a design constraint, steeper grades may be evaluated on a case-by-case basis by the City Engineer or Designee.
- Intersections shall be designed to drain away from the higher classification street.
- Stormwater flow shall be kept in the gutter, and shall not be allowed to flow across public intersections (i.e.; “valley gutters”). Catch basins shall be installed at appropriate locations to prevent flow across intersections. Catch basin “bubbler” type installations are not allowed. A maximum of 0.28 cfs is allowed to bypass into the intersection radius per City of Tacoma Stormwater Management Manual. The intent is to minimize drainage across pedestrian accessible routes (alley aprons and crosswalks).
- Minimum flowline slopes shall be 1 percent slope around intersection corners unless otherwise approved by the City Engineer or Designee.
- Drainage requirements at the intersection shall meet the requirements of the City of Tacoma Stormwater Management Manual. Intersections shall be designed to have positive drainage to a stormwater facility to prevent ponding and sheet flows across the intersection.
- The design engineer shall provide intersection details per the Intersection Detail on City Standard Plan DR-07. The design engineer shall show the grades around each radius and the grades from the centerline/centerline intersect to the ½ delta point of the radius through the gutter/gutter intersect as shown on Figure 4-4. Taking into consideration the 1-inch lip of the gutter, if applicable, as shown in the detail for curb and gutter on City Standard Plan SU-03.
- Misaligned lanes through intersections that are not stop controlled should, when practical and approved by the City Traffic Engineer or Designee, follow the requirements for tapers. Tapers shall confirm to Section 4.3.6 Tapers and Transitions.

Figure 4-13: Diagonal Profile



4.5.2. Horizontal Approach Angle and Offsets

The horizontal approach angle of street intersections shall be 90° at the centerlines of intersecting streets. Intersections shall be aligned so that opposing single left turn lanes and through lanes are not offset more than 3 feet as measured from the lane centerline approach tangent. Approach angles or offsets that do not meet the requirements shall be approved by the City Engineer or Designee.

Where street widths or alignments change at intersections and with half-street widening improvements, special consideration for each situation must be given to the design of the intersection offset and shall be approved by the City Engineer or Designee.

4.5.3. Intersection Spacing

Intersection spacing for classified streets shall be determined by the City Engineer or Designee on a case-by-case basis using industry best practices and contextual considerations. Local street intersections shall meet the minimum centerline spacing per section 4.6 and Table 4-11. Local streets shall not exceed 1,300 feet in length between intersections.

4.5.4. Intersection Curb Extensions

The designer shall integrate intersection curb extensions to enhance pedestrian crossing safety and to delineate on-street parking extents, if present, or if overall street width allows. The design shall consider effects (or constraints) on other existing and planned roadway features (e.g., future bike lanes) and provisions (see Section 4.2 - Basis for Geometric Design and Chapter 8). The minimum reverse curve radii creating an extension shall be 15 feet. If the determination is that intersection curb extensions cannot be incorporated, then the designer must provide written justification with the design plans for City review and consideration.

4.5.5. Intersection Corner Curb Radii

Intersection corner curb radii, or curb returns, of the adjoining curb lines at residential-to-residential classified street intersections shall have a minimum radius of 15-feet. Curb returns at other intersection types shall have a minimum radius of 20-feet. In some cases (e.g., along a Heavy Haul corridor, transit route), a larger radius shall be used based on turning radius of the

design vehicle (see Section 4.2) and site conditions. Turning movements of the design vehicle shall ultimately dictate the appropriate radius of the intersection corner.

4.5.6. Right-of-Way Chamfers

Right-of-way chamfers are required at intersections to preserve sight distance, to allow for additional space for curb ramps, and to accommodate other infrastructure when there is not enough right-of-way space available to meet the design standards. Right-of-way chamfers are areas of real property that will be dedicated to the City.

4.5.7. Intersection Approach Grading

The intersection approach grades shall be no more than 6% in an uphill approach direction for 30' beyond the point of horizontal curvature and on a downhill approach direction for 30' beyond the point of horizontal tangency of the intersection radius. The point of horizontal curvature can also be the end of a vertical curve and the point of horizontal tangency can be the beginning of a vertical curve.

Curb ramps shall be provided at intersections unless upon a complete evaluation of the full design criteria the designer and City agree a variance is appropriate. Curb ramps shall be designed and constructed to be ADA compliant in accordance with City Standard Plans and PROWAG. ADA and PROWAG requirements are discussed in CHAPTER 8. The City's Curb Ramp Installation Matrix shall also be consulted to identify the extent of required curb ramp improvements related to ROW improvements.

A legal crosswalk exists at every intersection of public streets, unless it is otherwise signed. Whenever streets, sidewalks, or curbs are constructed or altered, a curb ramp may be required, consistent with the Curb Ramp Installation Matrix. Curb ramps are typically required even if sidewalks do not currently exist along a corridor.

Marked crosswalks are intended to encourage pedestrians to cross at designated locations and can remind drivers to expect people walking and rolling. Additional treatments, such as beacons, signage, bulb outs, traffic diverters, or pedestrian refuge islands, may be required before adding a marked crosswalk in order to enhance safety on higher speed or volume roads. Traffic Engineering must approve all new marked crosswalks (see **Chapter 7** for more information).

Crosswalks between pedestrian ramps shall be designed to City Standard Details and PROWAG guidelines. Crosswalks at stop and yield controlled intersections shall have cross-slopes less than 2%. Crosswalks at uncontrolled approaches to intersections and signalized intersections shall have cross-slopes less than 5%. Road profiles shall be designed to accommodate the crosswalk cross slopes. When submitting design plans, the crosswalks shall be shown in the profile views with the appropriate grades referenced.

4.5.8. Sight Distance

Sight distance shall conform to the AASHTO Policy. See Section 4.2 for additional information.

4.5.9. Intersection Control

There are multiple ways intersection safety and driver behavior can be influenced in an intersection.

4.5.9.1. Uncontrolled

An intersection where there is no Stop sign, Yield sign, or traffic signal, is considered by state law an uncontrolled intersection. Drivers approaching these intersections must yield to vehicles in the intersection and to those at the intersection positioned to the right of them. The City of Tacoma, like many agencies in Washington State, does not install Stop signs at all intersections. Tacoma is required to follow the guidance of the federal Manual on Uniform Traffic Control Devices (MUTCD), as adopted in Washington Administrative Code 468-95, for proper and consistent use of traffic control devices like Stop signs.

4.5.9.2. Controlled

A controlled intersection is the counterpart to an uncontrolled intersection. The controls can take the form of signs (Stop, Yield), a roundabout (which utilizes Yield signs), or a traffic signal. The control type is based on the conditions of the intersection and any applicable warrants/criteria to consider for proper and consistent use of the control type. Whatever the control may be, it shall be based on, and adhere to, the standards set forth in the MUTCD.

4.5.9.3. Traffic Circles

Traffic circles are a form of uncontrolled intersection (and different from roundabouts in that they do not utilize Yield signs) and may be used on non-arterial streets where roadway widths, alignments and safety concerns have been identified by Transportation/Traffic Engineering. The designer should reach out to Transportation/Traffic Engineering early in the process to discuss any proposed traffic circles. Special consideration for each situation must be given to the design of the intersection and shall be approved by the City Engineer or their designee.

4.5.9.4. Roundabouts

Roundabouts are a type of controlled intersection and may be considered where particular roadway widths, alignments and safety concerns have been identified by Transportation/Traffic Engineering. In particular, the feasibility of roundabout control at new or reconstructed intersections should be compared against their operational and safety benefits. The designer should reach out to Transportation/Traffic Engineering early in the process to discuss any proposed roundabouts. Special consideration for each situation must be given to the design of the intersection and shall be approved by the City Engineer or their designee. The City will require an engineering study to determine feasibility of a roundabout.

SECTION 4.6 Street Access

Street access is necessary to allow properties, neighborhoods, commercial areas, and other intersecting streets to utilize the greater transportation system. Management of the resulting access needs focuses on the location, spacing, and design of driveways (access points), street intersections, and courts/alleys.

This section addresses access design to improve transportation operations and safety while supporting enhanced mobility, connectivity and accessibility. Since the frequency and location of access points creates conflict points, which can increase the likelihood of crashes, their design and consistency in use is an important aspect of street design.

4.6.1. Functional Classification and Connectivity

All street roadways are intended to provide multimodal connectivity. The level of connectivity is a function of access control which varies based on roadway classification. The City Engineer, or designee, likely can suggest the classification for all new roadways during the design process, but their official designation requires City Council action and codification. Construction of a continuing existing roadway shall have their classifications verified by the City as part of the design process. Street classifications can be found in the Transportation Master Plan, TMC 11.05, and section 4.1 of this manual.

Access management/control (discussed in more detail in the next section) refers to how access is managed on and off City roads. This includes access to/from the City's roadway network from driveways, courts/alleys, and private accessways. Access control can also be used to influence traffic volumes and routing to intended streets and intersections.

New developments shall provide new roadways and connections to support transportation interconnectivity including active transportation access. Pedestrian and bicycle access shall also be provided to bus/transit stops and existing/planned active transportation routes. Grid connections, connections to adjacent parcels, shared access, and new roadways shown in the Transportation Master Plan are examples of ways the City requires interconnectivity of the roadway network. Connections between similarly zoned properties shall be provided. Internal accessways should provide stubs to adjacent parcels and reciprocal access agreements. Roadway and active transportation connections shall be extended to and through property lines.

4.6.2. Access Management

The City manages access types and locations to minimize conflict points where vehicles interact with other vehicles, bicyclists, or pedestrians, causing potential safety concerns. State facilities operated within the City shall meet these access standards in addition to the access management state regulations in Revised Code of Washington (RCW) 47.50, Washington Administrative Code (WAC) 468-51, and WAC 468-52. The final determination of access allowances, including the number, location, and size, of permitted access points, shall be the responsibility of the City. The following information will be used to evaluate access and make a determination about permitted access in anticipation of City review and possible concurrence. This list should be consulted prior to street design.

- Refer to and address objectives and requirements conveyed in the City's Transportation & Mobility Plan and other related City policies/ordinances; applicable zoning, and land development regulations as set forth in adopted City comprehensive (and related) plans as administered by the City's Planning & Development Services Department.
- The current functional classification of the roadway (or potential classification in the case of a new roadway).
- Existing and projected vehicle, bicyclist, and pedestrian volumes (or trip generators), crash history, and other operational considerations that would support a proposed access plan for review.
- Existing and projected state, local, transit agency, and regional planning organization transportation plans and needs, including considerations of new or improved facilities.
- Drainage requirements and utilities.
- The physical features of land adjoining the roadway.
- Particular access needs of certain modes (vehicle classification, bicycle and pedestrian access points, etc.).
- The availability of alternative or shared connections to the existing roadway network.
- The cumulative effect of existing and projected connections on the roadway's ability to provide safe and efficient movement of people and goods.

4.6.3. Access Location and Spacing

Minimum access spacing provides drivers with sufficient perception-reaction time to minimize the number of potential conflicts to address at once, which likely improves safety for all road users including pedestrians and bicyclists. For specific pedestrian access information refer to Chapter 8.

Access points shall be located from an alley or court, when possible, and otherwise from the lowest classified abutting street; refer to TMC 10.14 for further guidance. Particularly when access is on a street other than an alley or court, the 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, to limit road user conflict opportunities, and the driver's perception of a corridor. New access points shall be placed in accordance with Table 4.11.

Table 4.11 - Access Spacing Criteria

Designated Speed Limit (per TMC Title 11)	**Functional Classification** (Transportation Master Plan)	**Access Spacing*** (centerline to centerline)
35 or greater miles per hour	All	600 feet
≤ 30 miles per hour	Principal or Minor Arterial	300 feet
	Collector or Unclassified Arterial	150 feet
	Local Street	50 feet
≤ 10 miles per hour	Alleys, courts	25 feet

* The spacing shown is minimum needed to allow for all vehicle movements at the location. Restricted access (right-in, right-out), is permissible (unless otherwise noted herein) at half of the spacing distances shown in the table above provided that a physical median restricts the prohibited left turn movements. The spacing shown for local streets, alleys, and courts is the minimum required for full or partial access along the associated frontage and the opposite frontage does not need to be considered. The spacing distances shown for all scenarios is the minimum required when measuring from highway ramps, 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 Engineer or designee as part of the Design Manual Variance Process.

4.6.4. Medians, Traffic Diverters & Centerline Hardening

Painted (flush medians), raised medians, hardened centerlines, and traffic diverters not only serve to delineate traffic flows but can also provide a range of effective access control when designed and implemented appropriately. Raised medians, hardened centerlines, and traffic diverters, whether used exclusively for access control or otherwise, shall be designed according to the applicable design parameters provided in/by WSDOT, NACTO, MUTCD, FHWA, and AASHTO Policy and the following design criteria:

- A raised median shall be bordered by a concrete curb. This curb can be a traffic barrier curb, concrete curb and gutter, or a similar alternative with approval from the City Engineer.
- The width of the raised median between the back of curb on each side shall be 6 feet minimum if any legal pedestrian crossing points are present—otherwise, narrower medians may be permitted with approval. Sizes and shapes of traffic diverters or hardened centerlines may vary.
- Raised medians can contain GSI, landscaping, irrigation, artwork (with approval), a brick paver style surfacing, or patterned concrete, but must be backfilled with acceptable material to provide support and stability for the curbing that defines its shape and location.
- For pedestrian crossings passing through a raised median, a depressed section of the median, or a raised crosswalk flush with the top of the median (or if depressed and sufficiently wide, then ADA-compliant ramps) shall be used to provide a pedestrian refuge access at crosswalks. For details on pedestrian crossings through medians – see Chapter 8.
- Consider maintenance needs (e.g., access, parking for authorized vehicles, appropriate design elements) in determining the type and applicability of median/access control.
- Pedestrian and bicycle access shall be provided through medians, traffic diverters, and centerline hardening at designated crossing locations, unless a crossing has been closed to pedestrians or bicyclists or there are other documented extenuating circumstances.
- Access for emergency services, including alternate route options, shall be considered in the design and implementation of medians, traffic diverters, and centerline hardening.
- Illumination needs and impacts shall be evaluated when installing raised medians, traffic diverters, and centerline hardening.

4.6.5. Alleys and Courts

Alleys provide vehicular access to abutting properties and are not intended for general traffic circulation. Dead-end alleys are generally unacceptable; however, if dead-end alleys are determined suitable by the City Engineer or their designee, they shall be provided with adequate turnaround facilities at the dead-end.

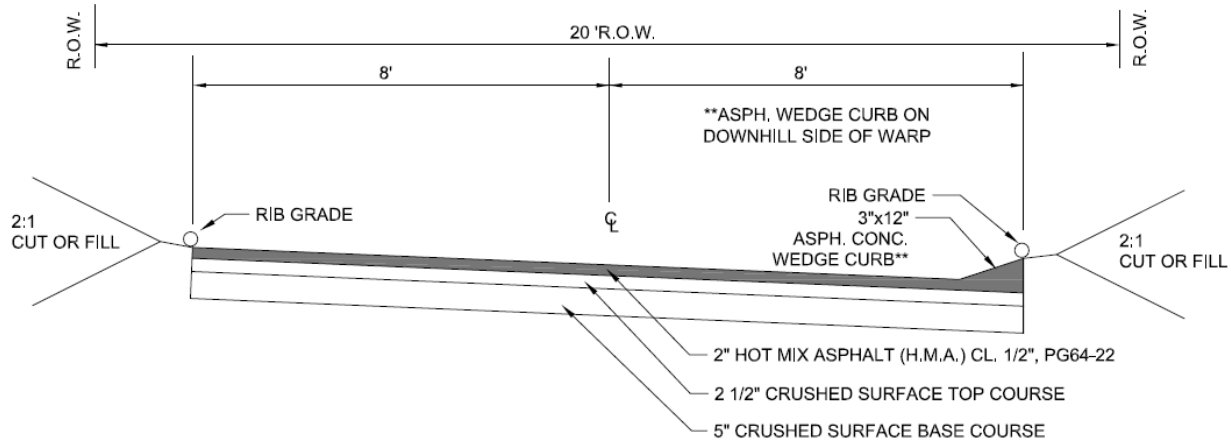
A minimum ROW width of an alley shall be 20 feet. Alleys may be required in the rear of commercial and industrial districts (per TMC 13.04.200). Improvements of alley ROW may be required when the alley is to be utilized as access to a residence, parking lot, or as otherwise directed by the Transportation Division or the Site Development Group. Typical alley pavement designs shall conform to Standard Plan PD-01. Incorporation of Low Impact Development

BMPs is encouraged when practicable (see the City of Tacoma Stormwater Management Manual).

The geometric design for alleys shall conform to the criteria as set forth in Section 4.2 of this chapter using a 10 mph design speed—an alternate design speed may be necessary in certain situations. The typical paved width of an alley is 16 feet with wedge curb on the downhill side. When constructing a new alley that connects to existing or proposed curb and gutter, a concrete alley return conforming to City Standard Plan SU-07 series shall be provided. Special design standards may apply in historic districts. A curb extension may also be a necessary mitigation to improve sight distance and delineate on-street parking.

Special attention should be given when designing alleys to incorporate garage and driveway connections from previously developed properties. To avoid extensive work on private property, the designer may be provided some latitude with meeting the standard cross-sections and longitudinal slopes with grade breaks. Positive drainage will be provided within the alley "gutter." It is preferential to not extend stormwater system (pipes) for the extents of the alley except to prevent flow from crossing the sidewalk at the alley return. Positive drainage should be towards the end of the alleys whenever possible.
Figure 4-14 shows the typical full-warp alley section, which may also be used for private accessways and driveways.

Figure 4-14 - Typical Full-Warp Alley Section



Courts are a variant of an alley and considered to be streets only with respect to required off-site improvements. Courts are typically crowned with concrete curb, gutter, and sidewalk on one side. A minimum of ROW width of a court shall be 40 feet. A standard alley approach conforming to City Standard Plan SU-07 series may be used where courts intersect with streets to facilitate grades and pedestrian accessibility. A curb extension may also be a necessary mitigation to improve sight distance and delineate on-street parking.

4.6.6. Driveways

All driveways shall be in conformance with the TMC 10.14, TMC 13.06, and the City Standard Plans. 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. Consistent with Chapter 2, variances, by the City Engineer or designee, may be

allowed for public safety, or if strict application of these standards would prohibit vehicular access to a development, pursuant to TMC 10.14.

New driveways are subject to review and approval by the City Engineer or designee pursuant to TMC 10.14, taking into account, the objectives and requirements of this chapter. New driveways can be prohibited or their associated traffic movements restricted on designated pedestrian streets (see TMC 13.06.010.D), existing transit or bike routes, or planned bikeways or transit routes identified in the Transportation Master Plan – or where the City has identified mobility of safety concerns, such as through its Vision Zero program.

Developments and redevelopments are expected to minimize the number of driveways to the maximum extent feasible and restrict vehicle movements entering and exiting driveways where possible in order to support the City's safety goals. Any reconstructed driveways shall meet current City Standards for width and other elements as identified in the city's Standard Plans. Driveway removal or access restrictions may be required at any time as part of redevelopment or capital improvements in order to improve safety and operation of the roadway.

New driveways associated with new developments shall be located from an existing or planned alley or court when they abut the project/property; or the lowest classified roadway when suitable alley or court access is not available. For redevelopment projects, existing driveways shall be relocated to the alley or court, when they abut the project/property, or the lowest classified roadway when suitable alley or court access is not available. In association with land use actions, the pre-existence of driveways does not guarantee their continued use as-is or even if rebuilt to current City standards. Redevelopment of a parcel will require any existing driveway locations that are permitted to remain be brought up to meet ADA requirements and current City standards.

Driveways cannot serve as accessible curb ramps. The designer shall consider the proximity of the driveway to existing or future pedestrian ramps. The separation should be sufficient to design a standard driveway and meet the accessibility needs of the pedestrian ramp. To help eliminate conflicts, future driveways (or the potential for them) shall be shown as part of the project/overall design when submitting plans for permitting.

Driveways shall not be constructed or maintained during redevelopment in a way that when used creates obstructions of the adjacent right-of-way, impedes bicycle or pedestrian travel, or prohibits any mode of travel.

City Standard Plans SU-07, SU-07A, and SU-07B show concrete driveways used for residential and commercial access and at the entrance to private accessways. Driveways shall be designed to meet applicable ADA and Public Right-of-Way Accessibility 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 and is preferred material for use everywhere. Type 1 driveways are preferred over Type 2 driveways since they allow for greater access for people with mobility issues. Asphalt driveways may be constructed where there is not existing or proposed concrete curb and gutter. Please note that for historic districts, special design standards may apply. Driveway profiles shall be required for any driveway where the undercarriage clearance is in question per Figure 4-15.

For concrete alleys, if there is not concrete curb present, driveway construction material can be asphalt, but concrete is preferred.

The City may require an increased driveway thickness and/or steel reinforcement in addition to the pavement requirements discussed in Section 4.7 for locations such as, but not limited to, heavy haul routes, developments that generate high truck traffic, or where poor soil conditions exist.

4.6.7. Driveway Classification

Driveway design shall consider the type of vehicle composition anticipated, traffic volume and land use activities being accessed. General driveway classifications are:

Residential Driveway – A driveway serving one single family residential property or a duplex/triplex.

Shared Driveway – a driveway serving two or more residential or commercial/industrial parcels.

Alley/Court Apron – a concrete driveway defining the entry to an alley or court when there is concrete curbing on the intersecting street adjacent to the alley. When only an asphalt wedge curb exists, an asphalt apron is required but the asphalt apron shall include a 6-inch concrete sidewalk section when adjacent to sidewalk or a future sidewalk alignment has been set on the street being accessed.

Commercial/Industrial Driveway – A driveway serving a commercial (including denser multi-family residential) or industrial parcel. The City may require commercial/industrial driveways along arterial roadways to accommodate the largest types of vehicles frequenting the parcel. These driveways may be required to accommodate design vehicle egress/ingress such that the design vehicle can make its turning movements without driving outside the apron, without swinging into opposing traffic lanes, and if possible being able to enter the driveway while another design vehicle is waiting at the driveway to exit. In these cases, design vehicle justification, turning templates, and City Engineer approval (per SU-07 series) of the resulting width are required.

Asphalt Driveway – a driveway constructed where concrete curb and gutter are not existing or proposed for the street being accessed. A 6-inch concrete sidewalk section shall be constructed across the asphalt driveway when adjacent to sidewalk or a future sidewalk alignment has been set for the street being accessed.

4.6.8. Private Streets and Accessways

Private streets and accessways are defined by the number of lots and the type of development they support and will incorporate different design criteria. Private accessways require additional design considerations and private streets use public street design parameters, as discussed previously in this chapter and Chapter 2. Where new development is proposed from an existing gravel street, the gravel street shall be paved meeting half street requirements to the nearest paved connector street to the approval of the City Engineer or their designee to ensure adequate access.

4.6.8.1. Private Streets (pending updated content)

Private streets serve five or more lots, excluding unit lot subdivision, and shall be designed to City standards as outlined in this section and in and Table 4-12. Private streets will not be allowed if there is the ability for a future public roadway extension or pedestrian access route (PAR). Refer to Table 4-12 and Section 4.6.8.2 for the differentiation of private streets and accessways.

Table 4.12: Design Requirements for Developments

	Greater than 4 Lots	3 to 4 Lots	2 Lots
Designation	Public street ROW or private street easement	Private accessway	Private accessway
ROW or Easement Width[1]	52 feet	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 4.7 of this chapter		
Driveway[3]	Required at entrances to all lots	Required at entrance to private accessway	
Sidewalks and Pedestrian Pathways[4]	Required along all lot frontages		
Street Trees	Both sides	See TMC 13.06.090.B	
Street Edge Improvements[5]	Both sides	Required for combination sidewalks	
Asphalt Wedge Curb	N/A	Required when concrete curb is not provided	

1 If constrained by site-specific conditions and with approval by the City Engineer, the shown widths may be reduced to a minimum of 41 feet for private streets serving more than 4 lots, 30 feet for private accessways serving 3 to 4 lots, and 20 feet for private accessways serving 2 lots.

2 For streets 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.

3 See previous Section 4.6.5. Approved pervious pavement sections may be allowed.

4 Pedestrian accessibility shall be required for each lot.

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

4.6.8.2. Private Accessways

Private accessways serve four residential lots or fewer and shall be designed as outlined in this section.

It is incumbent upon the design engineer to provide safe adequate access for all lots. The City strongly recommends that the design engineer follow the recommendations from the AASHTO policy, as discussed in this chapter. Justification for deviating from the AASHTO policy shall be provided as part of the design.

All private streets and accessways shall:

- Address adverse impacts to adjacent private property;
- 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;
- Not landlock other parcels;
- Not obstruct public street circulation;
- Be supported by covenants to provide for maintenance (covenants will be verified and approved by the City and recorded with the County);
- Meet all applicable standards for sidewalks and ADA accessibility;
- Meet the applicable requirements of the SWMM; and
- Meet private street lighting requirements throughout the plat per TMC 13.04.165, where applicable.

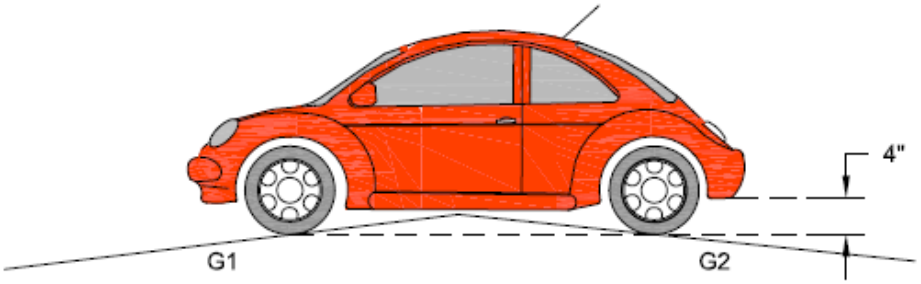
Additionally, private accessways shall provide a:

- Type 1 or 2 concrete driveway approach (see Standard Plan SU-07, SU07A, and SU-07B) where the private accessway enters onto public ROW where permanent concrete curb exists or is proposed(an asphalt driveway shall be provided if concrete curb does not exist nor is proposed)..
- Street section is in conformance with the standards and requirements discussed in this chapter;
- Turn-around meets the standards and requirements discussed in Section of this chapter;
- Longitudinal grade less than 15 percent (greater grades may be considered if constructed with concrete); and
- Street light(s) at the point of the access meeting the City's standards (see Error! Reference source not found.).
- Single lot access meeting the minimum width of the driveway and providing pedestrian access to the right-of-way.

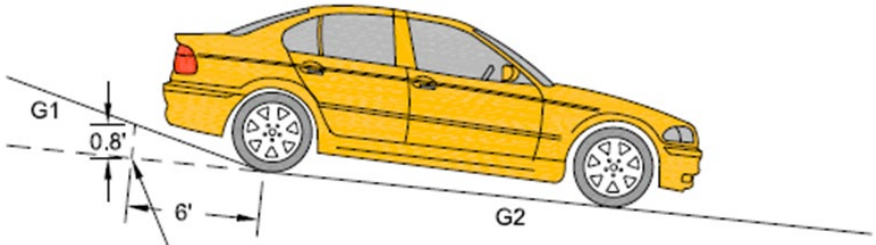
- Where new development is proposed with access from an existing gravel street, the gravel street shall be paved to the nearest paved connector street to the approval of the City Engineer to ensure adequate access.

Figure 4-15 shows the design requirements for grade-breaks and undercarriage clearance conditions for private accessways and driveways.

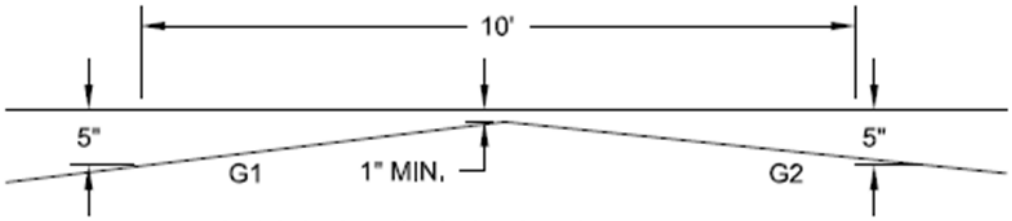
Figure 4-15 - Undercarriage Clearance Conditions for Driveways



14% GBK MAX,
12% DESIRABLE



MAXIMUM BREAK IN GRADE
0,8' IN 6' CONDITION FOR
CLEARANCE AT BUMPER
AND TAILPIPE



CHECKING WITH STRINGLINE
MINIMUM CLEARANCE CONDITION

SECTION 4.7 Pavement Design

Pavement section standards, including minimum allowable pavement sections for design, are provided in Standard Plans PD-01 and PD-02. For all pavement sections, the base material of the section shall extend 1 foot beyond the back of the concrete curb or asphalt wedge curb. Standard pavement sections for designated roadway classifications shown in PD-01 sheet 2 shall be generally approved, however, the City Engineer may request analysis and justification for any and all street sections.

Alternate sections providing the same structural number may be proposed, and are subject to approval by the City. The designer shall 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. Justification for new design methods shall include all variables/input values required by the AASHTO Guide for Design of Pavement Structures values.

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. The designer should evaluate the life cycle costs of a 40 year asphalt design life.

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

4.7.1. Simplified Pavement Design

UNDER CONSTRUCTION

4.7.2. AASHTO Pavement Design

4.7.3. Pavement Restoration

4.7.3.1. Pavement Restoration Policy

The design engineer shall familiarize themselves with most current City of Tacoma Pavement Restoration Policy and pavement restoration details SU14 A through F and SU15 A through C.

The most current city street GIS layers contain the pavement condition index, which along with the current Right-of-Way Restoration Policy and Standard Details for patches and street restoration, can be used to evaluate street condition and the existing street section. In some areas, additional, pot holing may be used to determine the existing street section.

Surface restoration limits are subject to the Right-of-Way Restoration Policy. Patches shall be consolidated as required based on the pavement condition of the road and the following:

If a project removes street pavement in two (2) or more locations within 75 feet of each other, measured longitudinally or transversely from any cut back zone, the project shall restore the street by incorporating the work in a single patch per the Standard Plans. If a project excavates and removes the street pavement in four (4) or more locations within 300 feet of each location, measured longitudinally or transversely from any cut back zone, the project shall restore the roadway by incorporating the work in a single patch per the Standard Plans.

Some existing streets will require reconstruction if they do not meet the approved design standards and associated geometry. For more information on pavement restoration refer to the Standard Details and Chapter 4, Section 4.7 – Pavement Design.

Five-Year Moratorium

Except for repairs that are necessary for the protection of the public's health and safety, excavations in newly constructed streets will not be allowed for a period of five years following substantial completion of the project.

Variance requests shall be submitted when a project proposes a cut in a street section with a current Five-Year Moratorium. Pavement patches will not be allowed and the full width of the disturbed infrastructure shall be restored to new condition between the property lines of the subject property.

4.7.3.2. Restoration Summary

The most current city street GIS layers contain the pavement condition index, which along with the current Right-of-Way Restoration Policy and Standard Details for patches and street restoration, can be used to evaluate street condition and the existing street section. In some areas, additional, pot holing may be used to determine the existing street section.

Surface restoration limits are subject to the Right-of-Way Restoration Policy. Patches shall be consolidated as required based on the pavement condition of the road and the following:

If a project removes street pavement in two (2) or more locations within 75 feet of each other, measured longitudinally or transversely from any cut back zone, the project shall restore the street by incorporating the work in a single patch per the Standard Plans. If a project excavates and removes the street pavement in four (4) or more locations within 300 feet of each location, measured longitudinally or transversely from any cut back zone, the project shall restore the roadway by incorporating the work in a single patch per the Standard Plans.

Some existing streets will require reconstruction if they do not meet the approved design standards and associated geometry. For more information on pavement restoration refer to the Standard Details and Chapter 4, Section 4.7 – Pavement Design.

Five-Year Moratorium

Except for repairs that are necessary for the protection of the public's health and safety, excavations in newly constructed streets will not be allowed for a period of five years following substantial completion of the project.

Variance requests shall be submitted when a project proposes a cut in a street section with a current Five-Year Moratorium. Pavement patches will not be allowed and the full width of the disturbed infrastructure shall be restored to new condition between the property lines of the subject property.

Asphalt/Oil Mat Streets (Aggregate Base)

4.7.3.3. Concrete Streets (content still pending)

4.7.3.4. Concrete Dowels (content still pending)

4.7.3.5. Cobblestone/Brick and Treatments (content still pending)

4.7.4. Permeable Pavements

The City of Tacoma encourages project owners and designers to utilize natural drainage practices, where possible, to mitigate stormwater runoff from the development of impervious surfaces on project sites. Permeable pavement can be a useful option for meeting stormwater management needs including providing treatment and flow control in addition to meeting regulatory requirements. The use of permeable pavements in a project's design must consider the suitability of the project site including review of Infeasibility Criteria. Projects shall reference the current version of the City of Tacoma SWMM to review and evaluate the criteria that must be considered including, but not limited to: facility setbacks, underlying soil suitability criteria, and traffic volumes.

Permeable pavements located in the ROW may not receive run-on from private property for purposes of providing stormwater management. Per the SWMM, private and public stormwater must be managed in separate facilities for flow control and water quality purposes.

In addition, adjacent areas outside of the ROW such as parking areas located off alleyways and un-stabilized surfaces including loose aggregate or soils shall not run-on to permeable pavements in the ROW. This does not include residential driveways serving up to two (2) single family homes.

Cross sections for permeable pavements shall be per the City of Tacoma Pavement Design Standards included in Standard Plan No. PD-01. Alternative pavement sections shall be designed by a Professional Engineer and require city review and approval. All requirements of

the SWMM shall be met. Design-life for all pavement sections shall meet or exceed a 30-year design life for porous asphalt sections and a 40-year design life for pervious concrete sections.

The cross section for any proposed alternative porous asphalt or pervious concrete pavement section shall meet or exceed the layer thicknesses listed in Standard Plan No. PD-01 for a Section with Approved Design.

4.1.1 Permeable Pavement Subgrade

Subgrade shall be designed with a zero percent cross slope and the running slope limited to 3 percent. If the roadway surface grade exceeds 3 percent, subsurface detention structures such as check dams or trench dams should be included. The top of check dams shall be a minimum of 3 inches below the bottom of the wearing course. Terracing reduces the retention of runoff and does not allow for maximum infiltration; it is discouraged and will only be approved on a case by case basis where site limitations do not allow check dams or trench dams. Appropriate consideration to runoff modeling must consider the reduced effectiveness and surface area that subsurface detention systems provide.

Permeable pavement subgrades shall be protected from construction activities including traffic and material storage to reduce compaction and maintain preconstruction infiltration rates. The subgrade shall also be protected from siltation. If subgrade material becomes contaminated or impacted once exposed so that it no longer provides the infiltration rate or capacity indicated in the project design, all unsuitable material shall be replaced or rehabilitated to meet the approved design conditions.

Subgrade shall be compacted to 90-92% standard proctor of maximum dry density and shall be firm and unyielding prior to placing pavement section material. Contractor shall protect the subgrade as necessary to maintain preconstruction infiltration rates. Traffic should be limited to emergency access during construction. If traffic is allowed on the exposed subgrade, the subgrade shall be re-evaluated for infiltration and scarification may be required prior to placement of the permeable base course, or geotextile when used.

Contractor shall phase the work so as to not compromise or overly compact the subgrade. Should it be necessary for machinery or trucks to access the final subgrade in certain areas, Contractor shall protect the subgrade from over-compaction by placing steel sheets or of other methods as prescribed by the Engineer of Record and approved by the Site Inspector

If the subgrade has been exposed for more than 48 hours prior to installation of the first section layer (geotextile fabric, filter sand, or permeable ballast), the Contractor shall scarify the top 6-inches of subgrade to ensure that subgrade is not sealed and re-compact the subgrade to 90-92% maximum dry density and proof-roll by the Contractor or probe by the Engineer to check for areas not in a firm, unyielding condition. Loose or disturbed areas identified shall be over-excavated to firm bearing and replaced with material as specified on the Plans.

The subgrade must be inspected by the Engineer of Record to verify its suitability prior to placement of geotextile fabric, filter sand, or the permeable ballast. An Engineer Certification Letter is required at the completion of construction to attest that the soils in the bottom of an infiltration facility - including permeable pavements - are as indicated in the plans. Testing or additional soil classification may be required if deemed necessary by the Engineer of Record or

the Site Inspector. Areas determined to be overly-compacted shall be scarified by the contractor to a depth specified by the Design Engineer and re-compacted per the specifications.

Contractor shall conduct infiltration tests immediately following final subgrade preparation, at the discretion of the Engineer of Record or Site Inspector, to verify that the subgrade is not over-compacted. The test shall be conducted using the wetting and measurement methods of the Small Scale Pilot Infiltration Test (PIT) described in the SWMM, with the subgrade surface representing the bottom of the test pit and a concrete, metal or plastic ring (minimum diameter of 3 feet) placed on the subgrade surface and pressed into the ground with soil backfill packaged around the outside of the ring.

Infiltration tests shall be conducted at a rate of one (1) test per 5,000 square feet or one (1) test per 200 linear feet of residential roadway.

4.7.5. Aggregate Requirements for Permeable Pavements

All porous asphalt pavement sections shall include the following three layers:

- Porous Hot Mix Asphalt/Porous Warm Mix Asphalt (PHMA/PWMA)
- Asphalt-Treated Permeable Base/Permeable Asphalt-Treated Base (ATPB/PATB)
- Permeable Ballast Base Course

Pervious concrete pavement sections include the following two layers:

- Pervious concrete
- Permeable Ballast Base Course

Aggregates for all layers of permeable pavement sections shall meet the manufacturing, testing, and gradation requirements below.

SECTION 4.8 Traffic Control Elements

Some design efforts may be in areas that require consideration of additional street or traffic control elements beyond the basic design and apart from, but related to, the actual channelization of the street which is addressed in Chapter 7. The following elements are provided particular attention due to considerations of their use when prompted by the street environment, location, or anticipated traffic conditions.

4.8.1. Traffic Calming/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 slower. Traffic calming may include or be provided in conjunction with green stormwater features. Traffic calming should not be confused with traffic **control devices**, which are discussed in Chapter 7.

Although traffic calming is primarily used on residential streets, there are certain treatments that could be considered for use on some arterial roadways. When a traffic calming treatment is considered for any street, the City applies the following guidance (also see Table 4-14):

- Traffic calming features should use best practice designs and reference available resources such as NACTO and the WSDOT Active Transportation Programs Design Guide.

- Designs should be predictable and easy to understand by people walking, rolling, bicycling, and driving. Emergency access and response times shall be considered.
- Traffic calming areas or facilities should be adequately signed, marked, and illuminated (when practicable) to be visible during daytime and night-time conditions.
- Treatments need to be spaced appropriately to have the desired effect on speed management – too far apart and they will have a limited effect, too close and they will be an unnecessary cost.
- Complete Streets designs are intended to create an environment that supports slower speeds for the entire corridor.
- Facilities shall be designed and constructed to meet industry practices to maximize their functionality. For example, keeping the slopes too gradual for a speed table or curves too gentle for a chicane will likely not have the desired effect.
- Traffic calming measures should accommodate bicyclists, pedestrians and people with disabilities, such as providing bicycle bypass features.
- If a measure is likely to divert traffic onto another local street, the area-wide street system should be considered to prevent shifting the issue from one place to another. However, the ability to fully address traffic diversion as part of a single project shall not be a reason to avoid introducing traffic calming to enhance safety.
- Individual treatments should be thought of as elements of a traffic calming system and be cognizant of active transportation needs throughout the affected area.
- Curb extensions (curb bulb-outs) shall be provided at the intersection and mid-block crossings where parallel or angle back-in parking is or shall be delineated. Curb extensions may be required for wider intersections, limited sight distance and where school pedestrian routes or other multi-modal needs have been identified by the City.

Table 4.14: Traffic Calming Treatments

Traffic Calming Treatment	Typical Use	Residential Street (non-	Collector Arterials	Minor Arterials	Principal Arterials
Curb bulb-outs (Curb extensions)	Reduce crossing distance Improve visibility of people crossing	●	●	●	●
On-street parking	Can effectively narrow roadway; needs to be designed to ensure safety/visibility of people walking & rolling	●	●	●	
Streetscape improvements (street trees, streetlighting, street furniture, public art, streateries)	Improves pedestrian experience and slows traffic	●	●	●	●
Signs	Communicate traffic rules and regulate behavior	●	●	●	●
Raised Medians	Manage access and reduce conflicting movements. Can accommodate pedestrian crossings.		●	●	●
Red curb painting & daylighting	Reinforce that parking is not allowed near intersections and driveways to improve road users visibility	●	●	●	●
Raised crosswalks	Enhance pedestrian visibility, slow traffic, and improve ADA access	●	●	●	
Raised intersections	Enhance pedestrian visibility, slow traffic, and improve ADA access	●	●	●	
Chicanes	Reduce effective roadway width and calm traffic	●	●		
Chokers	Reduce effective roadway width and calm traffic	●	●		
Diverters	Reduce conflicting movements and limit cut-through traffic	●	●	●	
Floating bus stops and bus extensions	Effectively narrow roadway and reduce bike and bus conflicts, enhances safety, speed, and reliability of transit	●	●	●	●
Speed humps, bumps, cushions, and tables	Reduce traffic speeds and cut-through traffic	●			
Traffic circles	Reduce collisions, slow speeds, and enhance safety	●			

Key: (●) Appropriate for Consideration

4.8.2. Guardrails and Traffic Barriers

Guardrail and other traffic barriers are usually part of a street design when certain street environment and/or roadside features are present. As such, they shall be designed in accordance with and to meet the requirements of the following manuals and design standards:

- AASHTO *Roadside Design Guide*
- FHWA *Barrier Guide for Low Volume and Low Speed Roads*
- WSDOT *Design Manual chapter 1610*

4.8.3. Bollards

Bollards can be used to prevent unauthorized vehicle access. However, bollards are not a traffic control or traffic redirecting device and have limited applications since their presence and usual proximity to the travel way introduces additional fixed objects within the right-of-way. The applicant shall work with City Engineer or designee if bollards are being suggested in a street or intersection design. Instances where bollards are usually permitted—primarily for access control—are associated with shared use paths, emergency/maintenance access, and to protect critical infrastructure. Bollards shall be timber unless otherwise approved by the City Engineer.

When designing the placement and type of bollard, the following generally apply:

Shared-Use Paths, Emergency/Maintenance Access

- The desirable design is to provide a single bollard (removable) with some type of locking mechanism (preferably at the top), installed in the middle of the path. A two-person (18-28 inches) or three-person rock (28-36 inches) placed on each side of the path may be necessary to fully restrict vehicular access. If multiple bollard posts are needed across a wider path (and only an odd number in total to ensure bi-directional traffic separation), 6-foot spacing between the edges of the bollards is required to permit passage of bicycle-towed trailers, mobility devices and adult tricycles, with room for bicycle passage without dismounting. Maximum spacing between edges of bollards should not exceed 8 feet as they may encourage access by unauthorized vehicles.
- Provide 5 feet minimum (6 feet desirable) clear width between the edge of a given bollard and the edge of the path.
- At a minimum, provide stopping sight distance (SSD) for trail user types to/from bollards. An ideal location for bollard placement is in a relatively straight area of the path where the post placement has adequate SSD.
- Bollards should be identifiable in daytime and nighttime through the use of coloring/object markings—per the guidance of the MUTCD—and reflective surfacing/banding as advised from the MUTCD or Chapter 7 of this manual.
- Design all bollards along a corridor to be uniform in appearance.
- Non-removable bollards may be used where vehicular/maintenance access is not needed or allowed.

Bollards within Street ROW

- Bollards, when authorized for use in the ROW, shall be designed with an improved streetscape and to allow for the material to yield/fail when struck at speeds in excess of what would be typically expected in a parking lot (i.e., 15 mph).

- Bollards should not be used where the streetside edge has not been defined with vertical curbing. Instead, vertical curbing and/or possibly other alternatives or design solutions should be evaluated to identify/direct traffic away from/around the area of concern.

SECTION 4.9 Street Amenities and Additional Design Features

Subsection 4.4.6.2 outlines the required widths of the sidewalk, amenity zone, and recovery zone. This section focuses on the many design features that may be included within the amenity or recovery zone.

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, electric vehicle charging stations, kiosks, and public art.

Amenities Belong in the Amenity Zone

When designing for pedestrian mobility, the designer shall avoid installing any new amenity appurtenances within the defined pedestrian access route. The designer shall relocate, avoid, or mitigate the impact to the sidewalk.

The public right-of-way, including sidewalks and amenity zones, shall not be manipulated to meet private property needs at the cost of creating insufficient mobility facilities that reduce accessibility and comfort for pedestrians who walk and roll.

4.9.1. Amenity Zone Features

The amenity zone can accommodate 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, and traffic circulation. There should also be considerations for creating great public spaces, increasing visibility and visual interest, and welcoming people to use public space.

Various objects (including potential infrastructure equipment such as streetlight poles, electric vehicle charging stations, and similar), sidewalk cafes, and landscaping placed in the amenity zone should not encroach upon the sidewalk zone. Where load zones for accessible transportation including transit and/or ADA parking spaces are provided, the amenity zone should be clear of obstacles that might impede the loading, unloading and movement of persons with disabilities.

4.9.2. Planting Areas and Street Trees

In accordance with City policies to establish a healthy and diverse urban forest, as defined in the Urban Forest Policy Element of the Comprehensive Plan, refer to the Urban Forest Manual (UFM) for standards that apply to all trees required by TMC 13.06.090.B. For regulations pertaining to trees located within the public right-of-way, see TMC 9.20 Urban Forestry. Planting areas/raised planter boxes may be part of the amenity zone. They are typically located between the curb or street edge and sidewalk. In certain circumstances, they may be allowed behind the sidewalk. In order to provide buffer between pedestrians and vehicles, retaining a planting area between the street and sidewalk is a priority. While amenity zones may be hardscaped, planting areas are not allowed to be paved and shall be depaved upon

redevelopment. Basic design elements for a planting area include the following, and may be subject to review and approval via permit and/or by the City Engineer or designee:

- Soil: 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 level with 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: Plant 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. Information about raised planter boxes is available from the City's Planning & Development Services Department or via their permitting website.
- Mulch: Organic wood chip mulch and/or permeable inorganic mulch. Finished grade after mulch application shall be level with the adjacent pavement surface or curb.

4.9.3. Signage

Signage is an essential component of the streets for providing traffic control, wayfinding, as well as visual cues to all road users. A number of sign standards are applicable within the City, including the MUTCD, AASHTO, City Standard Plans, neighborhood business district standards and applicable elements from Chapter 7. Whenever possible, and as long as consistent with design standards, signs/sign posts shall be placed within the amenity zone and separated from the pedestrian access route.

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 Traffic Engineer. See Chapter 10 for more information regarding bicycle route signage.

4.9.4. Stairs, Ramps, Fences, Handrails, and Guards

New and/or replaced stairs, ramps, fences, handrails, and guards, for explicit private property use, shall be installed and fully contained on private property. The public right-of-way shall not be manipulated for private benefit. When using stairs, ramps, fences, handrails and guards to comply with codes and/or connect private property to the public right-of-way, the sidewalk grades and other public spaces shall not be manipulated unless they benefit the public.

Where no feasible design alternative is available and a new and/or existing appurtenances (mentioned above) is needed for private use, it may be allowed within the ROW, if approved in writing via a variance by the appropriate City officials. Existing private improvements within the ROW shall be subject to a Right-of-Way Occupancy Permit and other permit(s) for construction of the improvement, as applicable.

Appurtenances, such as those mentioned above, that are for public benefit and placed in the ROW shall meet all applicable ADA, PROWAG and other federal, state and local requirements and be considered amenities. Construction of amenities shall be no closer than 2 feet behind the back of existing or future sidewalk. The designer should consider the future alignment of the roadway, curbing and sidewalk if none is present at the time of design. At no point shall amenities be placed closer than 2 feet from the edge of roadway, without prior approval.

Refer to Chapter 8, as well as, City Standard Plans SU-10 (stairs) and SU-11 (handrails/handrail guard combination) for more information.

4.9.5. Street Furniture

Street furniture such as benches, kiosks, lighting, bicycle racks, trash receptacles, etc.; support an inviting and comfortable pedestrian environment and can contribute to a neighborhood's identity and character. If identified by permit requirements or noted on the plans, the designer shall incorporate street furniture into their design. It is vital that street furniture be placed appropriately so as not to compromise ADA access or the pedestrian accessible route. Street furniture shall be placed in the amenity zone.

Several neighborhood business districts have developed streetscape design plans that identify a street furniture palette, which should be referred to when making streetscape improvements. For more information on acceptable street furniture fixtures and finishes see the Tacoma Downtown Streetscape Study and Design Concepts. The designer shall contact the City's Planning and Development Services Department (Land Use section), ADA, commercial site review when required to provide street furniture. For more information on street furniture requirements see TMC 13.06 and see Chapter 5 for more information about pedestrian lighting.

4.9.6. Bus/Transit Stops and Transit Routes

Prior to applying for City permits for any development impacting existing transit stops and routes, the design engineer is responsible for a preliminary design according to the guidance from the appropriate transit agencies with the City's concurrence. The City can help the design engineer with contact information for the appropriate transit agencies upon request. Depending on the size and use of the development, the developer may be required to cover the costs of transit amenities as part of their off-site improvement requirements. To achieve maximum safety and efficiency, bus/transit stop locations (and associated access zone) are restricted and controlled, through coordination of the design engineer, City, and the transit agency.

Bus Stops: Leading and rear boarding pads that are a minimum 7-foot by 8-foot clear area (with the 8-foot dimension extending laterally from the curb) must be provided at bus stops placed within the amenity/sidewalk zone to meet Federal/State/Local requirements and standards—see City of Tacoma Standard Plans SU-38 & SU-39. Shelter and bench pads may also be required.

Accessible ROW Access to Transit: In addition to the boarding/alighting area, private developments may be required to provide an accessible route that connects a site to the closest bus/transit stop(s). Additionally, the development may be required to upgrade crossing(s) with safety and accessibility improvements (i.e. pedestrian signal, RRFB, curb ramps, pedestrian refuge island) to enhance safety for pedestrians accessing the bus/transit stop.

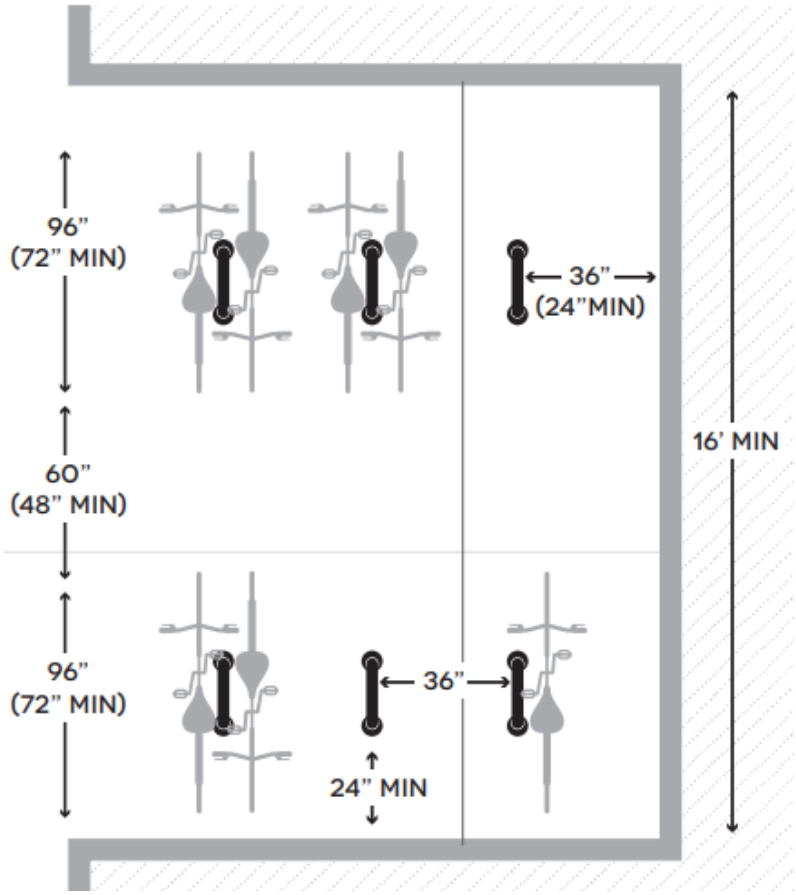
4.9.7. Bicycle Parking

The City requires long- and short-term bicycle/bike parking in association with certain development activities (see TMC 13.06). The City also installs bike parking in the public right-of-way – including the amenity zone and parking lane – to support active transportation access. The location of bike parking shall be designed/positioned to account for parked bicycles relative to adjacent roadway and other spaces reserved for pedestrians and other amenity zone elements.

When installing bike racks adjacent to sidewalks, provide ample space so that bikes do not overhang the pedestrian accessible route. The size of a typical bicycle is 6’ long by 2’ wide, while cargo bikes and those with trailers require 10’ of length or greater. Design plans shall include a general layout for bike racks, as well as, dimensions for bike spaces and relative to other street features.

Figure 4-16 Here is an example of a general layout with the desired dimensions listed first and the minimum dimensions in parentheses.

Figure 4-16: Bike Rack Dimensions



4.9.8. Mailboxes

The designer/applicant must contact the Inspector Postmaster General at the local/regional United States Postal Service (USPS) office serving the area in order to determine the postal requirements regarding mailbox access, but also must reconcile potentially conflicting City design requirements for the sidewalk/pedestrian access route and the planned roadway cross-section. The clear width of the sidewalk cannot be reduced to less than the City minimum (see Subsection 4.4.6) and mailboxes (including Neighborhood Delivery/Collection Box Units, “mailbox clusters“) may not protrude into the pedestrian accessible route of the sidewalk in accordance with PROWAG. Mailboxes shall be shown in the design’s plan view, including their

effective occupied space relative to the post and indicating the height of the mailbox above the finished surface.

Existing mail delivery approaches may need to be reconciled due to planned changes to the street cross-section or sidewalk/amenity zone. In areas of combination sidewalk, where mailboxes are required to be adjacent to the curb, the designer shall make every effort to provide 2 feet of additional and continuous sidewalk width or provide a continuous small amenity zone in which to place the mailboxes rather than meander the sidewalk around each mailbox. If the sidewalk is widened to accommodate mailboxes at the back of curb, the designer shall address protruding elements as defined by PROWAG. Mailbox clusters and those centrally located for a neighborhood shall allow for access by pedestrians with physical disabilities, as well as being located to avoid hindering any sight lines associated with a nearby intersection or driveway.

4.9.9. Sidewalk Cafes

Sidewalk cafes on City streets can be a great way to encourage walking, add vitality to the street, and promote local economic development. Sidewalk seating associated with an adjacent business requires a Right-of-Way Occupancy Permit for Sidewalk Cafes. Refer to the Sidewalk Cafe Tip Sheet for more information about permanent sidewalk cafes. Sidewalk cafes shall maintain the horizontal alignment of the sidewalk and minimum sidewalk widths as shown in Section 4.4.6. Sidewalk cafes must also provide access for people with disabilities in compliance with the American with Disabilities Act.

4.9.10. 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. Art installations must also be reviewed by staff from the Transportation Division as well as the City's ADA Coordinator prior to final approval.

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 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. In the event of damage or removal/relocation, the public art must be identified with a City point of contact (e.g. Arts Coordinator) to address the needs.

4.9.11. Solid Waste Collection

Permanent storage of solid waste bins in the ROW is not allowed. However, solid waste collection may be temporarily located within the right of way given it does not impede vehicle parking, pedestrian facilities, drive lanes, emergency vehicle access, loading zones, and bike lanes. Spacing for collection bins must be identified as part of design showing the required clearance (in feet) around automated side load containers when placed out for service, see TMC 12.09 for more information. Careful attention must be given to the collection surface and

slopes; waste bins do not have wheelstops and therefore the maximum running and cross slope of the collection area is 2%. In addition, some waste bins must be rolled to the refuse truck for loading. In those cases, careful attention must be given to ensure that waste bins can negotiate slopes and turning spaces.

- For automated side-load containers a 4 feet clearance around the containers and 16 feet overhead clearance is required in the area they are serviced.
- For front-load containers, a 3 feet clearance around the containers and 22 feet overhead clearance is required in the area they are serviced.
- For roll-off containers a 3 feet clearance around the container and 24 feet overhead clearance is required in the area where it is loaded.
- If the container/compactor is on a loading dock/elevated pad, then it changes the overhead height depending on the height of the loading dock/elevated pad. The loading dock/elevated pad cannot exceed 43 inches in height.

For information related to source control (leakage) from solid waste containers, see the 2021 SWMM Volume 6, Section 2.2.4.

4.9.12. Utilities

Utilities of all kinds need to be accommodated within the public ROW, whether in the roadway, amenity zone and recovery zone. The following points should be considered as well as consulting with the utilities in the project area. See City Standard Plans DR-04 and DR-05 for information concerning standard vertical and horizontal locations for utilities. See Chapter 11 for additional information around wastewater and stormwater design. See Chapter 12 for additional information around water design.

- Whenever feasible, utilities and municipal infrastructure should be placed within alleys.

- Utility poles and other utility-related structures should typically be placed within the amenity zone.

- If utilities cannot be located within the amenity zone, the preference for their placement is as follows:

    1. Behind the back of sidewalk
    2. Bulb out the curb to create space – this can also create space for tree planting and offer traffic calming benefits
    3. Private property (with required easements)

- New utility appurtenances are not allowed in sidewalks unless it is technically infeasible to locate them elsewhere; an approved maximum extent feasible justification is required prior to design completion. Non-slip utility covers meeting or exceeding a coefficient of friction of 0.6 shall be required when avoidance/relocation is not possible.

- 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 with Tacoma Power's Transmission and Distribution.

SECTION 4.10 Walls

Walls are classified by ownership as either public or private and require engineering for heights over 4 feet or when supporting a surcharge (load above the wall), that is in addition to the earth retained by the wall. For the purposes of this manual and as it pertains to permitting TMC 2, a wall that is under 4 feet in total height is defined as a landscape wall when it supports no surcharge. . A wall that is over 4 feet in total height is defined as a retaining wall. A retaining wall shall be designed by an engineer and shall meet all criteria set forth in this section and TMC 2.0.

4.10.1. Retaining Walls

As defined by the WSDOT Bridge Design Manual, a retaining wall is a structure built to provide lateral support for a mass of earth or other material where a grade separation is required. For their stability, retaining walls depend either on their own weight, their own weight plus the additional weight of laterally supported material, or on a tieback system. Additional information is provided in the WSDOT Geotechnical Design Manual chapter pertaining to retaining walls.

A **public retaining wall** was or is constructed for the public benefit under public contract or work order entirely located in the public right-of-way or contained in a dedicated public easement. A public retaining wall supports fill material from the remainder of the public right-of-way and potentially from adjoining private property. These public walls prevent material from entering further into the public right-of-way.

A **private retaining wall** is a wall that is entirely located on private property.

The face of any wall shall be constructed no closer than 2 feet from the back of the sidewalk or future back of sidewalk. When designing the wall, care should be taken by the design engineer to ensure the safety of both vehicular and pedestrian traffic. New private walls including the wall footing shall be located at or behind the property line on private property, including the vertical load zone of influence. Under no circumstance shall retaining walls solely for private benefit be constructed in the public right-of-way. The City Engineer shall have the final determination on materials and aesthetics of any public retaining wall.

Walls are exempt from permit per TMC 2.02.090 given the following is applicable:

- The wall is less than 4 feet in height, as measured from the bottom of the footing to the top of the wall, unless the wall is supporting a surcharge or impounding Class I, II or III-A liquids. A fence supported by a retaining wall shall be considered a surcharge.

Retaining walls shall be designed to account for all active loads, passive loads, and all possible surcharge loads as described by the IBC for a risk level 3 specific to a design life of 100 years. A **surcharge** is defined as the vertical load imposed on retained soil that may impose a lateral force in addition to lateral earth pressure of retained soil. Additional design considerations shall be considered for traffic loads as specified by AASHTO and seismic loads as specified by ASCE 7-16. Structural analysis is required for wall penetrations.

If construction including excavation is proposed adjacent to an existing retaining wall, a monitoring plan and subsequent monitoring as defined during and after construction is required by a licensed geotechnical engineer.

For any existing walls supporting right of way determined to be no longer necessary as part of a new permitted structure, the top portion of the existing wall shall be removed to a depth equal to

the deepest utility. This removal is required so the abandoned wall does not impede future utility reconstruction or utility connections. At no point will this depth be less than 4 feet.

4.10.2. Engineered Retaining Wall

As defined above, in areas where a wall will be supporting a surcharge from an adjacent area and/or 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 Load:	45,000 lbs

** Concentrated loading for sidewalks shall be distributed as specified in Table 1607.1 of the 2021 International Building Code (IBC).*

***Where firetruck or other utility truck loading is applicable, the design must account for firetruck or other utility truck concentrated loads associated with the downriggers or other point loads*.

4.10.2.1. Typical Section Detail and Plan Information

A typical section detail shall be provided for each retaining wall that includes all design information necessary to construct the wall. If a retaining wall has multiple cut/fill segments along its alignment, a section detail shall be provided for each segment.

Careful consideration of right-of-way infrastructure is paramount. Providing adequate information to the section detail will better ensure safe wall construction and protection of public/private infrastructure. The design engineer should account for the wall footing, face of wall, and back of wall when setting the horizontal location of the wall. When a wall batter is used, the back of wall at the farthest point shall be shown in plan view.

Typical section detail information shall include:

- Backfill material behind wall
- Wall drainage elements
- Existing and proposed utilities located in the general vicinity including equipment/infrastructure, e.g., poles, fire hydrants, junction boxes
- Influence zone of the wall footing
- Wall batter and dimension to back of wall at highest wall elevation
- Cut/fill slope behind wall
- Temporary excavation slope required to install the wall
- Property line dimension to the wall if applicable
- Dimension distance from the back of existing sidewalk (or property line when no sidewalk is present)

- Nearby buildings
- Maximum wall height dimension
- General wall dimensions and elevations

4.10.2.2. Retaining Wall Drainage

Retaining wall underdrains are required for all walls that are over 4 feet in total height and/or as identified by the design engineer. The use of granular backfill material, such as WSDOT Specification 9-03.12(2) Gravel Backfill for Walls or approved equivalent shall be utilized. Retaining wall drainage shall utilize weepholes or perforated pipe.

Weepholes penetrate the retaining wall and drain the area immediately behind the wall. Weepholes should have a minimum diameter two inches and should be approximately 36 to 48 inches apart to provide adequate drainage behind the wall. A geotextile filter fabric shall be used between the backfill soils and the weephole opening. Weepholes are not allowed when the wall is located adjacent to a sidewalk.

Perforated pipe shall have a 4-inch minimum diameter, or greater by design, and shall be placed in a shallow excavated trench located adjacent to the wall footing. The pipe shall be bedded on and surrounded with granular backfill material, such as WSDOT Specification 9-03.12(2) Gravel Backfill for Walls to a minimum height of 18 inches above the bottom of the pipe. A geotextile filter fabric shall surround the gravel backfill and shall have a minimum of 1 foot overlap along the top surface of the gravel. The perforated pipe shall be connected to a storm drain system or to an acceptable outfall.

4.10.2.3. Inspections, Reports and Acceptance

Retaining walls shall be constructed to meet the requirements set forth by WSDOT Standard Specifications - Division 6. Final acceptance of the retaining wall shall be determined by the inspector or City Engineer.

Retaining walls shall be constructed with fabrication/construction tolerances set forth by WSDOT Standard Specifications - Division 6, WSDOT Bridge Design Manual, and WSDOT Geotechnical Design Manual.

Typical wall inspections shall be completed by a third-party agency with observations by the City inspector. Inspections shall be conducted for the following:

- Subgrade shall be compacted to 95 percent
- Backfill shall be compacted to 95 percent
- Subgrade and backfill material shall be submitted and meet Project Specifications prior to installation.
- Tolerances as noted in the Section 4.10.2.4
- Wall drainage elements
- Horizontal wall placement

As required by the City Engineer, final acceptance of the constructed retaining wall may require a 1-year monitoring period to ensure the wall meets the required construction tolerances. Additionally, the geotechnical/structural engineer, for the project, shall evaluate the constructed wall to ensure it has been constructed per plan. A stamped acceptance letter from a geotechnical engineer/structural engineer of record shall be provided indicating the wall has been constructed per the approved plan and meets all City requirements.

During construction, the Geotechnical/Structural Engineer of record shall conduct daily observations and provide the City with a **Special Inspection Report**. The report shall include digital photos of wall construction, documentation of subgrade compaction, installation of wall drainage and backfill, wall batter, installation of geogrid or tie-backs, wall stability, and general observations that the wall has been constructed per plan.

When encountering an existing wall or vaulted sidewalk located in the public right-of-way, the conditions of the vaulted sidewalk and any associated retaining walls shall be evaluated by a structural engineer. A report, stamped by a structural engineer shall be provided to the City documenting the condition with any recommendations for repair or replacement. All recommended repairs or replacements shall be considered part of any off-site improvement requirements.

4.10.2.4. Tolerances

Retaining walls shall be constructed with fabrication/construction tolerances set forth by WSDOT Standard Specifications - Division 6, WSDOT Bridge Design Manual and WSDOT Geotechnical Design Manual.

Unless noted otherwise, walls shall be constructed in accordance with the following criteria:

- Deviation from plane: ±0.5 inch in 10 feet
- Deviation from plumb or specified batter: ±0.5 inch in 10 feet, but not to exceed a total of ±1.5 inch
- Length, width and thickness of wall elements including dimensions to construction joints in initial placements: +0.5 inch, -0.25 inch
- Length, width and thickness of spread footing foundations: +2 inches, -0.5 inch
- Horizontal location of the as-placed edge of spread footing foundations: The greater of ±2% of the horizontal dimension of the foundation perpendicular to the edge and ±0.5 inch. However, the tolerance shall not exceed ±2 inch
- Cross-sectional dimensions of opening: ±0.5 inch
- For any individual segmental block: ±1/2 inch for length, width tolerance of plus ½ inch and minus ¾ inch and a tolerance of ±1/4 inch shall be used for height

4.10.3. Rock Wall

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 the adjacent area or improvements.

Rock walls over 4 feet in height, as measured from the bottom of the footing to top of the wall, shall be designed by a professional licensed by the State of Washington to perform the associated work and approved by the City. Rock walls over 4 feet in height shall not be used in City right-of-way nor to support elements of the City right-of-way.

4.10.4. Temporary Retaining Walls

As defined by the WSDOT Bridge Design Manual, temporary retaining walls are defined as walls that are in service or have a design life of three years or less. Any retaining wall that is expected to be in service for more than three years shall be designed for seismic loading. Temporary retaining walls shall be designed in accordance with the requirements of the current editions of the LRFD-BDS and interims, WSDOT *Bridge Design Manual* including all design memorandums, and the WSDOT Geotechnical Design Manual chapter pertaining to retaining walls.

If existing utilities are anticipated in the nearby vicinity, additional inspections such as potholing and/or ground penetrating radar are required to ensure proper clearances are maintained. See Chapter 11 for required clearances from existing utilities.

Temporary (shoring) walls are considered engineered retaining walls and shall be permitted and designed to the requirements for loading as noted in Section 4.10.2 of this chapter.

Any permitted temporary (shoring) walls that impact the right-of-way shall require a ROCC permit. Temporary (shoring) walls upon completion of the work shall be removed from the right-of-way. Certain temporary wall elements may be left in place, if the structural engineer of record can, under license seal, state in writing the elements abandoned (e.g., soil nails, tie backs) can be removed without special consideration or equipment. The letter will indicate removal will have no adverse impacts to the structure that was constructed using the temporary (shoring) walls and is no longer necessary for structural support.

4.10.5. Temporary Cut Slopes

As indicated in the WSDOT Geotechnical Design Manual, temporary cut slopes are used extensively in construction due to the ease of construction and low costs. Since the contractor has control of the construction operations, the contractor is responsible for the stability of cut slopes, as well as, the safety of the excavations.

WAC 296-115 presents maximum allowable temporary cut slope inclinations based on soil or rock type, as shown in **Table 4.15** - WAC 296-115 also presents typical sections for compound slopes and slopes combined with trench boxes. The allowable slopes presented in the WAC are applicable to cuts 20 feet or less in height. The WAC requires that slope inclinations steeper than those specified by the WAC or greater than 20 feet in height must be designed by a geotechnical engineer.

For more information see WSDOT Geotechnical Design Manual.

Table 4.15 - WAC 296-115 Allowable Temporary Cut Slopes

Soil or Rock Type	Maximum Allowable Temporary Cut Slopes (20 feet maximum height)
Stable Rock	Vertical
Type A Soil	¾H:1V
Type B Soil	1H:1V
Type C Soil	1½H:1

5 Chapter 5 Illumination

INTRODUCTION

Illumination 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.

TMC 13.04, 13.06(A), and 13.07 provide regulatory authority for street lighting for new plats; illumination within certain zoning districts; and street lighting within landmarks and historic special review and conservation districts respectively. TMC 10.14 and 10.22 provide regulatory authority for streetlight provisions when placing or relocating driveways and when working in the ROW in general. When TMC requirements trigger offsite improvements, street lighting will also be addressed as a part of these improvements. This includes but is 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 Traffic 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 Traffic 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 street lighting 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 street lighting, the permitting, design, and construction elements are an integral part of the ROW Construction/Work Order Permit, a Local Improvement District project, or a specific Capital Delivery project as applicable. Third-party design and implementation of City-owned streetlight infrastructure must be closely coordinated with Traffic Engineering throughout the process and shall conform to the design requirements in this section.

SECTION 5.1 Illumination in the ROW

5.1.1. Construction and Inspection

Unless changed through a formal agreement, streetlights in the public ROW shall be owned and maintained by the City. Lighting along private streets and other lighting

outside of the public ROW shall be owned and maintained by the property owners or association.

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

All electrical work in the ROW shall be performed by 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 underground streetlight utilities as a part of the one-call service at 811.

The contractor shall notify the City Streetlight Inspection staff 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.

5.1.2. Project Completion

Before project closeout, the City will notify the applicant that the final inspection has passed and that the City has found the street lighting complete and operational. At this time, the ownership, operation and maintenance of the public lights shall transfer to the City.

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

SECTION 5.2 Illumination Plans

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

Plan sheets for a ROW Construction/Work Order Permits involving illumination shall show all existing features and identify all pavement removal. The plans shall provide a lighting layout plan and show all applicable details on the plan. Details include but are not limited to:

- Location of sidewalks, curb ramps, and other proposed roadway features;
- Above- and below-ground utilities;
- Street trees to remain;
- General, wire, and pole notes;
- Service connections coordinated with Traffic Engineering;
- Any intersection signalization; and
- Proposed location of junction boxes.

Where applicable, the plan shall also provide a service/circuit schematic and wiring diagram, and wiring and illumination pole schedules (complete with foundation, mounting, and fixture information).

SECTION 5.3 Illumination Design

Illumination design has evolved over time. The existing illumination in the project area shall be assessed in relation to current design practices.

Illumination in the ROW must meet design criteria described in the latest version of Illuminating Engineering Society of North America's (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 designing a bicycle or shared-use path as a separate facility (reference CHAPTER 10), areas of low pedestrian conflict shall have a uniformity ratio of 4:1 or better along the path. Where the path intersects a roadway of any classification, the uniformity ratio shall not be less than 3:1. All other design criteria for paths constructed as a separate facility shall be in conformance with the IESNA RP-8 or AASHTO's Roadway Lighting Design Guide as stated above.

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 Engineering section.

5.3.1. 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:

5.3.1.1. 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. For these areas, 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.

5.3.1.2. 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.

5.3.1.3. 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.

5.3.1.4. 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.

5.3.1.5. 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 5-1, lighting in the ROW shall meet the following BUG ratings where adjacent to the following LZs. For projects spanning multiple LZs, consult with Traffic Engineering to determine rating. Additional back cut-offs/shields shall only be utilized as allowed by Traffic Engineering and per manufacturer's recommendations.

Table 5-1: BUG Ratings

Lighting Zone	Examples	Maximum BUG Rating	
		Cobraheads and Overhead	Ornamental Lighting
LZ0	Nature preserves, wilderness areas	Not Applicable within Tacoma	
LZ1	Low-density residential	B1-U0-G1	B1-U3-G1
LZ2	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
LZ3	City-defined business districts and downtown; and Areas around Tacoma Mall, transit centers, and major public facilities.	B3-U1-G3	B3-U3-G3
LZ4	Theater District and Dome District vicinities	B3-U1-G3	B3-U4-G3

5.3.2. 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.

5.3.3. 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 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 General Special Provisions 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.
  - No shrouds shall be allowed at the base of pole.

- 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 existing fixtures, LED lights shall be used unless otherwise approved by the City Traffic Engineer. Due to the rapidly evolving LED market, please contact Traffic Engineering for a current list of acceptable fixtures. 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 for overhead cobrahead lighting)
    - Fusing at the base is reserved for installations which cannot accommodate in-head fuses such as ornamental light standards

Fixture optics shall meet the following criteria:

- Color correlated temperature from 4000 K to 5300 K
- Minimum color rendering index of 70
- See Section 3.1 for BUG ratings

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.

5.3.3.1. Pedestrian Ornamental Light

The standard pedestrian-scale ornamental light consists of an exposed-aggregate concrete post (13 feet, direct bury with 3 inch 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 neighborhood 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 in these areas 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.

5.3.4. Conduit and Electrical Design

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

All streetlight conductors shall meet the requirements of Section 9-29 of the WSDOT Standard Specifications 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 Polyvinyl Chloride (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 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.

Voltage drop calculations shall be provided for each lighting circuit. Each streetlight circuit should have a maximum of 20 lights unless otherwise approved. Wire shall be maximum #6 gauge 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 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 5.4 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.

All electrical services must conform to National Electrical Code and the WSDOT Standard Specifications as supplemented or amended by the Washington State Chapter of APWA or the

City of Tacoma General Special Provisions. A preapproved list of equipment can be obtained from Traffic Engineering.

6 Chapter 6 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 ROW 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 and Title 11 establish additional authority for permitting and specific uses of these facilities in the City.

Third-party design and implementation of City-owned traffic signal infrastructure must be closely coordinated with Traffic Engineering throughout the process.

Private and public projects shall follow the design requirements and policy stated and referenced herein.

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

For all construction involving arterial roadways and/or curb ramps, a pre-design meeting with Traffic Engineering and the ADA Coordinator is required to discuss accessible pedestrian signals (APS) (e.g., pushbutton) needs and potential issues between pedestrian circulation and electrical equipment.

SECTION 6.1 Permitting for Warning Beacons and Traffic Signalization

6.1.1. Construction and Inspection

All construction shall be in conformance with National Electric Code and the WSDOT Standard Specifications 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.

6.1.2. Project Completion

The applicant shall provide warranty(s) for all electrical and mechanical equipment, and strain poles and signal standards for satisfactory 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 6.2 Traffic Signalization Plans

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

Plan sheets for a ROW Construction/Work Order Permits 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 6.3 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. Construction and material details concerning signalization design are contained in Section 8-20 and 9-29 of the WSDOT Standard Specifications as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions.

6.3.1. 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 percent 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 located within 3 feet of the curb face or 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 located 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 face is not feasible, all pushbuttons shall be mounted within 10 feet of the curb face. See Section 6.3.4 of this chapter 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.

6.3.2. Typical Signal Displays

Traffic signal displays must conform to the WSDOT Standard Specifications as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions, and other applicable 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 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.

6.3.3. Vehicular Detection Systems

New detection systems should be non-intrusive and aerial-mounted, selected in coordination with the City Traffic Engineering section. 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 as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions.

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 Incorporated system are the preferred replacements to induction loops when non-intrusive systems cannot be used. Loops shall be placed only in new asphalt, new 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 Traffic Engineering at (253) 573-2332 to discuss this topic.

When Sensys Networks Incorporated 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.

6.3.4. Pedestrian Systems

When prescribed by City ADA policy and PROWAG, new pedestrian systems shall be fully compliant with MUTCD and PROWAG APS requirements. See CHAPTER 8 for additional information about ADA and pedestrian facility design.

As stated in Section 6.3.1 of this chapter, pole and support locations shall allow for pedestrian pushbuttons to be located per MUTCD and ADA standards. For optimal maintenance and use:

- Pushbutton posts shall be located 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 greater than 10 feet from the curb face will not be allowed.
- Pushbuttons shall be located within 5 feet of the extension of the crosswalk line and within reach of an ADA-compliant clear space, see CHAPTER 8.
- Target height is 3.5 feet above grade; 4 feet is the maximum height.
- All pushbuttons shall be oriented with the face of pushbutton and sign assembly parallel to the corresponding crosswalk
- New pedestrian signage at the pushbutton shall include MUTCD's R10-3b sign at 9 inches by 12 inches.

The new APS system must be programmable and 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.

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.

6.3.5. 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 Engineering section.

6.3.6. Conduit System

Conduit must conform to the WSDOT Standard Specifications 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.

6.3.7. Junction Boxes

Junction boxes shall meet the requirements of Section 9-29 of the WSDOT Standard Specifications 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. If a heavy duty junction box is proposed within a sidewalk section, a meeting with Traffic Engineering and ADA Coordinator is required to coordinate its location in relation to the PAR.
- 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. Junction boxes should be kept outside of the PAR but still adjacent the sidewalk or other paved surface. Any junction box located in the PAR must have an ADA slip-resistant lid as defined by applicable 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.

6.3.8. Wire Specifications

All traffic signal and streetlight conductors and cable shall meet the requirements of Section 9-29.3 of the WSDOT Standard Specifications 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 5-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 5 section signal 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 2 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 are 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.

6.3.9. 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 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 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. The location and orientation of the cabinet shall allow for a clear view of the intersection while the technician is working and shall not allow the open cabinet door to interfere with pedestrian circulation or otherwise cause a potential hazard to the signal technician and the public.

An uninterruptible power supply battery backup system will be installed at signals within 300 feet of rail lines, along school walking routes, and at other high volume and high risk locations as determined by the City Traffic Engineer. See the City of Tacoma General Special Provisions for additional cabinet requirements.

6.3.10. 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 6.4 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 Traffic Engineering.

6.4.1. 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 Traffic Engineering 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.

6.4.2. 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 yellow warning beacons. Selection of mounting equipment and posts should be coordinated with Traffic Engineering and the City Signal Shop.

SECTION 6.5 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.

All electrical services must conform to National Electrical Code and the WSDOT Standard Specifications as supplemented or amended by the Washington State Chapter of APWA or the City of Tacoma General Special Provisions. A preapproved list of equipment can be obtained from Traffic Engineering.

7 Chapter 7 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 chapter 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. It supplements the guidance found in the latest edition of the MUTCD as adopted and amended by WAC 468-95.

SECTION 7.1 Project Initiation

7.1.1. Project Scope

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

7.1.2. Identification of Design Elements

The design 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 4.2.3 for information concerning the determination of the design speed. The design 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 Sections 8-22 and 9-34 of WSDOT Standard Specifications.
  - Stop lines (bars), crosswalk lines, symbols, and word markings shall be thermoplastic, with the type (either A, B, C, D per Section 9-34 of WSDOT Standard Specifications) specified for the project. Use of Type C or D thermoplastic may not be permitted for certain applications.
- 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 Plans).

- 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 Plans.
  - Generally, all sign posts are to be 2 inch square perforated metal in accordance with City Standard Plans but otherwise shall meet the requirements of Sections 8-21 and Section 9-28 of WSDOT Standard Specifications.
  - Placement of new signs that can take advantage of available City-owned streetlight poles is preferred (with prior approval from Traffic Engineering). 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 owned by parties (e.g., Tacoma Public Utilities) other than the City.

7.1.3. Design Coordination

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

The design engineer/designer shall coordinate their efforts with other disciplines within the project (e.g., civil, traffic signal, landscaping, street lighting) 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 (e.g., lane shifts), roadway tapers, and lane reduction tapers for the speed ranges shown below :

  $L\ (\text{minimum}) = \frac{W(S^2)}{60}$ [less than 45 mph]

  $L\ (\text{minimum}) = WS$ [45 mph or greater]

  Where:
  L = length of deflection/taper in feet (as measured along roadway),
  S = posted speed in mph, and
  W = lateral shift in feet

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

SECTION 7.2 Documentation of Conditions

7.2.1. Site Visit

A site visit by the design 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.

7.2.2. Inventory of Existing Elements

As part of the site visit, the design 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; evidence, 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.) and determination 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; and
- Sign post type/material, foundation type, and mounting height of sign(s) as measured to the bottom of the sign.

7.2.3. 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 7.3 Plans Preparation

7.3.1. General Requirements

The design engineer/designer should refer to CHAPTER 3 for the standard requirements relating to the plan format. The channelization/signing plan sheets should be able to 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 (if applicable) 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 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.

7.3.2. Plan Sheet Content

At a minimum, the following items are expected to be included within the channelization/signing plan set (see CHAPTER 3 for additional details):

1. City of Tacoma Channelization and Signing General Notes (see Attachments 7-1 and 7-2.)
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 the new project limits meet the existing improvements
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.*

7.3.3. Design Guidance

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

7.3.3.1. Crosswalk Installation

In particular, guidance for when marked crosswalks may be installed at uncontrolled locations is shown in the Table 7-1. 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 Table 7-1 are general recommendations. Good engineering judgment should be used, and ADA/PROWAG needs and/or implications should be considered in individual cases for deciding where to propose/install crosswalks.

Table 7-1: 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) / **Total Lanes**	≤30	35	40	≤30	35	40	≤30	35	40	≤30	35	40
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 = Needs more treatment beyond just marking the crosswalk 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 Policy

7.3.3.2. 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 City's Traffic Engineering section to determine what is applicable. 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.

7.3.3.3. Additional Treatments at Crosswalks

Marked crosswalks alone are typically 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 7-1.

SECTION 7.4 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; City Standard Plans; City of Tacoma Channelization and Signing General Notes (Attachments 7-1 and 7-2); and the MUTCD.

All pavement markings in 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 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 to Section 1-07.23 and 1-10 of the WSDOT Standard Specifications 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.

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 2).

SECTION 7.5 Non-Essential Signs

7.5.1. Description

Destination/wayfinding signs, cultural interest signs, memorial signs, and other similar signs are supplemental to other signing and shall 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 when requests are submitted for consideration by the City's Traffic Engineering Section. Advertising and private signs are not addressed herein, but instead are controlled by applicable City ordinances and state and federal regulations.

7.5.2. Historical and Honorary Street Names

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 pertaining to the Uniform Traffic Control Devices for Streets and Highways Manual.

7.5.3. Private Street Name Signs

The construction of private street name signs shall follow the City's standards (contact the City's Traffic Engineering Section). 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 conforming 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

7.5.4. Temporary Signs

Political signs and other temporary signs placed within the ROW are allowed according to the provisions of the TMC (see TMC 2.05.275 for information about Political Signs). Other temporary signs not explicitly addressed by the TMC are not permitted within the ROW.

7.5.5. 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 Neighborhood and Community Services Department.

When the City Council adopts an act or resolution memorializing or dedicating a highway, bridge, or other highway component, the associated memorial or dedication signs shall meet the requirements of Section 2M.10 of the MUTCD.

7.5.6. Gateway and Neighborhood Signs

Neighborhood gateway signage plans are permitted on a case-by-case basis in consultation with the City's Traffic Engineering Section.

7.5.7. 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.

7.5.7.1. 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

7.5.7.2. 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 onsite 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.

7.5.7.3. 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 above, 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.

7.5.7.4. 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.

7.5.7.5. 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

Attachment 7-1: City of Tacoma Channelization General Notes

The following general notes shall appear within the sheets comprising the channelization plans. Additional notes shall be added by the traffic designer as necessary to properly clarify the intent of the design.

1. The City of Tacoma Traffic Engineering section shall be notified at least three (3) business days prior to starting any striping work.
2. Unless otherwise specified, all pavement marking installations and removals shall conform to the requirements set forth in the City's specifications. Items not covered under the City specifications shall conform to the WSDOT/APWA Standard Specifications and the most recent edition of the Manual on Uniform Traffic Control Devices (MUTCD) as adopted and modified by Washington Administrative Code (WAC) 468-95.
3. Temporary traffic control shall conform to the most recent edition of the City of Tacoma Traffic Control Handbook, the MUTCD, and/or as directed by the City of Tacoma.
4. The Contractor shall be responsible for the layout and installation of the permanent pavement markings. Pavement marking dimensions are to the center of the stripe for single-line striping and to the center of the gap between the two lines for double-line striping. Where curb and gutter are present, dimensions are to the face of curb, or to the edge of pavement absent curb and gutter. The Contractor shall schedule inspection of the pavement marking layout at least three (3) business days prior to the installation of the permanent pavement marking. Inspection shall take place during daytime and on a business day prior to installation of permanent pavement markings. Any permanent pavement markings applied prior to field inspection by the Traffic Engineering section shall be removed and re-striped at the Contractor's expense.
5. The Contractor shall follow all dimensions, notes, details, and standards when installing pavement striping, markings, and markers. The channelization plans may be modified as directed by the City Traffic Engineer. The Contractor shall refer any questions concerning pavement markings to the Traffic Engineering section via the City's Construction Inspector for the project.
6. Generally, raised pavement markers (RPMs) shall be installed in conjunction with striping efforts and in accordance with City of Tacoma Standard Plans. Exceptions are possible; coordinate with the City's Traffic Engineering Section. All markers shall be installed so that the reflective face of each marker is facing the direction of approaching traffic and is perpendicular to the direction of traffic flow.
7. The Contractor shall remove all existing pavement markings and striping in conflict with the final striping plan by hydro-blasting or other approved noninvasive method. All removal methods shall be done in conformance with WSDOT/APWA Standard Specifications. If the removal damages the underlying pavement as described in the WSDOT/APWA Standard Specifications, then the pavement shall be restored to a state equaling or exceeding its previous state. If the obliteration causes shadowing (or "ghost" markings), or in the opinion of the City Traffic Engineer will cause confusion to drivers, the Contractor shall remedy through an approved means and method. Applying additional markings to obscure erroneous markings is not an

approved method for obliteration. Striping obliteration may need to exceed the project limits so that the new striping will match permanent existing pavement markings.

8. The Contractor shall clean the roadway surface to the satisfaction of the City by power broom, street sweeping, air jet blowing, and/or water jet/truck prior to the placement of all pavement markings unless directed otherwise. The road pavement surface conditions, including any pavement curing times, shall be in accordance with the WSDOT/APWA Standard Specifications prior to the application of permanent pavement markings.
9. Permanent pavement markings should be fully implemented before allowing public use of the roadway. Temporary pavement markings controlling traffic as intended by the permanent channelization plans may be permissible in the case where pavement conditions/materials preclude implementation of the permanent pavement markings until a later time. Temporary markings shall not be used any longer than necessary and no longer than one (1) month unless otherwise approved or mitigated, which may include a re-application of the temporary markings.

Attachment 7-2: City of Tacoma Signing General Notes

The following general notes shall appear within the sheets comprising the signing plans. Additional notes shall be added by the traffic designer as necessary to properly clarify the intent of the design.

1. The City of Tacoma Traffic Engineering Section shall be notified at least three (3) business days prior to starting any signing work.
2. Temporary traffic control shall conform to the most recent edition of the City of Tacoma Traffic Control Handbook, the MUTCD, and/or as directed by the City of Tacoma.
3. All signs shall conform to the MUTCD with respect to colors, shape, size, content, retroreflectivity, and placement relative to the roadway. All sign panels shall be 0.080-inch thick aluminum (non-recycled) with prismatic sheeting (Type IV or better, or as specified). Sign posts shall be 2-inch square perforated galvanized steel tubing per City Standard Plans, unless otherwise specified.
4. The Contractor shall submit all sign formats/layouts (with dimensions) to the City's Traffic Engineering Section for approval prior to fabrication.
5. Any traffic signs, including street name signs, which are in close proximity to an existing or proposed street light pole (confer with Traffic Engineering in advance for approval), shall be properly mounted to the pole instead of installing a new sign post. Any added expense relating to a need for different mounting hardware and/or equipment shall be the Contractor's responsibility. Prior to installation, sign locations and offsets may be adjusted by the City to improve visibility or safety.
6. Any existing signs that need to be removed as a result of construction, or due to conflict with installed signs, shall be done so by the Contractor at their expense. These signs shall be removed, protected, and stored for possible reinstallation by the Contractor or for salvaging and returning to the City. Signs damaged during construction shall be replaced at the Contractor's expense.
7. The Contractor shall ensure that at no time a traffic sign is installed in such a way as to be blocked by trees or vegetation, either existing or pending. All sign locations shall not interfere with pedestrian movement as defined by the Americans with Disabilities Act (ADA) and/or Public Rights-of-Way Accessibility Guidelines (PROWAG). In both of these cases, the Contractor shall contact the Traffic Engineering section to provide an alternate location for the installation of the sign(s) in question.
8. Temporary signs installed for construction purposes shall be to be mounted in the least intrusive locations and manner as possible to minimize damage to sidewalks or blocking of other signs/traffic control devices. Use of existing sign posts and street light poles is preferred. Any damage to City infrastructure caused by temporary sign installations shall be restored upon removal of the temporary sign/post.

8 Chapter 8 Pedestrian Facilities

INTRODUCTION

The City strives to ensure that the ROW is usable and accessible for everyone. One common mode of transportation is pedestrian travel. 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 require pedestrian facilities to be designed and constructed to be 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 Transportation Master Plan, the Curb Ramp Installation Matrix, Right-of-Way Restoration Policy, and other applicable City plans and ordinances.

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 8.1 Design Guides and Resources

The following resources are meant to accompany the requirements of this Manual:

8.1.1. 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
- RCW 35.68.075, Curb Ramps for persons with Disabilities
- 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
- City of Tacoma Curb Ramp Installation Matrix
- City of Tacoma Right-of-Way Restoration Policy

- City of Tacoma Transportation Master Plan
- SWMM
- City of Tacoma Complete Streets Guidelines
- City of Tacoma APS Policy
- TMC

8.1.2. Design Guidance

- For buildings and onsite facilities; applies to new construction or alterations: ADA Standards for Accessible Design, U.S. Department of Justice
- For transit, light rail, and similar public transportation facilities: ADA Standards for Transportation Facilities
- U.S. Department of Justice/Department of Transportation Joint Technical Assistance on the Title II of the ADA Requirements to Provide Curb Ramps when Streets, Roads, or Highways are Altered through Resurfacing
- MUTCD, USDOT, FHWA; as adopted and modified by Chapter 468-95 WAC
- Revised Guidelines for Accessible Public Rights-of-Way. The current best practices for evaluation and design of pedestrian facilities in the public ROW per the following FHWA Memoranda: Bicycle and Pedestrian Program and ADA/Section 504
- City of Tacoma Standard Plans

8.1.3. 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
- 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 ROW.
- Pedestrian Facilities Guidebook: Incorporating Pedestrians into Washington's Transportation System
- 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
- 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
- "Special Report: Accessible Public Rights-of-Way – Planning & Design for Alterations," Public Rights-of-Way Access Advisory Committee, July 2007
- WSDOT's Understanding Flexibility in Transportation Design – Washington
- Washington State Bicycle Facilities and Pedestrian Walkways Plan

SECTION 8.2 Policy

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 are given full consideration in the planning and design of new construction and reconstruction ROW projects, except where bicycle and pedestrian use is prohibited.

SECTION 8.3 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 U.S. Department of Justice to ensure compliance with the ADA for transportation projects.

8.3.1. New Construction Projects

New construction projects including the construction of a new roadway, intersection, or other new transportation facility shall address and include pedestrians' needs in the project. All pedestrian facilities included in these projects must fully meet the ADA and City accessibility criteria when built.

8.3.2. 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 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, 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 at (253) 591-5785.

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 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 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 PAR 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 Curb Ramp Installation Matrix to determine which work requires the construction of curb ramps. The City of Tacoma Curb Ramp Installation Matrix is available on the City's website.
- 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 (see RCW 35.68.075). If there is no existing curb ramp in place on the receiving end, or the existing curb ramp does not meet the Existing Curb Ramp Evaluation Criteria found in the City of Tacoma Curb Ramp Installation Matrix, 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 scope of work.
- 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 City of Tacoma Curb Ramp Installation Matrix, Existing Curb Ramp Evaluation Criteria). Modify existing curb ramps that do not meet the ADA and City 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 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 (see Section 8.8.2 of this chapter). If it is not possible to meet the applicable ADA and City accessibility requirements for crosswalks, document this in a maximum extent feasible (MEF) justification and attach it to the final plan set (see Section 8.3.2.1 of this chapter).

- 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 8.8.2 of this chapter). Modify crosswalk slopes to meet the applicable ADA and City accessibility requirements.

8.3.2.1. Maximum Extent Feasible Justification

It may not always be possible to fully meet the applicable ADA and City 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 MEF has been met. If site conditions are determined to be 'virtually impossible' (per PROWAG definition and case law) to meet the accessibility criteria for an element, then 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 noncompliant 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 as part of the plan set. The MEF must include the following:

- A description of the scope of work;
- The site specific factors affecting compliance; and
- 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, City Engineer or designee.

SECTION 8.4 Pedestrian Circulation Paths

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. PCPs can either be immediately adjacent to streets or separated from streets by a buffer. Examples of PCPs are shown below.

Provide smooth finish to vertical surfaces (see Section 8.5.1.3 of this chapter) adjacent to a PCP to mitigate potential snagging or abrasive injuries from accidental contact with the surface. Any projections into the PCP must be cane detectable or extend 4 inches or less into the path (see Section 8.4.1.2 of this chapter).

When relocation of utility poles, signage, and other fixtures is necessary for a project, determine the impact of their new location on all PCPs. Look for opportunities to relocate obstructions, such as existing utility objects, away from the PCP.

Examples of PCPs

8.4.1. Accessibility Criteria for Pedestrian Circulation Paths

The following criteria apply across the entire width of the PCP, not just within the PAR.

8.4.1.1. Vertical Clearance

The minimum vertical clearance for objects, such as trees and canopies that protrude into or overhang a PCP is 80 inches (see PROWAG) unless otherwise specified in the MUTCD.

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.

8.4.1.2. Horizontal Encroachment

Protruding objects on PCPs shall not reduce the clear width of the PAR to less than 5 feet, excluding the curb.

If an object must protrude farther than 4 inches into a PCP 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 PAR must still be provided. For tree requirements, see CHAPTER 9 and Standard Detail LS-02 Street Tree Clearance.

8.4.1.3. 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 PAR.

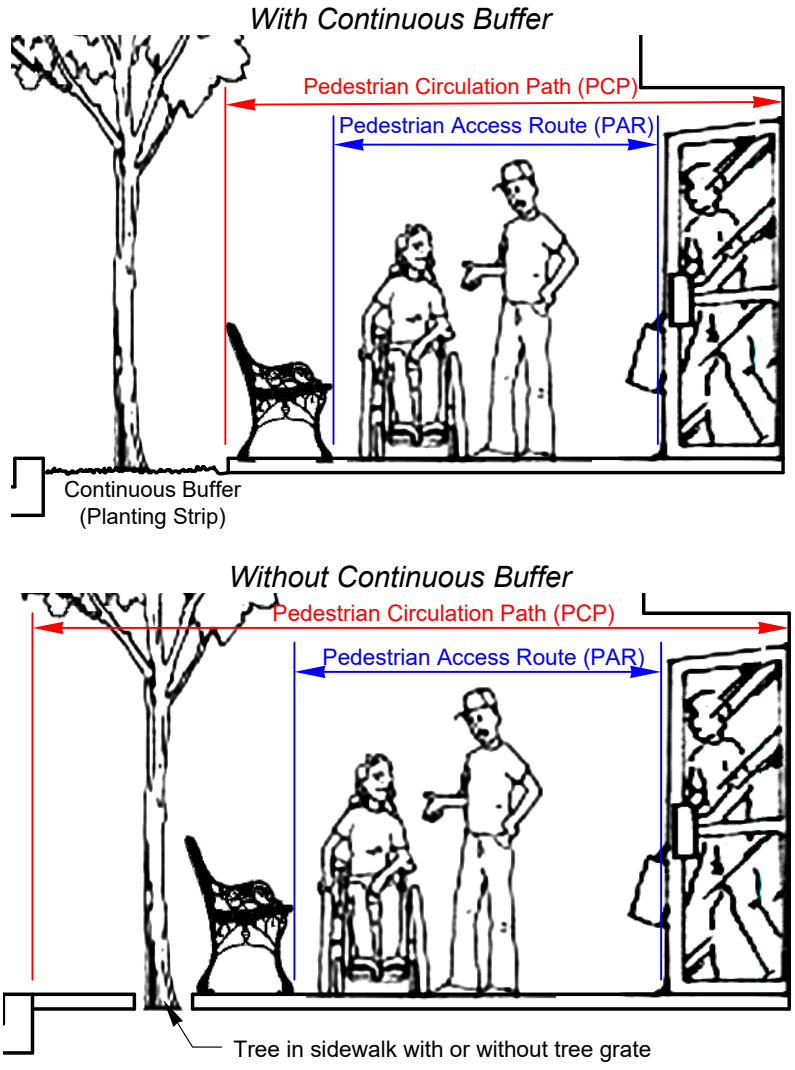
If an object must protrude farther than 4 inches into a PCP at a height that is greater than 27 inches and less than 80 inches above the finished surface, then it must be equipped with a warning device that is detectable by a vision-impaired person who navigates with a cane. The minimum clear width of the PAR must still be provided.

Where a sign or other obstruction on a PCP 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 8.5 Pedestrian Access Routes

All PCPs are required to contain a continuous Pedestrian Access Route (PAR) that connects to all adjacent pedestrian facilities, elements, and spaces that are required to be accessible (see Figure 8-1). 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 8-1: Relationship between PCPs and PARs



8.5.1. Accessibility Criteria for Pedestrian Access Routes

8.5.1.1. 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.

Example of Clear Width Obstruction

Provide wheel stops or a wider sidewalk to remedy the encroachment into the PAR.

8.5.1.2. Cross Slope and Grade

The cross slope of a PAR shall be 2 percent maximum. It is recommended that cross slopes be designed to less than the allowed maximum to allow for some tolerance in construction. 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 percent maximum.

Where a PAR is contained within the roadway ROW, its grade shall not exceed the general grade established for the adjacent roadway. See Section 8.72 of this chapter for curb ramp accessibility criteria. Exception:

The maximum grade in a crosswalk (marked or unmarked) is 5 percent, measured parallel to the direction of pedestrian travel in the crosswalk.

Where a PAR is not contained within the roadway ROW, the maximum running slope allowed is 5 percent unless designed as an access ramp. See Section 8.14.2 of this chapter for access ramp accessibility criteria.

For additional criteria when a PAR is supported by a structure, see Section 8.13 of this chapter.

8.5.1.3. Surface

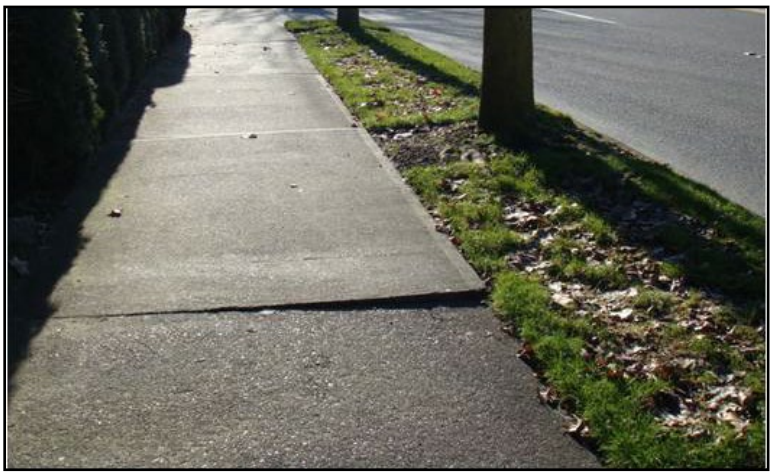
The surface of the PAR shall be firm, stable, and slip resistant. Use hard surfaces like concrete or asphalt. Pervious concrete or porous asphalt meeting ADA requirements is acceptable. Crushed gravel is generally not considered to be a stable, firm surface. The PAR surface must meet all ADA and City accessibility requirements. Pavers, bricks, and stamped concrete with gaps and uneven surfaces can cause pain and discomfort for people using mobility devices and are not allowed in the PAR. However, proposals to use permeable pavers in the PCP will be evaluated on a case-by-case basis for acceptability and maintenance as a walking surface.

Grade breaks shall be flush.

Surface discontinuities on existing surfaces in the PAR (such as at the joints of settled or upheaved sidewalk panels) may not exceed ½ inch maximum (see example photo below). Vertical discontinuities between ¼ inch and ½ inch maximum shall be beveled at 2:1 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.

Example of Surface Discontinuity



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.

8.5.1.4. 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 non-freight 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 8.12 of this chapter.

SECTION 8.6 Sidewalks

Sidewalks are one type of PCP; see Section 8.4 of this chapter for PCP accessibility criteria. Plan the design of sidewalks carefully to include a PAR that provides universal access; see Section 8.5 of this chapter for PAR accessibility criteria. Wherever appropriate make sidewalks continuous and provide access to side streets. The preferred installation for the PAR is a sidewalk separated from the traveled way by a planted buffer. This provides a greater separation between vehicles and pedestrians than curb alone.

8.6.1. Sidewalk and Buffer Widths

The City 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 TMC or design guidelines. For example, minimum widths for mixed-use centers shall be superseded by the mixed-use center design criteria found in TMC 13.06.300. A 10 to 12 foot sidewalk is preferred for high pedestrian traffic and commercial areas. Wider sidewalks may also be required adjacent to angle parking to account for vehicle overhang. Refer to CHAPTER 4 for additional information.

When a buffer 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.

Design subsurface infrastructure (such as structural soils) and select plants whose root systems do not cause sidewalks to buckle or heave. Refer to CHAPTER 9 for additional information.

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 sidewalk.

Shoulders, bike lanes, and on-street parking are not considered buffers, but they do offer the advantage of further separation between vehicles and pedestrians.

8.6.2. Sidewalks at Driveways

Provide a PAR where driveways intersect a PCP. See Standard Plans SU-07, SU-08, SU-09, and HD-NS02 for details of driveway designs that provide a PAR. See Section 8.4 and Section 8.5 of this chapter for accessibility criteria. When a driveway is signalized as part of an intersection, contact the ADA Coordinator at (253) 591-5785 for guidance on the design of the sidewalk.

Typical Sidewalk Design

SECTION 8.7 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 visual evidence of pedestrian traffic are present, except where pedestrian crossing is prohibited. See CHAPTER 4 for guidance on closed crossings.

Provide a curb ramp oriented in each direction of pedestrian travel and within the width of the crosswalk (marked or unmarked) the curb ramp serves. Every curb ramp shall have an opposing curb ramp that serves the other end of the crosswalk (marked or unmarked). If curb ramps are present, see the City of Tacoma Curb Ramp Installation Matrix, Existing Curb Ramp Evaluation Criteria.

Curb ramps shall be a minimum of 5 feet in width with a landing/turning space that is a minimum of 5 feet in length and 5 feet in width.

8.7.1. 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. Prior approval from the City Engineer or designee and written justification are required for non-directional curb ramps.

8.7.1.1. Perpendicular Curb Ramp

Perpendicular curb ramps are aligned to cut through the curb and meet the gutter grade break at a right angle (see Figure 8-2). 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.

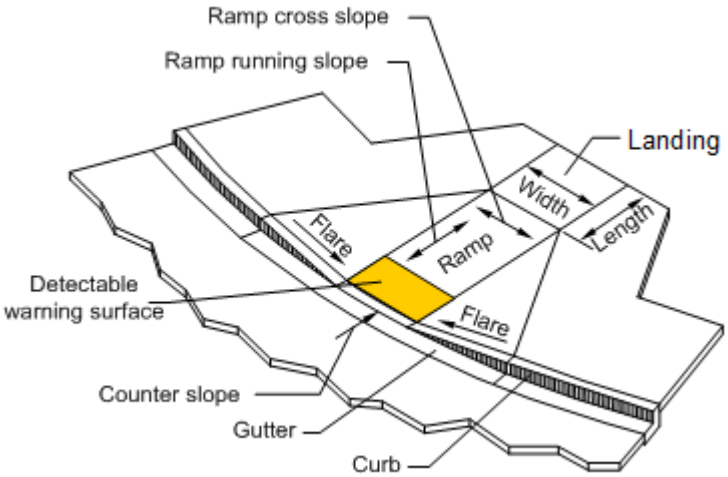
The height of the ramp run relative to the gutter elevation discourages vehicular traffic from cutting across the corner.

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.

Figure 8-2: Perpendicular Curb Ramp Common Elements



8.7.1.2. Parallel Curb Ramp

Parallel curb ramps are aligned with their running slope in line with the direction of sidewalk travel, parallel to the curb (see Figure 8-3). 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.

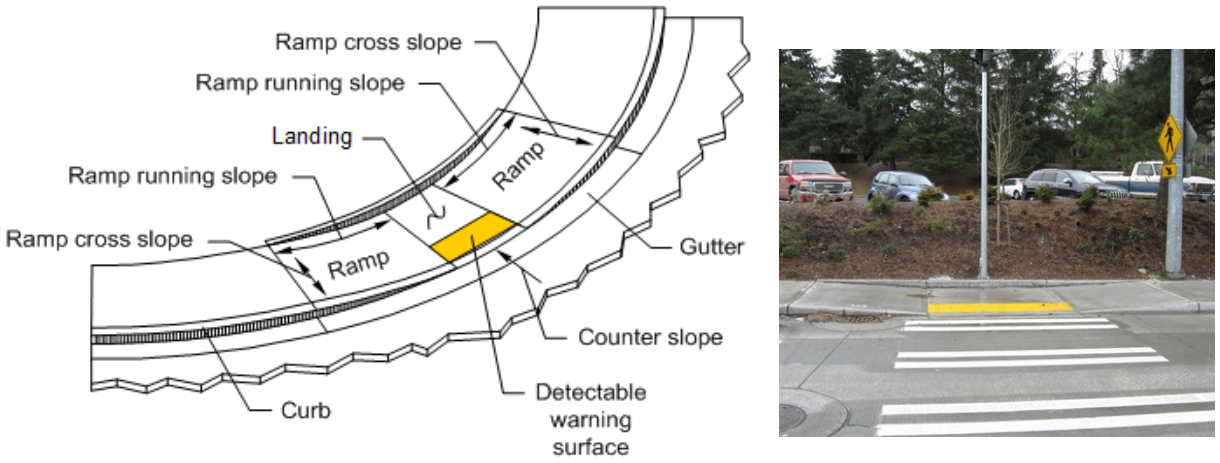
Allows ramps to be extended to reduce ramp grade within available ROW.

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.

Figure 8-3: 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.

8.7.1.3. Combination Curb Ramp

Combination curb ramps combine the use of perpendicular and parallel types of curb ramps (see photo below). 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.

Example of Combination Curb Ramps

8.7.2. Accessibility Criteria for Curb Ramps

The accessibility criteria for PCPs and PARS also apply to curb ramps unless superseded by the following accessibility criteria specifically for curb ramps (see Section 8.4 and Section 8.5 of this chapter).

8.7.2.1. Clear Width

The clear width of curb ramps and their landings shall be 5 feet minimum, excluding flares.

8.7.2.2. Running Slope

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

The curb ramp maximum running slope shall not require the ramp length to exceed 15 feet.

8.7.2.3. Cross Slope

The cross slope of curb ramps shall not be greater than 2 percent, measured perpendicular to the direction of travel. It is recommended that cross slopes be designed to be less than the maximum to allow for some tolerance in construction. For example, design for a maximum 1.5 percent cross slope (rather than the 2 percent maximum).

Instances where curb ramps are at midblock crossings, the cross slopes are permitted to match the street grade.

8.7.2.4. Landing

A landing, at least 5 feet minimum length by 5 feet minimum width, is required either at the top of a perpendicular ramp or the bottom of a parallel curb ramp.

The running and cross slopes of a curb ramp landing shall be 2 percent maximum.

8.7.2.5. Flares and Pedestrian Curbing

Flared sides are to be used where a PCP crosses the curb ramp from the side. Flared sides are to have a slope of 10 percent maximum, measured parallel to the back of curb.

Pedestrian curbs are to be used only where there is landscaping or other appurtenances, such as railing, that prevent cross travel by pedestrians. Pedestrian curbs are to be located outside the PCP. Pedestrian curbs may not be used to prevent pedestrians from using street crossings.

8.7.2.6. Counter Slope

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

8.7.2.7. Detectable Warning Surfaces

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

8.7.2.8. 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 PAR. See Section 8.5 of this chapter for more information.

8.7.2.9. 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.

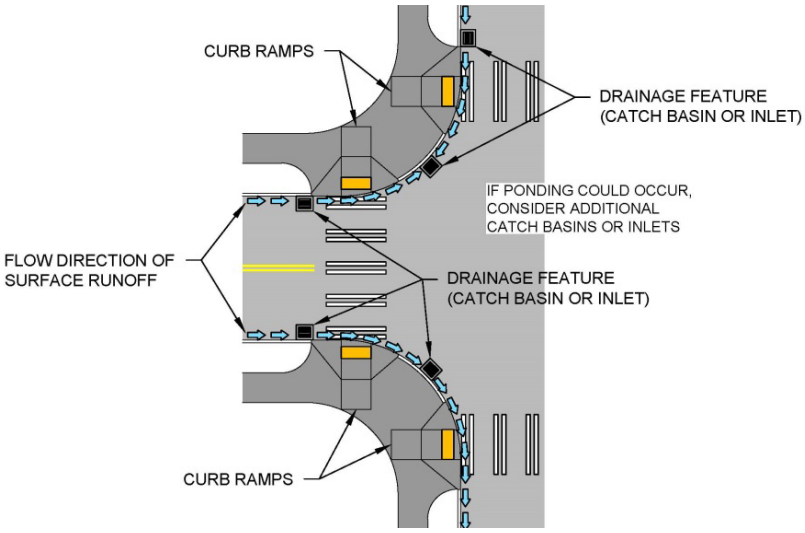
8.7.2.10. Clear Space

A clear space, to facilitate pedestrian turning maneuvers, is required within the roadway for all non-directional curb ramps. The 4 foot (minimum) by 4 foot (minimum) clear space shall be located beyond the curb face where the bottom of a non-directional curb ramp or landing meets the gutter, contained within the width of the crosswalk, and located completely outside the parallel vehicle travel lane.

8.7.3. Curb Ramp Drainage

Stormwater runoff from the roadway can flood the lower end of a curb ramp. Measures to prevent ponding at the base of curb ramps and landings (see Figure 8-4) must be taken. Refer to Chapter 11 Section 11.6 Curb Ramps for guidance and requirements. Verify that drainage structures will not be located in the PAR. Refer to the SWMM for additional information.

Figure 8-4: Typical Curb Ramp Drainage



SECTION 8.8 Crosswalks

8.8.1. 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 and pedestrian to driver).
- Consider the feasibility of restricting or prohibiting turns.
- Consider shortening the crossing distance.
- Use of a raised median/cut-through island for a pedestrian refuge.
- Use of 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.
- Provision of a PAR that meets the accessibility criteria at all pedestrian crossings.

8.8.2. Crosswalks at Intersections

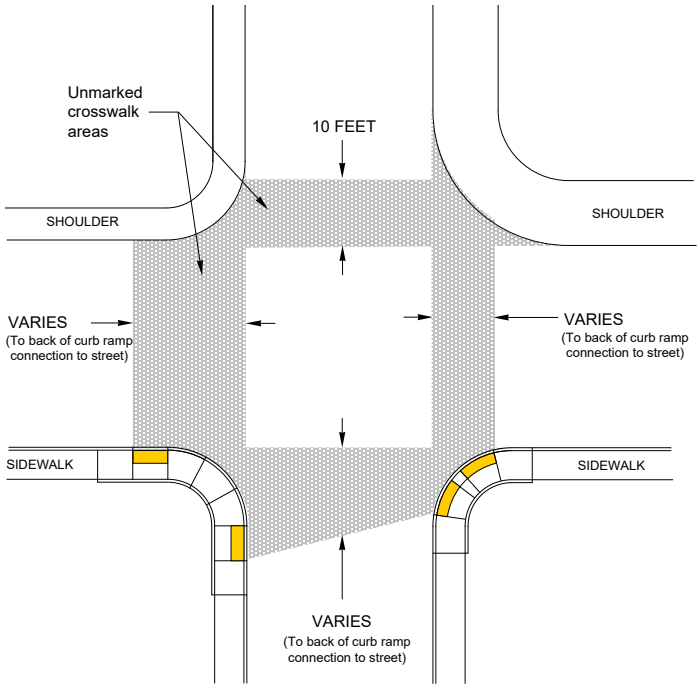
Provide a PAR within marked and unmarked pedestrian crossings. See Section 5 of this chapter for accessibility criteria for PARs.

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 intersection legs is a location with substantial turn movements that would conflict with a crossing.

8.8.2.1. Unmarked Crossings

Legal crosswalks exist at all intersections, whether marked or not, regardless of the number of legs at the intersection. An unmarked crosswalk 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 (per RCW 46.04.160) (see Figure 8-5).

Figure 8-5: Unmarked Crosswalks



8.8.2.2. Marked Crossings

Marked crosswalks are used at intersections or midblock crossings. The City Traffic Engineer has the authority as outlined WAC 308-330-265 to designate and maintain, by appropriate devices, marks, or lines upon the surface of the roadway, including crosswalks. On state routes within the City, maintenance agreements and RCW 47.24.020(30) provide jurisdictional authority to the City for decisions to mark crosswalks based on a population threshold of 25,000. The

decision to mark a crosswalk shall be based on the principles presented in CHAPTER 7.

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 (no 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) may cause confusion for visually impaired pedestrians. Crosswalks are distinct elements of the PAR (see Section 8.5 of this chapter). Pavers, bricks, and stamped concrete with gaps and uneven surfaces can cause pain and discomfort for people using mobility devices and are not allowed in the PAR. Decorative crosswalks should be supplemented with standard style pavement markings to enhance visibility and delineate the crosswalk. Refer to CHAPTER 7 for additional information (also refer to the MUTCD.)

8.8.2.3. Closed Crossings

Pedestrian crossings shall only be closed for a documented reason such as observed crash concerns or for essential signal operations. If an existing crossing has been closed, as indicated by existing signing, provide an appropriate treatment such as a railing that is detectable by people with vision difficulties who navigate with a cane. The City Traffic Engineer is the approval authority for the closing of crossings.

8.8.3. Midblock Crosswalks

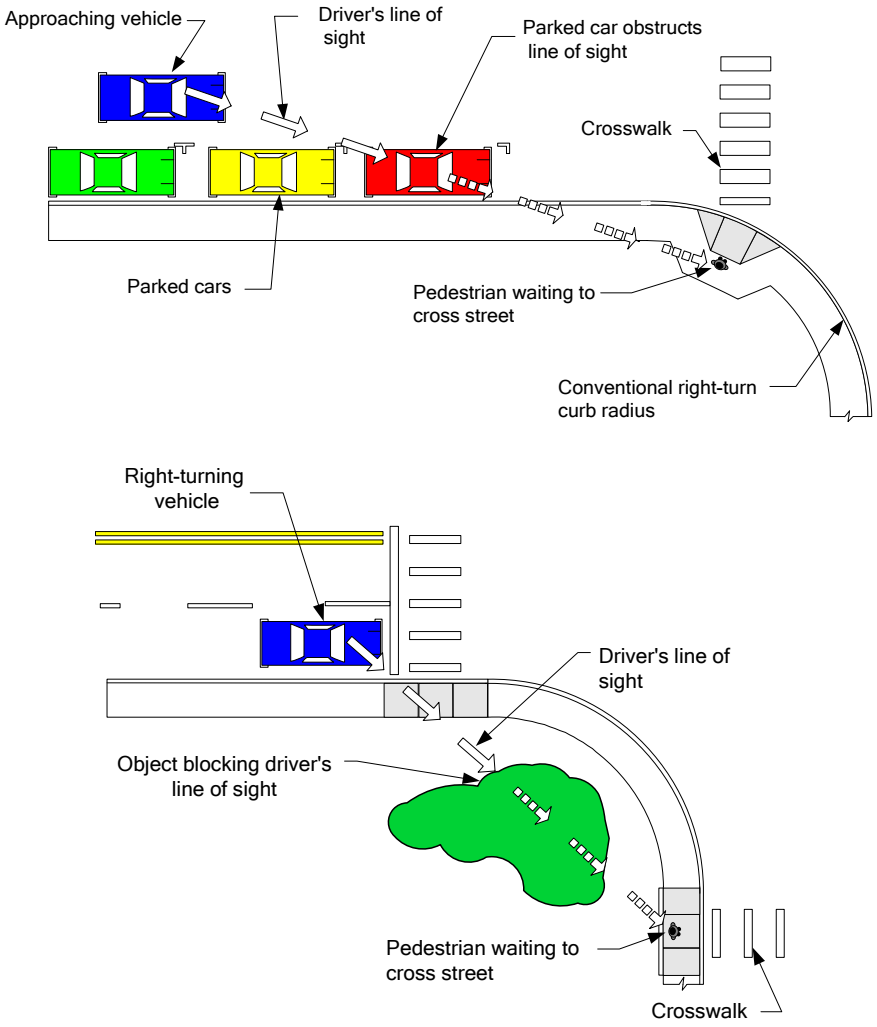
On roadways with pedestrian crossing traffic caused by nearby pedestrian generators, a midblock crossing may be appropriate. See CHAPTER 7 for crosswalk criteria and the MoMaP Pedestrian and Bicycle Guidelines for marked crosswalk recommendations at un-signalized intersections.

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.

8.8.4. 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 8-6 illustrates these sight distance concerns.

Figure 8-6: Obstructed Line of Sight at Intersection

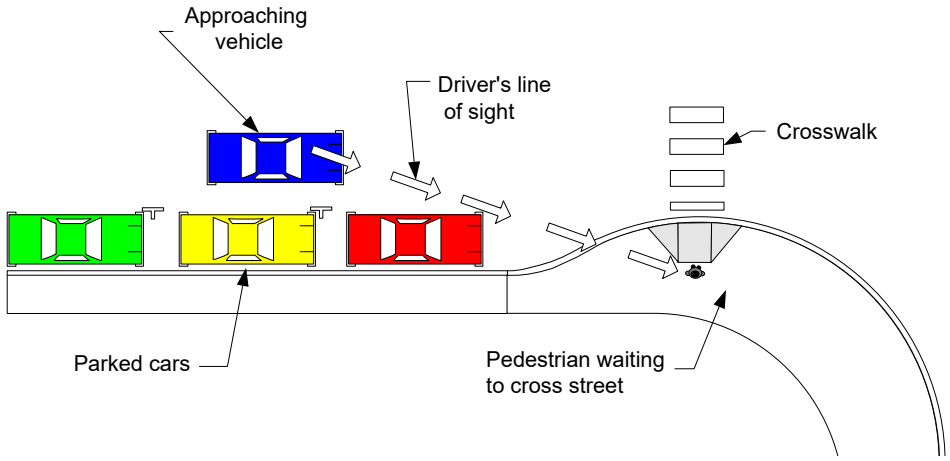


8.8.5. Curb Extensions

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 need to consider the needs of existing or future 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 the pedestrian signal clearance interval. Examples of sidewalk curb extensions are shown in Figure 8-7.

Figure 8-7: 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. 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 8.9 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 on roadways with the following conditions (see Figure 8-8):

Two-way arterial with intermediate to high speeds (35 mph or greater), moderate to high average daily traffic, and high pedestrian volumes;

Significant pedestrian collision history (reference crash data on the City's website);

Vehicle turn volumes and patterns; and/or

Complex or irregularly shaped intersections.

Prior approval by the City Traffic 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 PAR through a raised median or traffic island can be either raised with curb ramps or a cut-through type (see Figure 8-8). 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 SWMM).

8.9.1. 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:

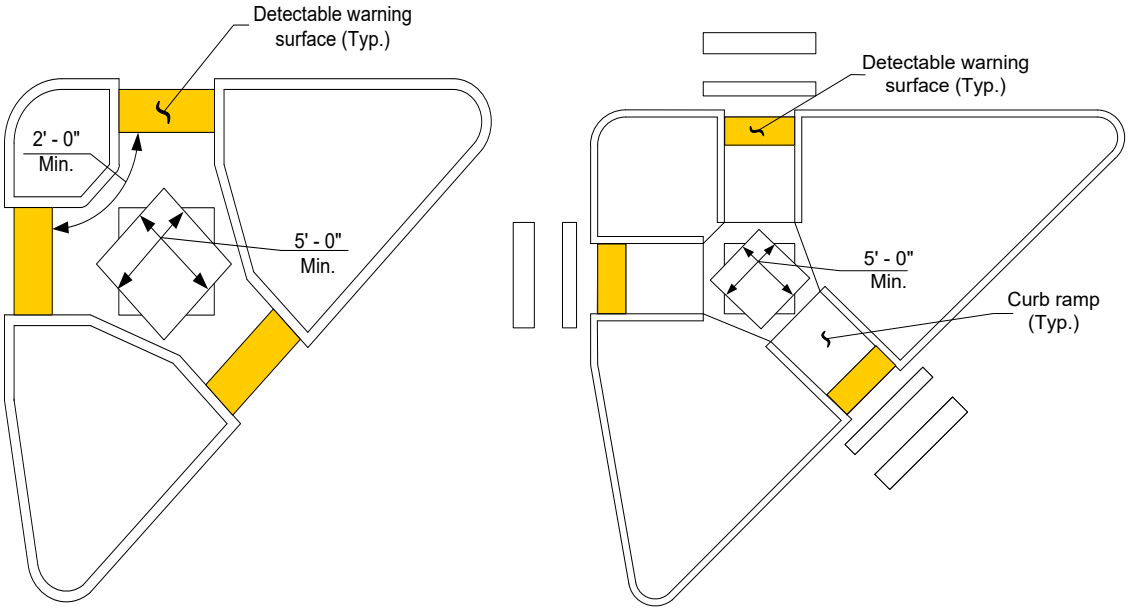
- Each raised median or traffic island shall contain a PAR connecting to each crosswalk (see Section 8.5 of this chapter).
- Cut-throughs shall be designed to have a minimum width of 5 feet to ensure a passing space is provided.
- Medians and pedestrian refuge islands shall be 6 feet minimum in length 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 Figure 8-8)
- PARs of shared-use paths that go through raised medians or traffic islands shall be the same width as the shared-use path (see CHAPTER 10).

See the City of Tacoma Standard Plans for details.

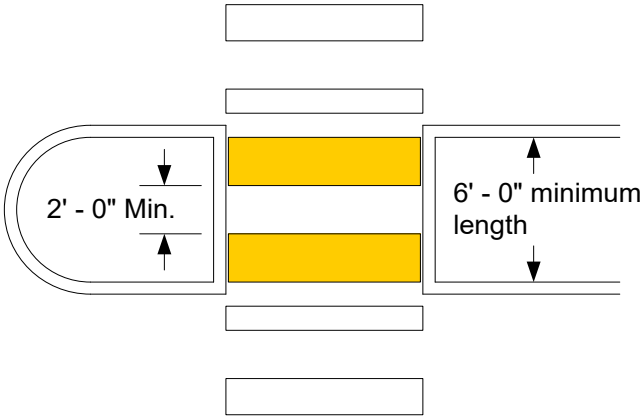
Figure 8-8: Raised Islands with Curb Ramps and Pedestrian Cut-Throughs

Island Cut-Through

Raised Traffic Island with Curb Ramps



Median Island Cut-Through (full width shown)



SECTION 8.10 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 APS Policy on the City's website.

8.10.1. Accessibility Criteria for All Pedestrian Pushbuttons

8.10.1.1. Location Requirements

No 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.

8.10.1.2. Clear Space Requirements

Grade: 2 percent maximum running and cross slopes.

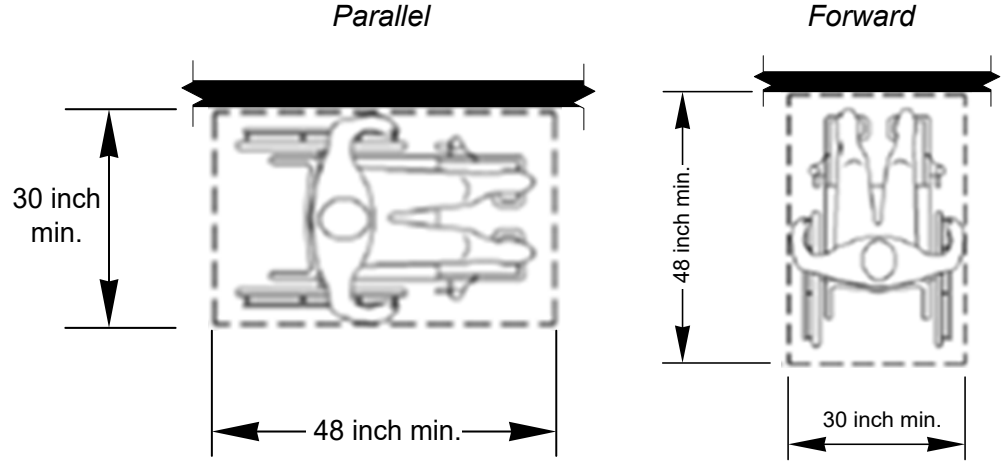
Clear space dimensions: 30 inches minimum width by 48 inches minimum length. More width may be necessary to ensure accessibility (see Figure 8-9).

Clear space is allowed to overlap other PAR elements (e.g., 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 8-9: 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.

8.10.1.3. 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.

8.10.1.4. Accessibility Criteria for APS

Refer to the City of Tacoma APS Policy on the City website for information about when APS are required. 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 Accessible Pedestrian Signal

In addition to the general pedestrian pushbutton accessibility criteria described in Section 8.10.1 of this 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 from the MUTCD (R10-32P) 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 Traffic Engineering Section and CHAPTER 6 for current equipment specifications and additional maintenance requirements.

SECTION 8.11 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 recommendations of the City Traffic Engineering section. 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 signed load zones) shall be signed and have an associated curb ramp to facilitate access for all to/from the sidewalk and passenger load zone area. If the load zone is in an angle parking area, the stall and associated access aisle shall be marked in traffic yellow. If the load zone is parallel to the curb, it shall be a minimum length of 20 feet. The top and face of the curb should be painted traffic yellow.

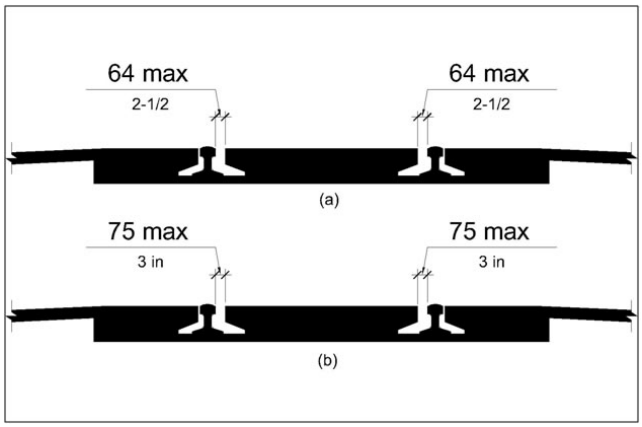
SECTION 8.12 At-Grade Railroad Crossings

The design of pedestrian facilities that cross railroad tracks often present challenges due to the conflicting needs of pedestrians and trains (see Figure 8–10). The flangeway gap allow 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 inches maximum on non-freight rail track and 3 inches maximum on freight rail track (see Figure 8–10).

Figure 8–10: 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 Engineering section 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 8.13 Pedestrian Grade Separations

On the approach to a bridge that has a raised sidewalk provide a ramp for the transition to the sidewalk from the paved shoulder if no sidewalk connection is present. A graded transition from a paved shoulder to a raised sidewalk on a bridge shall have a slope of 5 percent maximum and be constructed of asphalt or cement concrete. If a PCP (such as a raised sidewalk or shared-use path) is located near the bridge, consider eliminating the gap between the bridge sidewalk and the PCP by extending the bridge sidewalk to match into the nearby PCP.

At underpasses where pedestrians are allowed, it is desirable to provide sidewalks and to maintain the full shoulder width. When designing/constructing new bridges, there should be sufficient space between the columns and the side of the roadway to locate the pedestrian walkway for improved 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.

Locate the grade separated crossing where pedestrians are most likely to cross the roadway. A crossing might not be used if pedestrians are 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 involving pedestrians or bicyclists (reference crash data on the City's website).

One or more of the conditions stated above exists in conjunction with a well-defined pedestrian origin and destination (such as a transit center across the street from a major commercial area).

SECTION 8.14 Other Pedestrian Facilities

8.14.1. 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, and state and federal parking laws. Design newly constructed transit stops so that they are connected to the sidewalk, street crossings, and PCPs by PARs. 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 PCPs by PARs.
- All walking surfaces must be firm, stable, and slip resistant. Grass is not considered firm and stable.
- Signage usually supplied by the transit agency 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 percent.
- 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, relocated, or altered bus stops must obtain a ROW Construction/Work Order Permit from the City, unless the action is addressed within a separate agreement between the transit agency and the City. Where a separate agreement exists, the design engineer and/or transit agency must comply with all terms within that agreement. When locating a transit stop, the designer shall consult with the ADA Coordinator, the City Traffic Engineering Section, 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
- State and local parking laws under RCW 46.61.570

If any of the characteristics or laws listed above suggest 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 for this information. 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 Engineering section.

8.14.2. Access Ramps

An access ramp provides a PAR from a PCP to a facility such as a transit stop, park and ride lot, pedestrian overcrossing/ undercrossing structure, or building. When the running slope is 5 percent or less, the walkway can be designed as a PCP that includes a PAR. When the running slope is greater than 5 percent to a maximum of 8.3 percent, the walkway must be designed as an access ramp.

Example of an Access Ramp

8.14.2.1. 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 percent.

The cross slope of ramp segments shall be 2 percent 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 percent 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 8.14.3 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.

8.14.3. 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 8.14.2 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.

8.14.3.1. 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, the minimum railing height for bicyclist fall protection is 54 inches (see CHAPTER 10).

8.14.3.2. 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 Section 8.14.3.4 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, the minimum railing height for bicyclist fall protection is 54 inches (see CHAPTER 10).

8.14.3.3. 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.

8.14.3.4. 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 percent 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.

8.14.4. Other Pedestrian Facilities, Features, and Elements

The information discussed above 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 ADA Coordinator and the applicable federal guidance document(s).

SECTION 8.15 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 PCPs, intersections, and other pedestrian crossing areas. Refer to CHAPTER 5 for illumination design guidance and requirements.

SECTION 8.16 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 Alternate Pedestrian Route Quick Reference Guide, Checklist for Pedestrian Access through Construction Zones, City of Tacoma Traffic Control Handbook, 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 8.4 and Section 8.5 of this chapter for PCP and PAR, respectively, 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 8-11: Work Zones and Pedestrian Facilities

Meets ADA Requirements *Does Not Meet ADA Requirements*

9 Chapter 9 Tree and Vegetation Management

INTRODUCTION

This chapter establishes required procedures and standards for landscaping within the right-of-way (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 following resources are meant to accompany the requirements of this Manual:

- **Urban Forest Manual**

  The Urban Forest Manual (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 BMPs for landscaping. Specifically, the standards in the UFM which refer to the ROW shall be used when landscaping within the ROW.

- **American National Standards Institute**

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

- **Tacoma Municipal Code**

  Trees and landscaping within the ROW are discussed in several locations within Tacoma Municipal Code (TMC), including but not limited to TMC 9.20 Urban Forestry, TMC 13.06.090.B Landscaping and Buffering Standards of the Land Use Regulatory Code, and

TMC 13.11 Critical Areas Preservation. These sections of TMC shall be adhered to in addition to the requirements set forth in this Manual.

SECTION 9.1 Applicability

9.1.1. 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 9.20, a Right-of-Way Tree Work i (RTRE) Permit is required for the planting, pruning, or removal of any regulated tree.

9.1.2. 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.

9.1.3. 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 9.2 Tree Planting, Removal and Replacement Permitting

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

RTRE Permit applications may be obtained online or through the Planning and Development Services Permit Intake Center located on the third floor of the Tacoma Municipal Building, 747 Market Street, Tacoma, WA 98402.

9.2.1. Exemptions

The following activities are exempt from the requirements of TMC 9.20 to obtain a street tree permit; provided that, pruning shall utilize BMPs to protect the health of the tree, and in no instances is tree topping permissible:

1. Small trees. Pruning by an abutting owner, or authorized agent, of street trees which are less than 15 feet in height.
2. Fruit trees. Harvesting of fruit and pruning of fruit bearing street trees.
3. Protection of public travel. Pruning or removal of street trees by the City of Tacoma Dept of Public Works, or the Washington State Dept of Transportation, to abate a

condition that poses a threat to public health, safety or welfare, to maintain visibility to traffic devices and signage, or to abate a public nuisance.

4. Public Works Dept. Pruning of street trees by the City Public Works Dept for the purpose of providing adequate clearances for construction equipment, to abate a hazard, or to perform general maintenance to support the continued growth, health, structure, and longevity of the tree. Planting of street trees by the City Public Works Dept for the purpose of replacing trees that have died or have been removed.
5. Restoration of utility services and emergency communications. Pruning of street trees to the extent reasonably necessary to allow for restoration of an unplanned interruption of utility services or emergency communications.
6. Power Utility Service Providers. Pruning of street trees by a power utility service provider to the clearance standards under the National Electric Safety Code.
7. Modification for Emergencies. Street tree pruning or removal activities necessary to manage an immediate threat to public health, safety, or welfare that require action in a timeframe too short to allow for normal processing, is allowed without first obtaining a street tree permit; provided that, the person performing the work to prune or remove the street tree(s) shall, as soon as practical but no later than 30 days following completion of the emergency pruning or removal work, apply for a street tree permit, and fulfill the rest of the requirements necessary to bring itself into compliance with this chapter.

9.2.2. Tree Planting

All trees planted within the ROW shall comply with TMC 9.20 and TMC 13.06.090.B 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.

9.2.2.1. Permit Application

Planting trees within the ROW when not otherwise permitted through a ROW Construction/Work Order Permit requires a separate RTRE Planting Permit. A

RTRE Planting 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 all of the following, with slight variations for planting, pruning, removal, or pruning for view enhancement:

1. Name, address and telephone number of the applicant where applicant agrees to receive communications from the City;
2. A declaration of the applicant meeting the requirements of Ch. 5.50 RCW that the applicant is the owner of the abutting property, or an authorized agent, and has authority to submit the application;
3. If applicant is an authorized agent for the abutting owner, the name, address and telephone number of the abutting owner. If applicant is an authorized agent of a utility, a public transportation agency, or the City, the name, address and contact information for the utility, public transportation agency, or applicable department or division of the City;
4. If applicant is not an abutting owner and is required under a project permit to make off-site improvements adjacent to property in which they do not own, a description of the attempt to communicate with the property owner as set forth in TMC 9.20.220.H;
5. Description of the public right-of-way within which each street tree that is the subject of the application is located;
6. Description of each street tree to be pruned or removed with sufficient detail to accurately identify each street tree that is the subject of the application;
7. An image clearly delineating each street tree proposed to be pruned or removed;
8. A detailed statement demonstrating that each street tree proposed to be removed meets one or more of the categories set forth in TMC 9.20.220.E below and why each street tree should be removed, together with any other relevant information;
9. A street tree removal plan that sets forth in detail the proposed plan for removing each street tree that is proposed to be removed, certified by the applicant or authorized agent to meet requirements of the Design Manual, and all necessary traffic control measures of the City of Tacoma Traffic Control Handbook, as applicable;

   The application shall include an application complying with the street tree planting permit requirements of TMC 9.20.230 for planting of a street tree;

10. Name, address and telephone number of the person(s) to perform the street tree pruning or removal work;
11. Such other information as may be requested by the Director that is reasonably related to the application and approval requirements; and,
12. Payment of a permit application fee when established pursuant to TMC Chapter 2.09.

In addition, the applicant must select a tree from the City of Tacoma Approved Tree List (see UFM, Volume 3, 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.

9.2.2.2. Tree Clearances

Standard clearances for trees in the ROW are as defined in the 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 RTRE Permit submittal, and will be reviewed based on demonstration of mitigating potential impacts to public infrastructure.

9.2.2.3. Line of Sight

For adequate line of sight, street trees must be placed no closer than 25 feet from intersections; measurement must be 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 Intersection Sight Distance section of the Intersection chapter of the latest edition of the AASHTO Green Book on recommended sight distance for intersection control conditions.

9.2.2.4. Alternate Specifications

The Planning and Development Services Department will review proposed alternatives to the standards contained here and in the UFM. These alternate specifications must be submitted to the City with the ROW Construction/Work Order Permit or RTRE 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 (e.g. Silvacells), etc.

9.2.2.5. Planting Strip Treatments

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

- 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 MoMAP, which can be found in Appendix C of the Tacoma Transportation Master Plan.
- 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 equal to the grade of

the adjacent pavement surface or curb, and in no instance may be greater then 1 inch below the adjacent pavement or curb surface.

- Low Impact Development/GSI – The SWMM outlines requirements for stormwater mitigation including low impact development.
- Low impact development or 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 as well as other low impact development BMPs including bioretention areas, dispersion, or infiltration. All proposed stormwater facilities within the ROW will need to acquire a permit prior to construction in the ROW. Please contact the Planning and Development Services Department for permit requirements. For more information on GSI requirements, see CHAPTER 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 Right-of-Way Occupancy (ROCC) 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 Planning and Development Services Department to apply for a Right-of-Way Occupancy Permit to construct permanent improvements within the planting strip.
- Raised Planter Boxes – Raised planter boxes may be installed in the ROW, provided that a Right-of-Way 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.

9.2.2.6. Planting Materials

- 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.
- 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.
- 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.

- 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 8, Section 8.5 for the requirements regarding tree grates.

9.2.3. Tree Pruning (Trimming)

A Tree Work in the ROW Pruning Permit is required for all proposed pruning activities on regulated trees, and shall comply with TMC 9.20 and TMC 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. In no circumstance does tree topping qualify as appropriate tree pruning. Pruning must be performed according to ANSI A300 guidelines by an individual or company with a valid Washington State contractor's license, City 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.

9.2.3.1. Permit Application

A Tree Work in the ROW Pruning Permit may be granted provided that the adjacent property owner (applicant), or authorized agent, 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 ROW 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 percent of the tree's 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).

9.2.3.2. 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 ROW 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 ROW Permit and must comply with the City of Tacoma Traffic Control Handbook.

9.2.4. Tree Removal

A Tree Work in the ROW Removal Permit is required for all regulated tree removals, and shall comply with TMC 9.20 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.

9.2.4.1. Permit Application

A Tree Work in the ROW Removal Permit may be granted if the adjacent property owner (applicant), or authorized agent, 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, pruning, or other management strategies;
- The cost of routine tree maintenance (pruning, watering, fertilizing, etc.);
- Normal maintenance activities such as the raking of leaves, cones, needles, and flowers, and cleaning of gutters;
- Hazards that can be controlled or eliminated through appropriate pruning or maintenance; or
- Dislike of the tree(s).

If tree removal is permitted, all stumps and surface roots of trees shall be ground or removed to a point at least 8 inches below the top of the adjacent curb/sidewalk or proposed grade.

9.2.4.2. 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 ROW 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 ROW Permit and must comply with the City of Tacoma Traffic Control Handbook.

9.2.4.3. Tree Replacement

The City requires tree replacement as a standard condition for issuance of a permit for removal of a tree within the right-of-way.

SECTION 9.3 Tree Protection During Construction

The UFM contains the mandatory actions in addition to those contained in TMC 9.20 for protection of existing trees during construction activities, as well as permitted construction activities around existing trees.

Per the 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

10 Chapter 10 Shared-Use Paths

INTRODUCTION

This chapter provides guidance on how to achieve the appropriate separation, amenities, and design tools to ensure that the Shared-Use Path is designed consistent with the context of its location and intended users. Refer to CHAPTER 4 for planning documents outlining the bicycle network. Shared-use paths are designed for both transportation and recreation purposes and are used by pedestrians, bicyclists, skaters, and other users.

The City's planning efforts include a network of shared-use paths that internally connect City neighborhoods and provide connections to neighboring jurisdictions and the regional trail network. The goal is to ensure that the design and construction of shared-use paths are consistent with the most current regulations, guidelines, and community plans. 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 (DIRT)] and/or stakeholder advisory group to the City to help ensure they are consistent, well-suited designs and user amenities. An applicant, for purposes of this chapter, includes design engineers, project managers, developers, property owners, or other project representatives intending to develop a shared-use path.

The information herein is resourced from the various state and federal laws/codes/and guidance report/documents. The user of this chapter is advised that the referenced materials reflect the needs and desire of the City, its citizens, and stakeholders. Figures are provided throughout this chapter to illustrate possible design solutions and flexibility as long as the corresponding laws, regulations, and standards are not compromised.

SECTION 10.1 References

10.1.1. 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)

10.1.2. Design Standards and Guidance

Federal and State:

- Rails-to-Trails Conservancy Trail-Building Toolbox with informative chapters ranging from bridges, crossings, accessibility and user types.
- WSDOT Design Manual - Chapter 1515 - Shared-use Paths
- 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 .
- Manual on Uniform Traffic Control Devices for Streets and Highways, USDOT, FHWA, as adopted and modified by Chapter 468-95 WAC (MUTCD).

- Guide for the Development of Bicycle Facilities, AASHTO.
- ADA Standards for Accessible Design, USDOJ; consists of 28 CFR parts 35 & 36 and the ADA and Architectural Barriers Act Accessibility Guidelines for Buildings and Facilities, U.S. Access Board.
- FHWA-HRT-05-137 Evaluation of Safety, Design, and Operation of Shared-Use Paths: Final Report, which documents the research and the spreadsheet calculation tool and is the basis of FHWA-HRT-05-139 Evaluation of Safety, Design, and Operation of Shared-Use Paths Tech Brief. This report provides step-by-step instructions on how to use the LOS procedure and spreadsheet calculation tool, which can be downloaded from the Turner-Fairbank Highway Research Center.
- WSDOT Standard Plans

Local:

- City of Tacoma Transportation Master Plan
- City of Tacoma Waterfront Design Guidelines
- City of Tacoma Pedestrian and Bicycle Design Guidelines
- MoMap
- Pedestrian Bicycle Information Center
- Metro Parks Tacoma Trail Management Plan

SECTION 10.2 Shared-Use Path Design – The Basics

Shared-use paths shall be designed to accommodate all intended users and minimize conflicts. A shared-use path can accommodate several travel modes at altering speeds. Therefore a suitable bicycle design speed is just one of the critical elements to consider. For example, the pedestrian is generally the slowest mode so the design of an intersection crossing should be prioritized over a bicyclist which can travel at higher speeds.

10.2.1. 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 10-1 by designing to the horizontal curve radii shown. Refer to the WSDOT Design Manual, Section 1 for additional guidance on bicycle design speed.

Table 10-1: Bicycle Design Speeds

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

Where minimum radius curves cannot be obtained because of limited ROW, topography, or other space constraints, the applicant can request in writing a deviation from standards. The City's Traffic Engineering shall review the applicant's request. Consideration by the City does not guarantee approval.

The following measures may help 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 running grade should be designed not to exceed 5 percent.

SECTION 10.3 Shared-Use Path Design Widths

The standard minimum width of a shared-use path shall be 14 feet including a minimum of 10 feet of paved width and 2 foot shoulders on either side. Path widths of 8 feet are allowed for distances up to 50 feet due to physical constraints, such as bridge abutments. The applicant shall submit plans for review and approval by the City's Traffic Engineering.

The pavement width for a shared-use path in an area of higher demand should be widened to accommodate the anticipated demand and context of the trail location (see demand calculation tool, FHWA-HRT-05-137 Evaluation of Safety, Design, and Operation of Shared-Use Paths: Final Report). For wider, high demand paths, consider separating modes with striping, path materials, or physical barriers as shown in the image below.

10.3.1. Deviations from Standard Path Width

The applicant can request in writing a deviation from standard path width. Traffic Engineering shall review the applicant's request, which may include considerations such as:

- Exclusive use by one mode.
- Horizontal and vertical alignments provide frequent, well-designed passing and resting opportunities.
- Connects to a neighborhood for a short distance.

Consideration by the City does not guarantee approval. Should the request for deviation be approved by the City, the applicant shall be responsible for all signing and pavement markings for such conditions. Applicant shall use the MUTCD to develop a plan for review and approval by the City.

10.3.1.1. Existing Shared-Use Paths – Considerations

When an existing shared-use path does not meet current standards, the applicant shall be prepared to justify the deviation from current shared-use path standards. The applicant can request in writing a deviation from standards. Traffic Engineering shall review the applicant's request. Consideration by the City does not guarantee approval.

SECTION 10.4 Slope

10.4.1. Cross Slope of the Path and Shoulder

The cross slope on a paved shared-use path is 2 percent maximum. The cross slope of the shoulder cannot exceed 6:1. For drainage purposes, the entire section including the shoulders must transition through the curves. To avoid pavement crowning, it is desirable to design the pivot point on the outside edge of one shoulder. It is recommended to design the cross slope to less than the allowed maximum to allow for some tolerance during construction.

10.4.2. Side Slopes and Pedestrian Rail

A gentle side slope along shared-use path is an important safety design feature. Therefore an embankment side slope of 6:1 or flatter is recommended.

For shared-use paths with side slopes steeper than 3:1, or where obstacles or waterways may exist, other options may be considered by the City at the request of the applicant, including:

- 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.
- A natural barrier such as dense shrubbery on the side slopes along the entire length of the trail where there is steep slope.

Where a shared-use path is adjacent to a vertical drop of 2 feet 6 inches or more, a pedestrian rail is needed.

- 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.

Figure 10-1: Two-Way Shared-Use Path; Independent Alignment

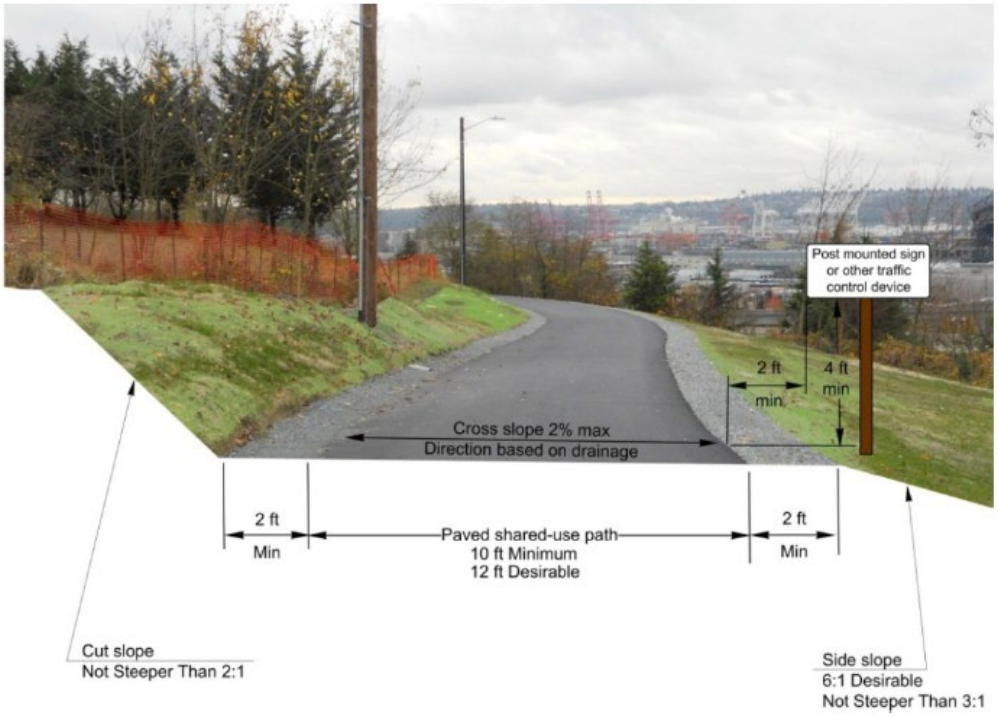
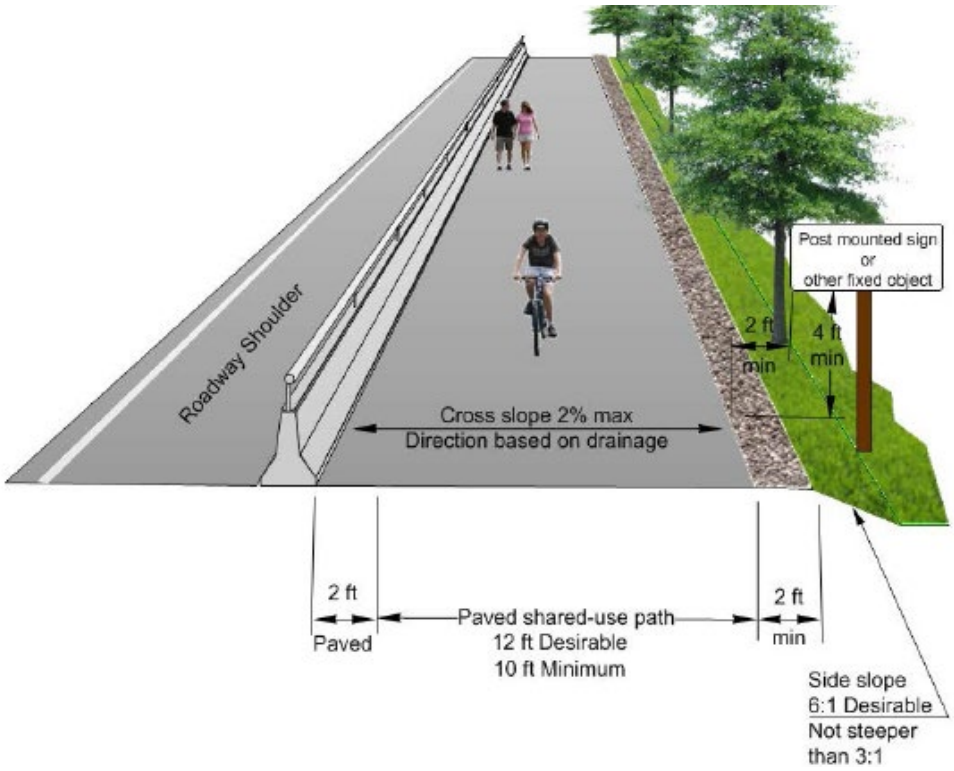
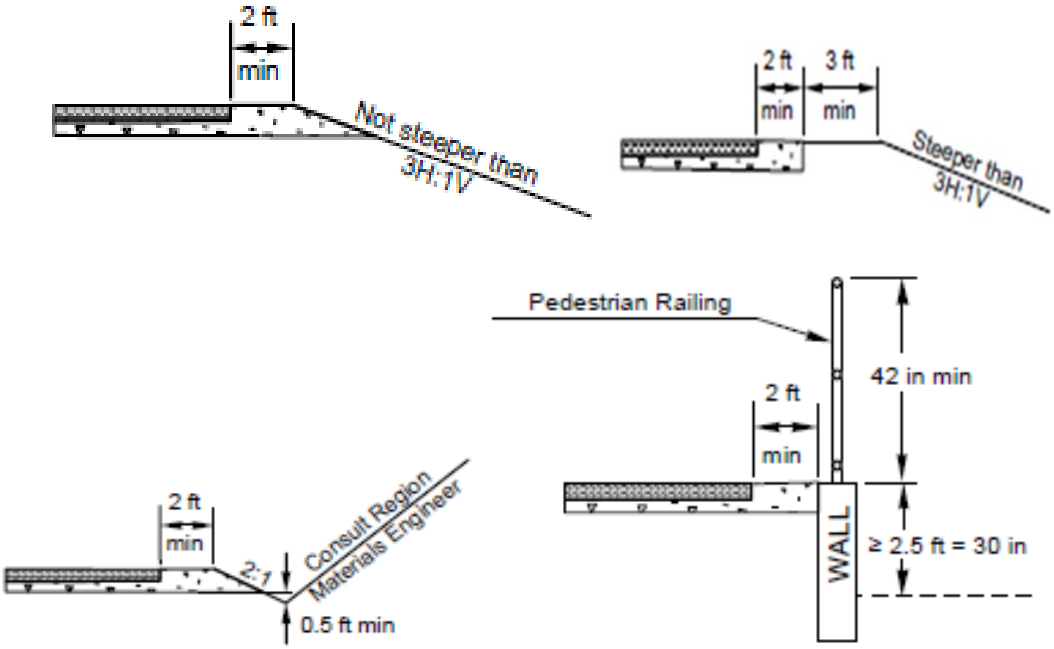


Figure 10-2: Two-way Shared-Use Path: Attached to > 35mph Roadway



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

Figure 10-3: Shared-Use Path Side Slopes and Railing



Example 1 (upper left): Embankment: Based on context, flatter slopes are desirable.

Example 2 (upper right): 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 (lower left): Cut section with ditch. Consult with Traffic Engineering to determine for appropriate cut slopes.
Example 4 (lower right): 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 Traffic Engineering to determine if shoulder along wall should be paved.
Note: These drawings depict some common applications for various slope alternatives.

SECTION 10.5 Clearances

The minimum horizontal clearance from the edge of pavement to an obstruction (such as bridge piers or fence) 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 10.6 Buffers

A buffer area provided directly adjacent to the shared-use path to create separation and a planting area is a very desirable feature and may be required. The City recognizes that in a built urban setting a buffer area may not be feasible. Therefore at the written request of the applicant, Traffic Engineering will consider exceptions to buffers. The applicant is responsible to explain and/or present the circumstances warranting no or reduced buffer area. Should a buffer area be required, any vegetation provided there shall be of an approved species and maintained per City standards as defined in CHAPTER 9.

SECTION 10.7 Running Slopes, Landings, and Rest Areas

10.7.1. Running Slopes

The design of a running slope on a shared-use path is not to be greater than 5 percent.

An exception is a path parallel to street in the ROW where running slope can match the grade of the roadway.

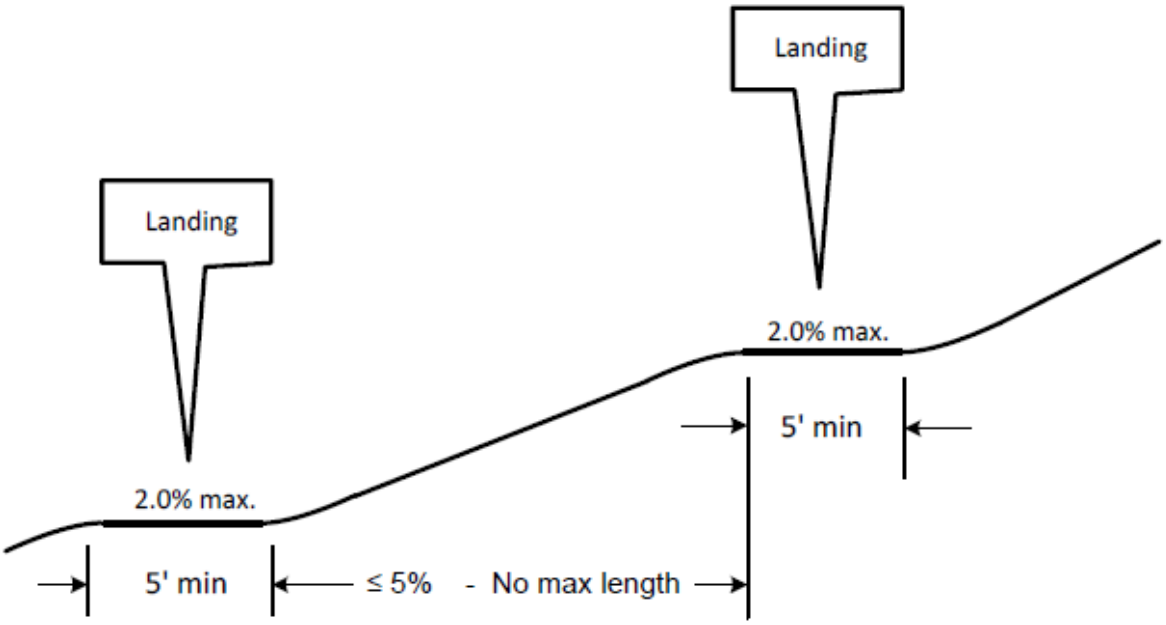
10.7.2. Landings

Landings are desirable on extended grades as they provide users with a level place to rest. Design vertical curves to transition from the grade to the landings. Figure 10-4 and Figure 10-5 show these features.

Design landings to:

- Permit users to stop periodically and rest.
- Not exceed maximum running slopes of 2 percent and cross slopes of 2 percent.
- 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 10-4: Shared-Use Path Landing Profile



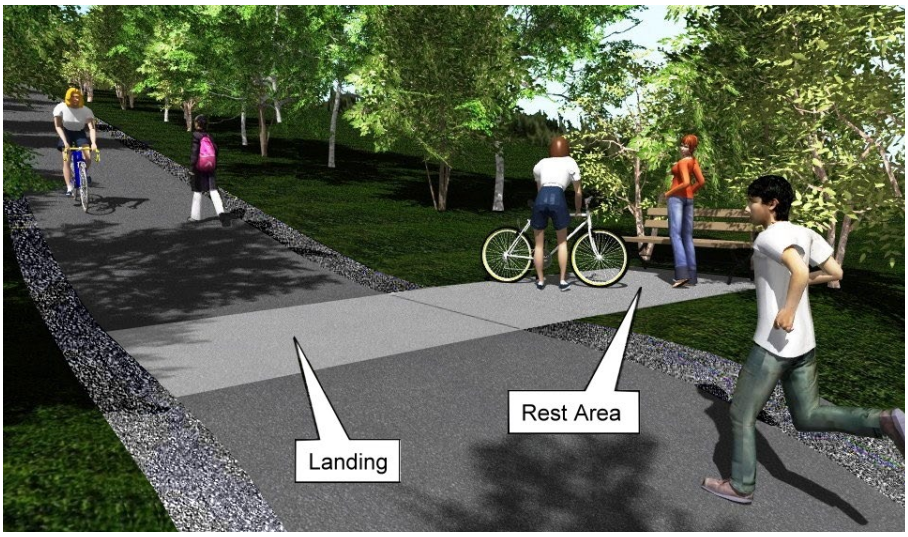
10.7.3. Rest Areas

Rest areas may be provided adjacent to the shared-use path outside of the pathway travelled as shown in Figure 10-5.

Requirements for rest areas include:

- The maximum running slope and cross slope is 2 percent.
- The minimum landing size is 5 feet by 5 feet and it must be parallel and abutting the path.
- If features such as benches are provided, they must meet ADA requirements; consult with Traffic Engineering and ADA Coordinator for guidance.

Figure 10-5: Landing and Rest Area Example



Notes:
Design landings at least 5 feet long and as wide as the shared-use path.

SECTION 10.8 Pavement Structural Section

Design the pavement structural section as recommended by Public Works Engineering, considering the quality of the subgrade and the anticipated loads on the path. Design loads are normally for maintenance and emergency vehicles, reference CHAPTER 4. Provide a firm, stable, slip-resistant pavement surface.

Use crushed rock or other suitable material for shoulder graded areas, reference WSDOT Standard Specifications Division 9. Consult with Public Works Engineering as needed. On bridges or in tunnels, it is a common practice to pave the entire shared-use path area, including shoulders across the structure.

The use of pervious asphalt or porous concrete should be considered when practicable. Consult the SWMM Volume 6 for design methodology and to help determine feasibility of permeable pavements. Standard Plan PD-01 has section designs for porous asphalt and pervious concrete.

SECTION 10.9 Stopping Sight Distance for Shared-Use Paths

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.

10.9.1. Stopping Sight Distance on Crest Vertical Curves

Refer to the MUTCD for charts and tables for SSD on crest vertical curves.

10.9.2. Stopping Sight Distance on Horizontal Curves

Refer to the MUTCD for charts and tables for SSD on horizontal curves.

SECTION 10.10 Intersections and Crossing Design

This section covers path/roadway intersections and grade separated crossings.

10.10.1. Path Intersects with Roadways

The applicant shall be responsible to evaluate intersection controls including the need for traffic control devices at the 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.

The applicant shall be responsible for evaluation of signal actuation mechanisms including the placement of manually operated accessible pedestrian pushbutton that comply with ADA requirements. Passive detection may be required in addition to the manually operated accessible pedestrian pushbutton, refer to CHAPTER 6 and CHAPTER 8.

The applicant shall be responsible for the evaluation of intersection signage including a list of signs by type, size, and location in accordance with the MUTCD.

The applicant shall be responsible for evaluation of approach treatments including the design of the shared-use path and roadway intersections with level grades and sight distances. Evaluate the need for advance warning signs and pavement markings that alert and direct path users that there is a crossing (refer to MUTCD).

The applicant shall be responsible for evaluation of sight distance including at minimum, provide SSD for both the roadway and the path at the crossing. Refer to MUTCD, CHAPTER 4, and the guidance set forth in this chapter on SSD for the roadway and for shared-use path respectively.

The applicant shall be responsible for evaluation of curb ramp widths including the design of curb ramps with a width equal to the shared-use path if possible. Curb ramps at path/roadway intersections must meet the requirements for curb ramps at a crosswalk. See CHAPTER 9 for additional guidance.

10.10.2. Midblock Crossings

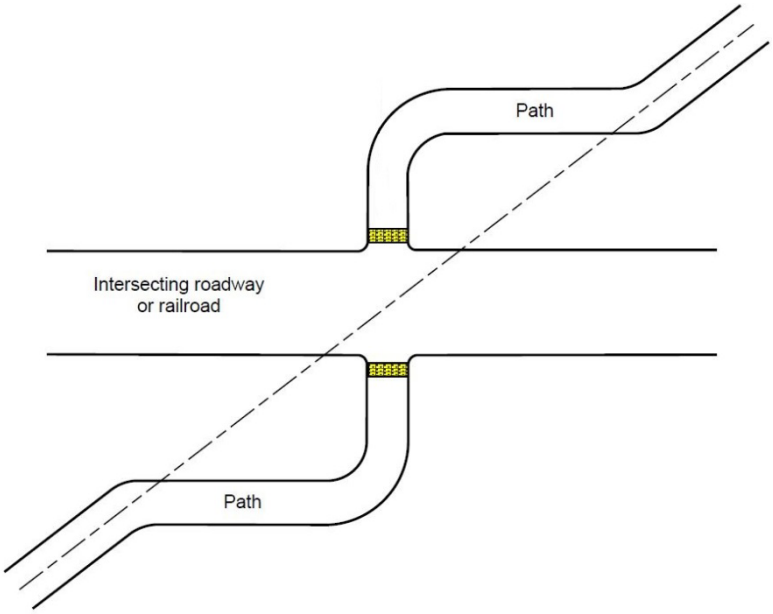
Clearly define who has the ROW and provide sight distance for all users at shared-use path and roadway intersections on the plan set.

For roadway intersections with roundabouts, see WSDOT Design Manual Chapter 1320 Roundabouts.

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 Figure 10-6.

There are several considerations for the designer for midblock crossings. These include detectable warning surfaces, traffic ROW assignments, various traffic control devices, sight distances for both bicyclists and motor vehicle operators, refuge island use, access control, and pavement markings.

Figure 10-6: Typical Redesign of Diagonal Midblock Crossing



10.10.3. Adjacent Paths

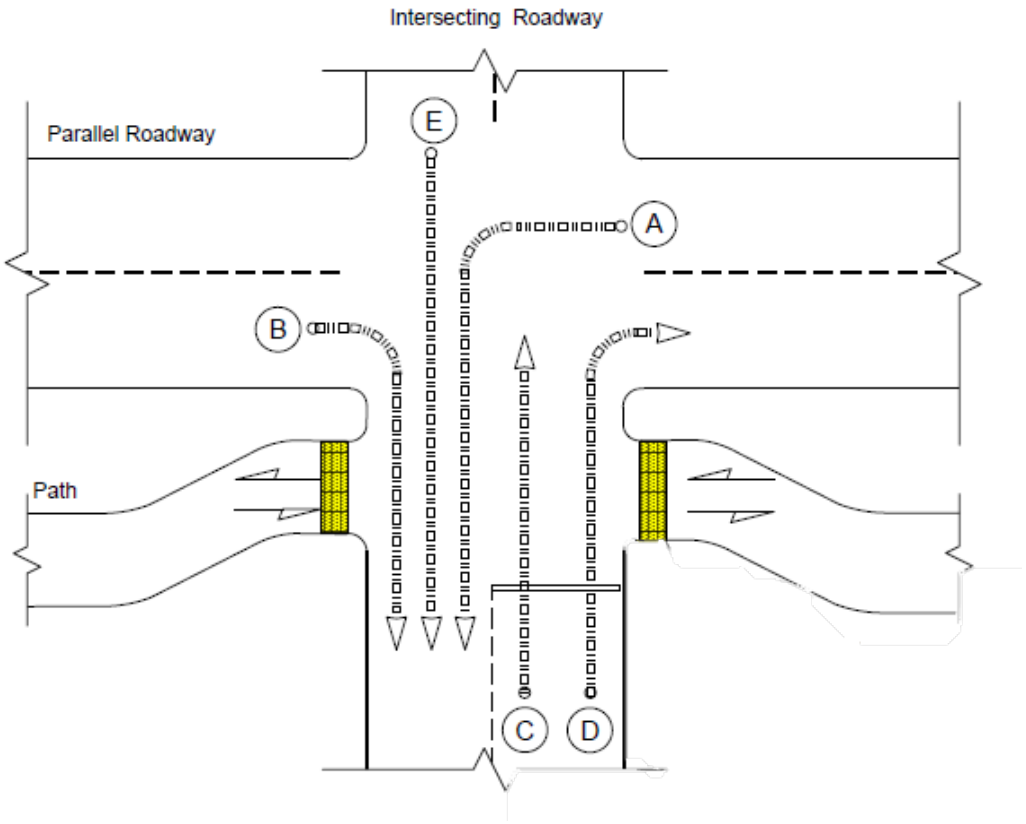
Adjacent path crossings are located at or near public intersection crosswalks and are usually placed with pedestrian crossings, where motorists can be expected to stop. If alternate intersection locations for a shared-use path are available, select the one with the greatest sight distance.

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 Figure 10-7. The applicant or design engineer should 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).

Traffic Engineering will 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 10-7: Adjacent Shared-Use Path Intersection



Note:
For more information search the various references from Section 10.1.2

10.10.4. Additional Roadway/Path Intersection Design Considerations

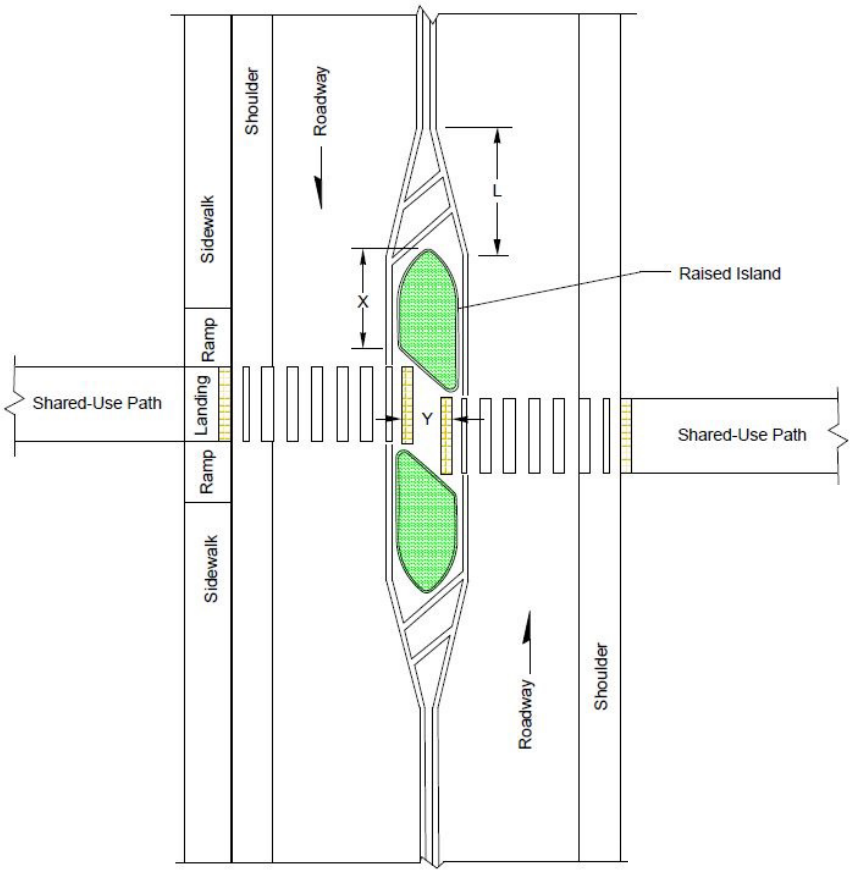
Additional roadway/path intersection design considerations include the following:

- Elevated crossings: Consider refuge islands or raised asphalt humps where a shared-use path crosses a non-arterial.
- The refuge area may either be designed with the storage aligned perpendicularly across the island or be aligned diagonal (Figure 10-8). 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.

10.10.5. 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 City of Tacoma Standard Plans. Also, see design of at-grade pedestrian railroad crossings.

Figure 10-8: Roadway Crossing Refuge Area



Key:
L= Length of taper (see Chapter 7).
X = Length of island each side of path.
Y = Width of refuge (6 feet minimum 10 feet maximum).
Notes:
For striping details, see Chapter 7 and the MUTCD.
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 10.11 Grade Separated Crossings

When a grade separation is desired for a path to cross a roadway or railroad, designers sometimes have the option to construct a tunnel or underpass under the roadway or railroad. The project design shall 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 of 2 feet 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 Public Works Engineering to verify that the planned path width meets their specifications.

If expansion joints are used in the shared-use path then they should be placed 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, see CHAPTER 8.

If the shared-use path requires consideration of screening materials or railings, as identified in the above sections or to address neighborhood impacts, then consult with Public Works Engineering for such accommodation.

SECTION 10.12 Signing, Pavement Markings and Illumination

Refer to the MUTCD for guidance and directions regarding shared-use path signing (regulatory, warning, and way finding) and pavement markings. Wayfinding should be used on all trail corridors. The City is using the green and white MUTCD wayfinding as a standard to identify destinations of significance. Special districts may have individual signage styles, consult with Public Works Engineering.

For pavement markings around bollards and other obstructions see Section 10.13 of this chapter.

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. Illumination of the shared-use path should be considered for all segments not illuminated by arterial lighting or other sources. The City has an LED standard for pedestrian level illumination. Lighting may also require a cut-off shield to reduce light intrusion on to adjacent homes or properties. The applicant shall submit a lighting plan for review by Traffic Engineering that is consistent with guidance outlined in CHAPTER 5.

10.12.1. Mileage Markers

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. Markers should be inset and flush with the shared-use path, such as a tile or metal plate.

SECTION 10.13 Restricted Use Controls

This section presents requirements on use of fencing and other treatments to separate motor vehicles from the shared-use path.

10.13.1. 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 Figure 10-8, likely require fencing. For guidance on fencing controls in the ROW, refer to WSDOT Design Manual, Division 5.

Figure 10-8: Shared-Use Path n Limited Access Corridor

10.13.2. Restriction of Motor Vehicles

Shared-use paths often need some form of physical barrier at roadway intersections to prevent unauthorized motor vehicles from entering.

10.13.2.1. Landscaped Islands

An acceptable method for restricting entry of motor vehicles is to split the entry way into two sections separated by landscaping. This method creates an island in the middle of the path to prevent vehicles from entering. A landscaped island is recommended to be planted with low-growing, hardy, native vegetation consistent with the UFM. This method would also require installation of pavement markings and signing per the MUTCD.

10.13.2.2. Bollard Considerations

Bollards can be used to prevent unauthorized vehicle access. However, bollards should not be applied indiscriminately, and should be considered as the last option to restrict motor vehicles. The applicant shall work with Public Works Engineering to determine the bollard type and its placement.

When designing the placement and type bollard, the following apply:

The desirable design is to provide a single bollard (Type 1, removable) with the locking mechanism at the top, installed in the middle of the path. A two-man (18-28 inches) or three-man rock (28-36 inches) placed on each side of the path may be necessary. If multiple bollard posts are used, minimum 5 foot spacing between the edges of the concrete footings is required to permit passage of bicycle-towed trailers, mobility devices 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 SSD to bollards. An ideal location for bollard placement is in a relatively straight area of the path where the post placement has the SSD.

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 SSD.

Use a contrasting striping pattern on the post or use reflective materials, such as a band at the top and at the base.

Design all bollards along a corridor to be uniform in appearance.

Non-removable bollards (Bollard Type 2) may be used where vehicular access is not needed.

For additional guidance on bollard design refer to the Standard Plans SU-12 and for pavement markings the Standard Plans and MUTCD.

11 Chapter 11 Stormwater and Wastewater Sewer Design

INTRODUCTION

This chapter provides design criteria for the construction of all publicly owned wastewater, sewer and stormwater conveyance systems. In the City stormwater and wastewater systems are separate and distinct systems. Wastewater ultimately discharges to one of two wastewater treatment systems. The stormwater system ultimately discharges to the Puget Sound.

TMC 12.08 provides the City the regulatory authority for wastewater and stormwater discharges within the City.

The 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 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. 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 Side Sewer Manual is available online.

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

SECTION 11.1 Existing System Drawings

Design and record drawings for most City-owned and maintained wastewater and stormwater systems and facilities can be viewed online on the City's 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, Tacoma, WA 98402.

Project design shall not be based solely on drawings available on the City's website. Available drawings are not a substitute for field investigation or field survey. For all projects, survey data shall be used for project design.

SECTION 11.2 Wastewater Assessment and Connection Charges

Property owners are responsible for the installation costs of the adjacent public wastewater sewer serving a property and must pay connection costs before a connection to the public wastewater system will be allowed. Payment of connection costs can be satisfied in one of the following ways:

11.2.1. Local Improvement District Charge

If a public wastewater sewer is constructed via a local improvement district (see CHAPTER 2, Section 2.8), properties are assessed for the design and construction cost of the public sewer.

11.2.2. Connection Charge-in-lieu-of-Assessment

If a property owner was not assessed through a local improvement district and public sewer service is already available, the property owner may be required to pay a

Connection Charge-in-lieu-of-Assessment prior to connecting to the public wastewater sewer. Connection Charge-in-lieu-of-Assessment costs are established in TMC 12.08.350. The applicant should contact the Local Improvement Office at (253) 591-5522 to determine if a Connection Charge-in-lieu-of-Assessment if due.

11.2.3. Right Of Way Construction/Work Order Permit

If public wastewater service is not available, private property owners must pay for the design and construction costs to have the public wastewater sewer extended. Since the design and construction costs are the full responsibility of the property owner, there is no assessment or Connection Charge-in-lieu-of-Assessment due at the time of connection.

If a proponent is extending the public wastewater sewer through the Local Improvement District process or the ROW construction process described above, an In Lieu of Assessment Release Form shall be completed and returned to the City after the wastewater sewer has been constructed, tested, and approved by the City of Tacoma. The In Lieu of Assessment Release Form is required prior to closeout of the ROW Construction/Work Order Permit of Local Improvement District project. 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 fee as required by TMC 12.08B and to remove from the public record the parcels subject to additional tap or connection charges for side sewers as may be required by RCW Chapter 65.08. After construction of the public wastewater system is complete 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.

The In Lieu of Assessment Form can be obtained from City of Tacoma Planning Development – Site Development staff.

SECTION 11.3 Sizing the Stormwater and Wastewater System

11.3.1. 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.

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.

If the existing public wastewater system is determined to be under capacity, the project proponent may be required to upsize the existing downstream system.

11.3.2. 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 Additional Protective Measure – Infrastructure Protection in the City of Tacoma Stormwater Management Manual 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, the project proponent may be required to upsize the existing downstream system or provide detention onsite.

SECTION 11.4 Gravity Pipe Design Criteria

11.4.1. Pipe Size

11.4.1.1. Wastewater System Pipe Size

The minimum pipe diameter for the wastewater conveyance system is 10 inches.

11.4.1.2. 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.

11.4.2. Pipe Slope and Velocities

The connection point to the existing pipe system will dictate the minimum slopes that can be achieved for a project. The City may require that certain existing pipe segments and structures be replaced in order to establish superior pipe types and achieve greater minimum slopes when minimums shown below are not possible to achieve.

Maximum slopes, velocities, and anchoring requirements for certain pipe types are shown in Section 11.4.10. The maximum slope of a pipe is also dictated by constructability and will depend on the pipe diameter, maintenance hole diameter, and number of connections into that maintenance hole.

11.4.2.1. Wastewater System Pipe Slope

The minimum slope for wastewater pipes is 1 percent. Slopes less than 1 percent may be allowed provided calculations are provided showing that the proposed system are designed and constructed to provide mean velocities, when flowing full, of not less than 2 feet per second. An “n” value of 0.013 shall be used in the Manning’s formula per the Criteria For Sewage Works.

11.4.2.2. Stormwater System Pipe Slope

The minimum slope for all stormwater pipes is 0.5 percent. Slopes less than 0.5 percent may be allowed provided calculations are provided to demonstrate that a minimum velocity of 3 feet per second can be maintained at full flow.

11.4.2.3. Minimum and Maximum Velocities

Minimum velocities prevent solids from collecting inside pipes. Maximum velocities intends to help prevent system corrosion.

11.4.2.3.1. Wastewater System Minimum and Maximum Velocities

The minimum velocity for wastewater pipes shall be 2 feet per second though it is desirable to have velocities of 3 feet per second or more where practicable.

The maximum velocity for wastewater pipes shall be 15 feet per second. Where velocities greater than 15 feet per second are expected, special provisions shall be made to protect against internal erosion or displacement by shock.

11.4.2.3.2. Stormwater System Minimum and Maximum Velocities

The minimum velocity for stormwater pipes shall be 3 feet per second.

The maximum velocity for stormwater pipes shall be 15 feet per second. Where velocities exceed 15 feet per second energy dissipation may be necessary.

11.4.3. Pipe Material

11.4.3.1. Wastewater Conveyance Pipe Material

Table 11-1 lists the acceptable pipe materials for the wastewater conveyance system. The maximum out of round deflection allowed in flexible pipes is 5 percent. The primary formula used for predicting horizontal deflection for flexible pipe is the Modified Iowa Method. Special consideration must be made for any pipes that may be placed above ground to account for temperature variations.

11.4.3.2. Stormwater Conveyance Pipe Materials

Table 11-2 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 out of round deflection allowed in flexible pipes is 5 percent. The primary formula used for predicting horizontal deflection for flexible pipe is the Modified Iowa Method. Galvanized, aluminized, and/or corrugated iron or steel pipes are not allowed within the public ROW or as a connection to the municipal system. Special consideration must be made for any pipes that may be placed above ground to account for temperature variations.

Table 11-1: 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 - Typical
Solid Wall PVC; 18 inches in diameter or greater	115 psi SDR 26	ASTM F 679	WSDOT 9-05.12(1)	Standard use – Typical
Vitrified Clay	Extra Strength	ASTM C 700	WSDOT 9-05.8	Standard use - Typical
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 - Typical
Solid Wall PVC; 12 inches in diameter or greater	SDR 18	AWWA C 900 (AWWA combined C905 and C900 into one Standard)	WSDOT 9-30.1(5)A	Shallow or deep cover, non-standard separation from water main - Typical
Lined Ductile Iron	Special Thickness Class: 50 Minimum Pressure Class: 350 (If joined using bolted flanged joints – Special Thickness Class 53 required)	ANSI A 21.51 AWWA C 151	WSDOT 9-05.13	Shallow or deep cover, non-standard separation from water main, above ground installation in vertical applications or steep slopes
Solid Wall High Density Polyethylene (HDPE), Heat Welded, Butt Fused	SDR 17	ASTM D 3350	WSDOT 9-05.23	Pipe bursting, steep slope installation, or above ground installation in vertical applications or steep slopes
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.*	Large diameter (typically 36” and above)
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.****	Large diameter (typically 36” and above).
Triple Wall Polypropylene Pipe (PP), 30 inches in diameter or greater (Sanitite or engineer approved equal)	Minimum Pipe Stiffness of 46pii in accordance with ASTM D2412	ASTM F2764 ASTM D3212 ASTM F477	WSDOT 9-05.24(2) Requires prior approval from Environmental Services.**** .	Large Diameter (typically 36” and above).

****Additional design requirements may apply.

1 Table 11-2: Acceptable Stormwater Conveyance Pipe Materials

Pipe Material	Minimum SDR/Class	Reference	Specification Reference	Applicability
Solid Wall PVC 15 inches in diameter or less	SDR 35	ASTM D 3034	WSDOT 9-05.12(1)	Standard use – Typical
Solid Wall PVC 18 inches in diameter or greater	115 psi SDR 26	ASTM F 679	WSDOT 9-05.12(1)	Standard use – Typical
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 – Typical
Solid Wall PVC 12 inches in diameter or greater	SDR 18	AWWA C900 (AWWA combined C905 and C900 into one Standard)	WSDOT 9-30.1(5)A	Shallow or deep cover, non-standard separation from water main – Typical
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, above ground installation in vertical applications or steep slopes
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; Steep Slope Installation; Above Ground Installation in vertical applications or steep slopes
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 (typically 36” or larger)
Dual Wall Polypropylene Pipe (PP) 12 inches to 30 inches	Minimum Pipe Stiffness of 46pii in accordance with ASTM D2412	ASTM F2736 ASTM D3212 ASTM F477	WSDOT 9-05.24(2)	Standard Use
Triple Wall Polypropylene Pipe (PP) 30 inches to 60 inches	Minimum Pipe Stiffness of 46pii in accordance with ASTM D2412	ASTM F2764 ASTM D3212 ASTM F477	WSDOT 9-05.24(2) Requires prior approval from Environmental Services. Additional design requirements may apply.	Large Diameter (typically 36” or larger)

2

11.4.4. Pipe Depth

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

Existing conditions will dictate the depth of any new connections. Depths of new connection shall allow for future extension of the systems and ensure pipes are laid true to line and grade with not curves, bends or deflections and laid to alignment.

11.4.5. Pipe Cover

The minimum pipe cover is 3 feet.. When site conditions require pipe cover that is less than 3 feet, calculations shall be provided (calculations from the pipe manufacturer can be provided) showing that the pipe type can handle the reduced pipe cover. 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 base course for pipes under pavement or the outside surface of the pipe for pipes in softscape locations.

All installations must ensure bedding requirements can be met and pipes can be installed without damaging the pipes.

11.4.6. Pipe Alignment

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

Existing conditions shall dictate the alignment of any new connections to the system and shall match the existing alignment unless that alignment can be easily adjusted to match the standard alignment. The standard distance between utilities shall be maintained to the maximum extent feasible.

A minimum of 5 feet horizontal separation shall be maintained between:

- wastewater sewers and adjacent stormwater conveyance pipes,
- wastewater sewers and adjacent wastewater sewers,
- stormwater conveyance pipes and adjacent stormwater conveyance pipes,
- stormwater conveyance pipes and wastewater side sewers that run parallel to stormwater pipes,
- wastewater sewers and wastewater side sewers that run parallel to the wastewater sewer,
- stormwater conveyance pipes and potable water pipes.

A minimum vertical separation between stormwater conveyance pipes and any other utility shall be 12 inches.

A minimum vertical separation between wastewater sewers and any other utility (except potable water*) shall be 12 inches.

A minimum of 2 feet vertical separation shall be maintained between any building tie-backs, soil nails, anchors, etc. and wastewater and/or stormwater systems. Where

crossings occur, tie-backs, soil nails, anchors, etc. shall be below the wastewater and/or stormwater pipe. A minimum 5 feet vertical separation shall be maintained between any building tie-backs and wastewater and/or stormwater systems. Environmental Services shall review all plans where building tie-backs, soil nails, anchors, etc. may affect the City's stormwater and/or wastewater system. A pre and post video inspection of the wastewater and/or stormwater system will be required where building tie-backs, soil nails, anchors, etc. may affect those systems.

*Separation between the wastewater system and potable water system shall meet separation requirements of the most recent version of the Criteria for Sewage Works Design (Orange Book). This document can be found on the Washington State Department of Ecology website.

Separation must be sufficient to allow for proper bedding and compaction. Additional separation may be needed for larger diameter pipes, deeper pipes, and local site conditions.

Separation requirements for private side sewers shall comply with the most recent version of the City of Tacoma's Side Sewer and Sanitary Sewer Availability Manual.

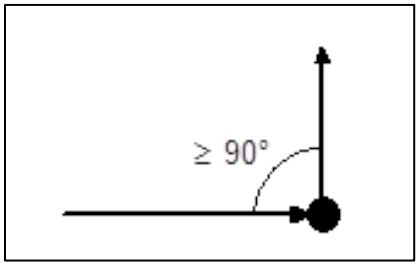
Distance between utilities shall be measured from edge of pipe to edge of pipe.

Gravity wastewater sewers not meeting the minimum separation requirements and all pressurized wastewater sewers shall be designed in accordance with the Criteria for Sewage Works (Orange Book).

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 maintenance hole should 90 degrees or greater, as shown in Figure 11-1.

Figure 11-1: Wastewater Sewer Mains Entering or Exiting Maintenance Hole Angle



Where crossing an existing or proposed utility, the alignment 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.

See Section 11.9 – Access and Easement for additional information concerning pipe alignment in easements.

11.4.7. 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.

See the City of Tacoma Side Sewer and Sanitary Sewer Availability Manual for required pipe coupling types for side sewers located in the ROW.

11.4.8. 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.

11.4.9. Pipe Casings

Pipe casings are provided when conventional open trench replacement and/or repair of the stormwater or wastewater pipe would be 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 percent 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 the Environmental Services Department.

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. A basis for analysis shall be provided that clearly describes all assumptions.

5. All casing pipe welds shall be inspected by a third party testing agency, including both 100 percent 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 and shall extend at least 5 feet either side of the improvement under which the stormwater/wastewater utility will be located. An engineering analysis will be required to show that the casing extent is appropriate. The loading zone of influence shall be shown on the plan set.

7. Pre-manufactured non-metallic or non-corrosive (stainless steel, carbon steel or similar) casing spacers shall be used to support the carrier pipe in the casing to facilitate pipe removal and 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 the Environmental Services Department.

Pipe casing are also required on wastewater pipes where wastewater pipes are placed above water pipes. See the Washington State Department of Ecology Criteria for Sewage Works Design (Orange Book).

11.4.10. Pipe Anchors

Pipe anchors and/or restrained joints at bends and junctions are required if velocities exceed 15 feet per second. A basis of design shall be required for pipes with velocities exceeding 15 feet per second.

Pipe anchors may be required when placing pipes on steep slopes (15% or greater).

The following table shows criteria to be used in determining whether pipe anchoring is required and describes the maximum pipe slope allowed for various pipe types. The table does not fully encompass all scenarios where pipe anchors may be necessary – site specific conditions shall be reviewed to determine if pipe anchors are necessary. Anchor design and spacing shall be submitted to the Environmental Services Department for approval. Table 11-3 applies to pipe anchoring above and below ground. Only Solid Wall HDPE and Lined Ductile Iron pipe should be used in above ground installations. A basis for design shall be provided when pipe anchors are used.

Table 11-3: Pipe Anchor Requirements

Pipe Material	Pipe Slope Requiring Pipe Anchors and 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 may be allowed with additional anchoring and analysis)	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 percent to minimize disturbance to steep slopes.
3 Maximum slope of 200 percent 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 percent. Above-ground installation is required on slopes greater than 40 percent to minimize disturbance to steep slopes.

11.4.11. Considerations for Future Development

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

11.4.12. Pipe Buoyancy

Pipe buoyancy should be considered when there is a possibility that pipe flotation could occur including:

- Pipe placed in areas with high groundwater table. Review the geotechnical report to determine if the area has high groundwater.

- Pipe placed in areas subject to flooding such as floodplains
- Pipe placed underwater.

Whenever the potential for flotation exists, the design engineer shall design the system accordingly which may include consideration for heavier pipe or appropriate pipe anchors. When designing the system, the pipe shall be considered empty in the event the line must be dewatered. Pipe buoyancy design shall be submitted to the Environmental Services Department for review and approval.

SECTION 11.5 Maintenance Hole Design Criteria

11.5.1. Maintenance Hole Locations

The maximum distance between maintenance holes is 400 linear feet for the wastewater sewer system and 350 linear feet for stormwater conveyance system.

In addition, maintenance holes 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 8-inches in diameter or greater; or
- As otherwise required by the Environmental Services Department.

For construction and maintenance purposes:

- Horizontal separation between maintenance holes and structures (vaults, light poles, buildings, retaining walls, etc.) shall be a minimum of 10 feet.
- Horizontal separation between adjacent maintenance holes shall be 5 feet.
- Horizontal separation between maintenance holes and catch basins shall be 5 feet.
- The minimum distance shall be measured from the outside diameter of the maintenance hole (including the bottom slab) and the adjacent structure, maintenance hole, or catch basin.

The number of maintenance holes constructed shall be limited to the extent feasible. For example, a new maintenance hole shall not be constructed solely for the purpose of it being undesirable to replace an existing maintenance hole in order to allow a connection from an onsite parcel(s). Onsite utilities shall be adjusted first to accommodate fewer public structures.

11.5.2. Maintenance Hole Types

All maintenance holes shall either be Type 1 or 2 concrete maintenance holes with concentric cones for up to 54 inch diameter maintenance holes and eccentric cones for 60 inch or greater maintenance holes as shown on the City Standard Plans SU-17 and

SU-18. The use of Type 3 concrete maintenance holes requires prior approval from the Environmental Services Department. The use of non-concrete maintenance holes requires prior approval from the Environmental Services Department.

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

A plan view of the maintenance hole, 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 maintenance holes shall be channelized in accordance with City Standard Plans SU-17, SU-18, and SU-19. City maintenance holes generally do not have sumps though some maintenance holes, such as flow control maintenance holes associated with the stormwater system, may contain sumps.

11.5.3. Maintenance Hole Covers

All maintenance hole frames and covers shall be as shown on City Standard Plan SU-22. Inlet grates are not allowed on City maintenance holes.

Maintenance holes are not allowed within the sidewalk unless no alternative alignment is possible. If no alternative is possible, maintenance holes 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 maintenance hole.

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

11.5.4. Connections to Maintenance Holes

Connections to the stormwater system shall be made at a structure. Provide connections into the public stormwater system at 90 degrees to the stormwater system where possible. Private connections to catch basins are allowed if there is sufficient capacity within the catch basin (capacity to accommodate the pipe and hydraulic capacity) – see Section 11.6 below for more information on catch basins.

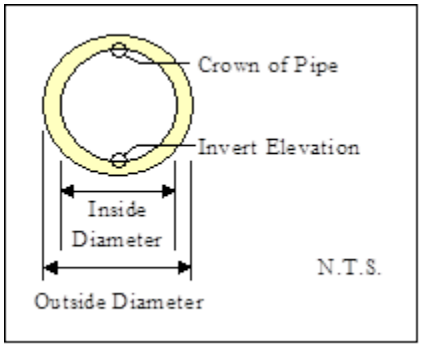
Changes in pipe direction or increases or decreases in pipe size shall only be allowed at structures.

Side sewer connections to maintenance holes shall only be as allowed per the Side Sewer and Sanitary Sewer Availability Manual.

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

Pipes of different diameters shall be aligned vertically in maintenance holes by matching crowns. Where existing conditions prohibit the ability to match crowns, pipes shall be aligned vertically to match crowns as close as possible. Matching the crown elevation of the pipes helps prevent backflow conditions in the smaller pipe.

Figure 11-2: 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 the Environmental Services Department. Drop connections are permitted for stormwater catch basin leads. Catch basin leads shall connect below the cone of the maintenance hole.

A flexible pipe-to-maintenance hole connector shall be employed in all connections of all pipes to new and existing precast concrete maintenance holes to provide a watertight joint between the pipe and the maintenance hole. 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 the Environmental Services Department approved equal. The connectors shall be installed in accordance with the manufacturer's recommendations. "Kor-N-Seal" or equivalent are not used where knockouts exist, in the instances where connection requires utilizing the existing knockout, a sand collar shall be used.

Connections to existing brick maintenance holes may be allowed on a case by case basis. Maintenance hole replacement may be required by the Environmental Services Department based upon the condition of the existing maintenance hole.

SECTION 11.6 Catch Basins

11.6.1. Catch Basin Locations

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 11.3.2 of this chapter).

Catch basin leads shall be no longer than 50 feet. Extension of the stormwater system may be required to ensure catch basin leads do not exceed 50 feet.

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 (the structure offset shown on the plans shall be to center of grate, not center of structure to ensure grate location is appropriate);
- At all closed contour low points and minor low points along the roadway;
- Upstream of all intersections;
- Upstream of all crosswalks and curb ramps (catch basins shall be located outside the wing of the curb ramp);
- At the downstream end of alleys upstream of the sidewalk;
- Prior to transitions from a typical crown to a full warp through a downhill grade; and

Private development will be required to install catch basins as required above if stormwater is discharged from private property into the ROW, if roadway improvements are required as part of the project that include curb and gutter and/or wedge curb, if curb ramps are required to be installed or replaced, or as directed by plan review staff or Environmental Services.

Catch basins shall not be located in:

- Areas of expected pedestrian traffic;
- Crosswalks (the minimum clear distance from the curb ramp landing to any grate shall be 1 foot);
- The wheel path of vehicles;
- Driveways;
- Graveled areas or high sediment generating areas unless pretreatment per the City of Tacoma SWMM is provided; and
- Areas where they will conflict with other utilities.
- Within 5 feet from the edge of a tree trunk.

Catch basins shall not be installed as part of the public wastewater sewer system.

11.6.2. Catch Basin Types

Catch basins shall be Type 1, Type 1L or Type 2 catch basins conforming to WSDOT Standard Plans B-5.20, B-5.40, or B-10.20.

Catch basins shall use Combination Inlets per WSDOT Standard Plan 25.20-02, where feasible. The design engineer shall describe why combination inlets cannot be used if deemed infeasible.

Type 1 and Type 1L basin heights shall not exceed 8 feet from finished grade to sump bottom and shall not exceed five (5) feet from finished grade to lowest pipe invert. This allows repairs to be made to ensure the system remains water-tight (*WSDOT Technical Commentary for Standard Plan B-5.20, October 2017*).

Type 2 catch basins shall be used when:

- The overall structure height exceeds 8 feet from finished grade to sump bottom elevation, OR
- The pipes entering or exiting the catch basin are greater than the allowable diameters specified for Type 1 catch basins.

Type 2 catch basins shall not exceed 15 feet for maintenance purposes (*WSDOT Technical Commentary for Standard Plan B-10.20, October 2017*).

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 knockout and outside of pipe per WSDOT Standard Plans can be maintained.

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-30.30-03 or WSDOT Standard Plan B-30.40-03.

Where existing catch basins are modified due to slight grade change, grates shall be replaced with vaned grates. Where existing catch basins are replaced, the replacement shall be oriented to accommodate a combination inlet where feasible.

Catch basins shall be designed for H-20 loading.

All catch basins, inlets, etc. shall be marked. The City of Tacoma has curb markers available for both public and private projects. Contact your City of Tacoma site inspector to obtain curb markers for the project.
Bubble up systems shall not be allowed.

11.6.3. Stormwater System Connections

Connections to the stormwater system shall be made at a structure. Provide connections into the public stormwater system at 90 degrees to the stormwater system where possible. Private connections to catch basins are allowed if there is sufficient

capacity within the catch basin (capacity to accommodate the pipe and hydraulic capacity).

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. Catch basins within stormwater facilities (such as bioretention facilities) may be allowed to connect to catch basins that are part of the stormwater conveyance system.

Catch basins shall connect to maintenance holes. Catch basins are not a part of the City of Tacoma mainline system.

Connections to catch basins shall be made using sand collars.

To accommodate maintenance, quarry spalls shall not be placed around catch basin inlets.

The slope of the ground surfaces for a radius of 5 feet around a catch basin grate or solid lid shall be 5:1. Where not physically feasible, a maximum slope of 3:1 shall be provided around at least 50% of the catch basins circumference.. The slope restrictions help to facilitate maintenance.

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Strip drains are not allowed.

SECTION 11.7 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 maintenance holes. 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 ROW 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 11.8 Open Channel Design Criteria

The stormwater conveyance system may have open channel flow. See the City of Tacoma Stormwater Management Manual for design criteria specific to open channel flow.

The wastewater system shall not be designed for open channels.

SECTION 11.9 Access and Easements

See CHAPTER 13 for additional information concerning ROW and easements.

11.9.1. Access

All components of the stormwater and wastewater system must be accessible for inspection and maintenance purposes. Construction of access roads and ramps may be necessary for system components located outside the roadway section to ensure all components of the system are accessible. Maintenance holes shall be placed in or at the edge of access roads when possible.

Maintenance access roads shall:

- Be a maximum of 15% grade except for crushed surfacing base course which shall be limited to 12% grade,
- Have a minimum 40 foot outside turning radius,
- Be a minimum of 15 feet wide on curves and minimum of 12 feet wide on straight sections,
- Provide a paved apron where the access road connects to paved roads,
- Be constructed with permeable pavement, crushed surfacing base course, modular grid pavement, asphalt, or concrete,
    - HMA shall be a minimum thickness of 2 inches and in accordance with City of Tacoma General 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).
- Be limited by a double posted gate or bollards to discourage vehicular use.
- Access required over sidewalks requires that sidewalks be designed for H20 loading.

Maintenance access ramps shall:

- Be sufficient to provide sediment removal with a trackhoe and truck,
- Extend as far into the facility as necessary to allow for maintenance,
- Be a maximum of 15% slope except for crushed surfacing base course which shall be limited to 12% grade,
- Be constructed with permeable pavement, crushed surfacing base course, modular grid pavement, asphalt, or concrete,
    - HMA shall be a minimum thickness of 2 inches and in accordance with City of Tacoma General 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).
- Be limited by a double posted gate or bollards to discourage vehicular use.
- Access required over sidewalks requires that sidewalks be designed for H20 loading.

11.9.2. Easements

All components of a public system shall be located in dedicated tracts, dedicated easements or within the public right-of-way.

Public easements are easements granted by private entities to the City for access, maintenance, and protection of City infrastructure. Public easements are separate documents prepared by the City Real Property Services and are recorded with the Pierce County Auditor. Public easements must be granted to the City and fully executed before final permit closeout.

Permanent structures and/or public and private utilities shall not be located within the easement area (the easement area shall be free and clear) except utilities that must cross perpendicular to the easement to connect to the wastewater sewer or stormwater system and other utilities that fully cross the easement provided this crossing is perpendicular to the easement. The actual easement documents will contain specific language related to applicable restrictions and allowances.

Where separate access roads are required per Section 11.9.1 above, the access roads/ramps shall be located within the easement area which may necessitate a larger easement area.

Examples of permanent structures and/or utilities include:

- Concrete foundations
- Concrete slabs
- Walls
- Rockeries
- Buildings
- Decks
- Fences
- Overhanging structures

- Fill material
- Recreational sport courts,
- Carports,
- Portable Sheds,
- Private utilities including private stormwater BMPs,
- Concrete curbs,
- Franchise utilities (telecom, gas, etc.)
- Other public utilities (Tacoma Water, Tacoma Power),
- Any other site improvement that may interfere with the need to access or construct utilities in said easement area(s).

Examples of items that are not considered permanent structures*:

- Simple landscaping (grass/sod/lawn areas),
- Asphalt paving,
- Gravel,
- Other site improvements that do not prevent the easy access of people, materials, and machinery across, along and within the said easement area.

*Land restoration by the City within the easement area will be strictly limited to grass seed, grass sod, and/or asphalt replacement.

Preliminary project planning shall consider the potential loss of buildable area or the need to purchase more property to accommodate required public easements.

Public wastewater sewer easements shall conform to Table 11-4. Public stormwater easements shall be a minimum of 20 feet in width and conform to Table 11-5. Environmental Services will make the final determination of easement width required based upon the site conditions and proposed pipe diameter. The values in Table 11-4 and Table 11-5 are for ideal site conditions.

Table 11-4: Wastewater Sewer Easement Minimum Width Requirements

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 (typically 24" and larger) and/or unfavorable site conditions (poor soils, proximity to steep slopes, proximity to wetlands, etc.).
Pipe shall be installed in center of easement.
If two public pipes are to be installed in an easement, add a minimum of 10 feet to the easement widths listed above. Use the deeper of the two pipes in selecting the easement width from this table.

Table 11-5: Stormwater Conveyance System Easement Minimum 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 (typically 24" and greater), open channels with top widths greater than 5 feet, and/or unfavorable site conditions (poor soils, proximity to steep slopes, proximity to wetlands, etc.).
* 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.

12 Chapter 12 Water Plans

For Tacoma Water Standard Use:
This document is to be incorporated as Chapter 12 in the City of Tacoma Right-of-Way Design Manual with the anticipated 2024 update. Chapter 12 is written so that it may be applicable in multiple jurisdictions, not just in the City of Tacoma. The design manual is primarily focused on the distribution system. However, Tacoma Water intends to further develop the design manual, and in the future, it will be more comprehensive and include other infrastructure in the water system as well.

INTRODUCTION

This chapter provides design criteria for the construction of all publicly owned water distribution infrastructure which provide drinking water to customers within the City.

TMC 12.10 provides the City and its Water Division (Tacoma Water) the regulatory authority for water utility service.

The material, design, and guidance standards in this chapter are in accordance with the following documents:

- American Water Works Association (AWWA) Standards for Water
- Washington State Department of Ecology and the Department of Health Pipeline Separation Design and Installation Guidance (Separation Design Guidance)
- Washington State Department of Transportation Standard Specifications for Road Bridge and Municipal Construction (Standard Specifications).

SECTION 12.1 Water Distribution Design Criteria

The following section describes the standard design criteria for distribution water mains and associated appurtenances.

12.1.1. System Requirements

The water distribution system shall be appropriately sized for the proposed development. Distribution mains shall be sized to accommodate requirements for peak hour demand or maximum day demand plus fire flow, whichever is greater. Pipe sizing should conform to Tacoma Water standards below and regulatory requirements per WAC 246-290-230. Tacoma Water will complete a hydraulic modeling analysis on all water main extensions to assist with sizing the main to meet the required fire flow and Tacoma Water's Pressure Level of Service.

Regulatory requirements per WAC 246-290-230 require maintaining a minimum residual pressure of 20 psi when delivering fire flows under maximum day demand conditions, and 30 psi minimum during peak hour demand conditions. Tacoma Water seeks to exceed these minimums and strives to maintain static system pressures in the range of 45 to 100 psi per the Water System Plan.

Water mains are designed to handle maximum internal velocities up to 15 feet per second, and they must be sized to support anticipated land use, customer demands, and fire flow requirements. Velocities above 15 feet per second generate significant head losses which can impact the pressure within the system and water main parts used may have velocity limits. Tacoma Water strives to aim for internal velocities between 8 feet per second and 10 feet per second to limit head losses.

The potential for future development is considered in the design of the water mains. Tacoma Water may increase the water main size and depth to accommodate for future system growth.

12.1.2. Pipe Size

The standard distribution water main size is:

- 4-inch in diameter for looped mains located in residential areas not serving fire hydrants and less than 650-feet in length.
- 8-inch in diameter for most residential areas and some commercial and industrial areas serving fire hydrants.
- 12-inch in diameter or larger for most industrial and commercial areas and trunk mains providing system looping.
- Other pipe diameters may be allowed on a case-by-case basis.

12.1.3. Pipe Slope

The standard for water main slope for most pipes is less than 20 percent grade. Water mains with greater than 20-percent slopes may be allowed on a case-by-case basis. These water mains require restraint at every pipe joint and trench dams at every 50-feet along its length.

12.1.4. Pipe Joints

The standard distribution water main joints are rubber-gasketed non-restrained push-on joints. Mechanical joints are used for thrust restraint and potential pipe separation.

12.1.5. Materials

Table 1 summarizes the standard materials for the distribution water mains. All materials are NSF 61 certified for drinking water use.

Table 1: Standard materials

Type	Material	Class	Standard	Applicability
Water main 24-inches or less	Ductile Iron Cement Mortar-lined	Special Class 52 with push-on rubber gasket bell and spigot joints	AWWA C151	Standard use
Water main 24-inches or less	Solid Wall PVC	Dimension Ratio (DR) 14 with push-on rubber gasket bell and spigot joints	AWWA C900	Corrosive soils or stray current
Fittings 24-inches or less	Ductile Iron Cement Mortar-lined	Full-body with cold-working pressure of 250 psi with mechanical joints	AWWA C153 or C110	Standard use
Couplings 24-inches or less	Ductile Iron Cement Mortar-lined	Full-body with cold-working pressure of 250 psi and mechanical joints	AWWA C110	Standard use
Valves Resilient Seat Gate	Ductile Iron 8-inches or less	Non-rising stems with cold-working pressure of 250 psi and mechanical joints	AWWA C509 or C515	Standard use
Valves Rubber Seat Butterfly	Ductile Iron 12-inches to 72-inches	Cold-working pressure of 150 psi and mechanical joints	AWWA C504 AWWA C516-21	Standard use

12.1.6. Pipe Depth and Cover

The standard distribution water main cover from the top of pipe to the top of the ground surface is 42-inches, with a minimum cover of 36-inches and maximum cover of 60-inches. Variances in the pipe covers are reviewed on a case-by-case basis.

12.1.7. Pipe Alignment

The standard alignment for new distribution water mains in residential streets is shown on City Standard Plans DR-04 and DR-05. Generally, water main alignments will avoid being adjacent to curb and gutter pans, roadside drainage ways, under sidewalks and parking lanes, and within pedestrian access routes.

The alignment will follow the line and grade to within 3-inch variance and use fittings for changes in direction. When the water mains cross other utilities, the alignment should be as close to perpendicular as possible.

12.1.8. Separation Requirements from Other Utilities

Separation guidelines between water mains and other utilities are summarized in the following tables. In certain special conditions, where the minimum separations cannot be achieved, special construction methods may be used, including casings, special backfill material between

utilities, and other methods approved by a Tacoma Water. For more information on special construction methods, refer to Separation Design Guidance document.

Table 2: Minimum Horizontal Clearances from Water mains

Utility	Minimum Horizontal Clearance (feet)
Cable	5
Gas	5
Power	5
Telephone, Fiber Optic	5
Street Trees	5
Storm Drain	10
Sanitary Sewer	10
Reclaim/Non-Potable Wet Utility	10

Table 3: Minimum Vertical Clearances from Water mains

Utility	Minimum Vertical Clearance (inches)
Cable	12
Gas	12
Power	12
Telephone, Fiber Optic	**6**
Storm Drain	18
Sanitary Sewer	18
Reclaim/Non-Potable Wet Utility	18

12.1.9. Pipe Casings

In instances where the minimum separation between utilities cannot be achieved, or open trench replacement is not practical, or for protection of the overlaying infrastructure, pipe casings are used. Casings are typically constructed of PVC, ductile iron, or steel materials and are approximately 33 percent greater in diameter than the water main. Casings typically include compatible spacers and leak-proof end seals. The length of the casings is subject to site specifics and at a minimum should extend 10-feet on each side of the crossing when possible.

12.1.10. Concrete Thrust Blocks

Concrete thrust blocks are the standard restraint mechanism in the water distribution system. When there is not enough space for the thrust blocks, or in special conditions, mechanical joints are also used. Thrust blocks are required when there are horizontal and vertical changes in pipe direction, at tees (not including fire hydrant tees), plugs, caps, reducers, blow-offs, and dead ends. Thrust blocks are engineered based on the thrust forces, soil type, and soil bearing area.

12.1.11. Joints

Restraining glands are required for all water main connections unless determined not necessary by Tacoma Water. Standard pipe joints typically consist of non-restrained push-on joints. Push-on joints can be installed with thrust blocks, and/or restraint gaskets for restraint and separation

prevention. In addition, Tacoma Water uses mechanical joints (MJ) for all hydrants and services 4-inch in size and larger.

Flange joints are used for space constraints; avoid using flanges as connections where possible. In instances where there are space constraints, flange joints can be used. Isolation kits with two flange X MJ adaptors can be used between flange isolation kits for corrosion protection. Flanges can be used on both ductile iron and steel pipes.

12.1.12. Pipe Bedding and Backfill

Crushed surfacing top course, as specified in Section 9-03.9(3) of the Standard Specifications, is the standard bedding and backfill material for water mains.

For the bedding of ductile iron pipe, crushed surfacing top course material is used from 4-inches below the invert of pipe. The same material can be used from the top of the pipe to the remaining depth of the trench. For private contracts outside of the public ROW, native material that conforms to Section 9-03.12(3) of the Standard Specifications, may be substituted for bedding and backfill.

12.1.13. Hydrants

Tacoma Water works with the authority having jurisdiction (AHJ) to identify and construct fire hydrants based on their requirements. Typically, hydrants are located at intersections or on property lines and are generally spaced 500 feet apart in residential areas and 300 feet apart in commercial areas, but this is subject to jurisdictional requirements.

Fire flow requirements throughout Tacoma Water's service area are established by jurisdiction and local code, including the Uniform Fire Code, and Pierce County Code 17C.60.165. Costs associated with improvements to increase the fire flow greater than regulatory fire flow requirements will be the responsibility of the developer. Table 4 shows the required fire flow new development in the City.

Table 4: City's Required Fire Flow

Basic Land Use Type	Required Fire Flow (gpm)
Residential	1,000
Commercial	1,500
Mixed Use	1,500
Residential High Density	1,500
Park	1,000
Industrial	2,000

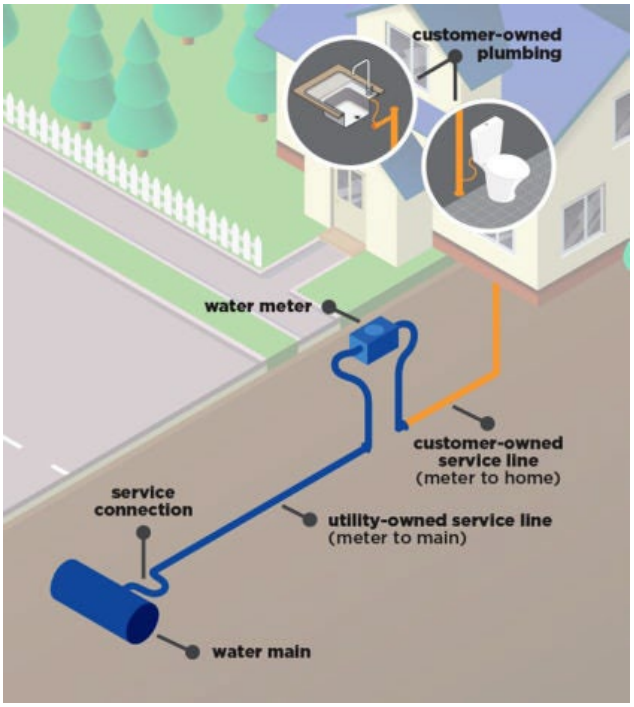
12.1.14. Water Service Lines

An application must be submitted for new water service lines (including fire services) or changes to existing water service lines within the City, for more information refer to the Water Construction & Development Services website. When a water service line is required in an area where no water main exists, a water main extension is needed, refer to Chapter 12.2.

Water services lines, meter boxes, and appurtenances are located within the ROW and perpendicular to the water main, where practical. Meter boxes are typically installed outside of the sidewalks, driveways, and paved surfaces, where practical, and immediately adjacent to the customer's property. Figure 1 illustrates the water service line components.

Tacoma Water provides cost estimates, permits, and construction services for the installation of water service lines and associated appurtenances.

Figure 1: Water Service Line Components



SECTION 12.2 Private Contracts

When new water services and/or fire hydrants are required where there is no existing water main infrastructure, applicants are typically responsible for extending water mains through the Private Contract process (PCs). Water mains can also be installed by Local Improvement Districts, refer to Chapter 2. For the PC process, engineering design and construction oversight is completed by Tacoma Water, while water main construction is completed by the developer.

The PC process is separate from the City's ROW Construction/Work Order Permit process. The PC process is guided by the Tacoma Municipal Code (Chapter 12.10 Water Regulations and Rates) and the Water Division - Customer Service Policies. For more detailed description of the PC process and contact information, refer to the Water Construction & Development Services website.

SECTION 12.3 Access and Easements

In general, most water infrastructure is in the public ROW. In public ROW, Tacoma Water has franchise agreements, and therefore, easements are not required. In circumstances where the public water main is located on private property, easements will be required to access, maintain, and protect water infrastructure from private entities.

Water easements can be permanent or temporary. Permanent easements allow Tacoma Water to construct, maintain, operate, and access the land and facilities in the easement while mitigating the landowner's ability to interfere with the maintenance and operation of the water facilities. Temporary easements, provide similar rights to permanent easements except they are for limited duration. Refer to Chapter 13 for more information when a temporary easement may be required.

For water easements dedicated to Tacoma Water for the purpose of maintenance or construction the following typically applies. The actual easement document will contain all applicable restrictions or allowances.

- For projects with no adjacent public ROW, a minimum 20-feet wide easement is required for water mains, fire hydrants, and other appurtenances (such as meters, sampling stations, air/vacuum valves, blow-offs, facilities, etc.). The easement will extend 5-feet past the end of the water main, fire hydrant, and meters. All water mains and facilities will be centered within the easement.
- It is agreed that the Grantor and its successors shall not construct any new permanent structures within the easement area; provided that said easement area may be used for ingress, egress, parking, and landscaping purposes to the extent the same shall not unduly interfere with the operation and maintenance of the facilities for which this Easement is granted. However, if the Grantor does construct a permanent structure within the easement area, the Grantee may at any time remove or cause the removal of such structures at the Grantor's cost. In addition, the Grantee is not responsible for damaging the Grantor's structures within the easement area. For the purposes of the Easement, a "structure" includes, but is not limited to, any building, carport, trash enclosure, fence, drainage structure such as turf fields and rubberized tracks, fountain, wall, and rockery.

- All publicly maintained water infrastructure will be in dedicated tracts, public easements, or public ROWs.
    - When the water main is in the public ROW, water meters should be kept in the ROW as well. Water meters should be in areas that are easily accessible for maintenance and replacement – such as landscaping, sidewalks, or parking areas.
- Easements maybe sized to allow for future maintenance, replacement, and or expansion of infrastructure. The size of the easement area for water infrastructure is also subject to the specifics of the site.
- Preliminary project planning should consider the potential loss of buildable area or the need to purchase more property because of the easements and tracts.

SECTION 12.4 Transmission Pipelines and Appurtenances

All work within ten-feet of Tacoma Water transmission pipelines and appurtenances must be engineered by a Washington State licensed engineer and must be submitted to Tacoma Water for review prior to finalization of construction drawings and specifications.

13 Chapter 13 Construction Related Permits and Easements

INTRODUCTION

This chapter focuses on miscellaneous subjects that may have applicability to any proposed development within the City ROW including easements, dedications, State Environmental Policy Act (SEPA), and erosion and sediment control.

SECTION 13.1 Temporary Construction Easement

The Temporary Construction Easement shall be completed for each adjacent private property impacted by the project prior to ROW Construction/Work Order Permit 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 percent slope immediately adjacent to the roadway. It is the design 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 13-1). 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 13.2 ROW 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 ROW Construction/Work Order Permit 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 13.3 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 11 for specific easement requirements for public stormwater and wastewater systems.

13.3.1. Private Accessway Easements

Private accessway easement widths are as specified in CHAPTER 4 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 accessway easements.

13.3.2. Recording Prior to Work Order Approval

Easements shall be provided to the City prior to ROW Construction/Work Order Permit approval except for plats or short plats where easements may be provided at the time of final plat or short plat approval.

13.3.3. 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.
- 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 on the third floor of the Tacoma Municipal Building at 747 Market Street; 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 13.4 Traffic Control Requirements

All work within the public ROW that may affect traffic (both vehicular and pedestrian) shall provide traffic control. The Traffic Control Handbook available on the City's website provides requirements and guidance for creating traffic control plans.

All ROW Construction/Work Order Permits 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 plan set.

Exceptions to the typical requirements will be required for any construction contained within an arterial street. Exceptions in these cases will be written by Traffic Engineering and will be required to be shown on the plan sets.

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

13.4.1. 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.

13.4.2. 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 the City Traffic Engineering section 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.

13.4.3. 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 13.5 Environmental Checklist and EIS

The 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 City to 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 Tip Sheet P-110.

In many cases, an environmental checklist may be required in conjunction with the improvements outlined on the ROW Construction/Work Order Permit plan sets 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 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 12 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 at www.tacomapermits.org and (253) 591-5030. If an environmental checklist is required for the improvements to be constructed under the ROW Construction/Work Order Permit, the environmental review process must be completed and a final environmental determination obtained prior to permit approval. If the project is associated with a land use action, SEPA is typically completed as part of the land use permitting process.

SECTION 13.6 Erosion Control and Contaminated Soils

13.6.1. 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 SWPPP per the SWMM, 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.

13.6.2. Contaminated Soils

Contaminated soils may be located in the city. 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 delivery projects and maintenance projects completed by City staff. The Soil Management Plan addresses soil sample collection and analysis, and disposal for soil contaminated with arsenic and lead in the Tacoma Smelter Plume area.

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

Attachment 13-1: 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 design 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 Design Engineer that there are no adverse impacts to abutting private properties, he/she shall sign below and return this form.

Signature _____

Attachment 13-2: 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, WA 98421

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 (253) 591-5529.

Date: _____

Business Operations
Environmental Services
Tacoma, WA 98421

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 Signature

_____
Address

_____
Phone

Subscribed and sworn to me this____day of_____, 20___.

_____, Notary Public in and for the State

of_____residing at_____.

Attachment 13-3: Special Traffic Control Requirements

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 – Option 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.

Definitions

Accessible Pedestrian Signal (APS) – a device that communicates information about the 'WALK' phase in audible or vibrotactile information through touch.

Advisory Bike Lanes – a bicycle lane in which motorists may legally encroach as indicated by the pavement markings (usually dashed) used to delineate the lane.

Alteration – a change to a facility in the public right-of-way that affects or could affect access, circulation, or use.

Alternate Pedestrian Access Route – a temporary accessible route to be used when the existing pedestrian access route is blocked by construction, alteration, maintenance, or other temporary condition(s).

Arterial Street (Roadway/Highway) – a City of Tacoma designation and classification of a street that signifies its intended purpose for the movement of people and goods; further classified as principal arterials, minor arterials, collector arterials, or nonclassified arterials.

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.

Bike Passing Lane – the addition of second bicycle lane adjacent to the first to allow for bicyclists to pass other bicyclists.

Billable Work Order – *a* City of Tacoma permit required to be obtained (TMC 10.22.080) for private construction of City-owned infrastructure with funding provided by a private entity (Permittee).

Buffer – when present, a space measured from the back of the curb to the edge of the sidewalk.

Buffered Bike Lanes – a conventional bike lane with an adjacent space that is usually marked separating the bicycle lane from the motor vehicle travel lane and/or parking lane.

Centerline – channelization that is yellow and indicates the separation between travel lanes in opposite directions; typically is composed of two 4 inch solid yellow stripes separated by 4 inches.

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

Clear Width – the unobstructed width within a pedestrian circulation route, shared-use path, or temporarily-defined travel lane.

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

Complete Streets – a nationally recognized term referring to streets and sidewalks that are designed, operated, and maintained to enable safe and convenient access and travel for all users – pedestrians, bicyclists, transit riders, and people of all ages and abilities, as well as freight and motor vehicle drivers.

Contractor – a company that is licensed and bonded to perform work in the City of Tacoma.

Contraflow Bike Lanes – bicycle lanes that are design and channelized to permit bicyclists to travel in the opposite direction of the motor vehicle flow.

Counter Slope – the slope of the gutter or street at the foot of a curb ramp or landing where it connects to the street, measured along the axis of the running slope extended.

Cross Slope – the slope measured perpendicular to the direction of travel—whether pertaining to a vehicle or a pedestrian.

Crosswalk – the portion of the street/roadway between the intersection area and a prolongation or connection of the farthest sidewalk line or in the event there are no sidewalks then between the intersection area and a line ten feet therefrom, except as modified by a marked crosswalk.

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

Cul-de-sac – the circular design of a residential street that does not continue any further.

Curb Extension – a bulge or extension of the street's curb alignment into the parking lane (if present) or overall width of the travelway located at a legal crosswalk that is intended to decrease the length of a pedestrian crossing and increase inter-visibility for pedestrian/driver interactions. Also known as a bulb-out.

Curb Ramp – *a combined ramp and landing to accomplish a change in level at a curb. This element provides street and sidewalk access to pedestrians with mobility impairments.*

Cycle Track – a bicycle facility that is exclusively for bicyclists traveling in one or both directions and physically separated from motor vehicle traffic while remaining distinct from any sidewalk.

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

Detectable Warning Surface – A tactile surface feature of truncated dome material built into or applied to the walking surface to alert persons with visual impairments of vehicular ways.

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

Design Engineer – the professional civil engineer licensed in the State of Washington who prepares the analysis, design, and engineering plans for an applicant's permit or approval submittal.

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.

Dual-Faced Curbing (including Profiled Plastic Curbing) – curbing that has sloped faces which can be installed in between lanes of travel in order to aid in restricting turns to and from access points/streets or for channelizing the flow of traffic

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.

Edge Line/Stripe – channelization that typically defines the right-side of a travel lane (when the stripe is solid 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 solid yellow), and

defining an on-street parallel parking lane (when the stripe is solid white or solid white "tick" marks).

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.

Flangeway Gap – the gap for the train wheel at a railroad crossing. The space between the inner edge of a rail and the pedestrian crossing surface.

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 ROW.

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

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 (e.g., twice the width of a typical lane line).

Grade Break – The intersection of two adjacent surface planes (e.g., streets, sidewalks, etc.) of different grade.

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.

Greenroads – a performance metric for quantifying sustainable practices associated with street design and construction.

Hazard Trees – those trees which have the potential to cause property damage, personal injury or fatality in the event of a failure. 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).

Improvement – a constructed, or to be constructed, element consisting of, but not limited to, streets (with or without curbs or gutters), sidewalks, crosswalks, parking lots, water mains, wastewater and stormwater pipes, stormwater facilities, street trees and other associated items.

Land Use Action – action taken by the City of Tacoma when a variance, special use permit, rezone, plat, or other land use permit 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.

Landing – A level (within ADA compliant allowances) paved area, within or at the top and bottom of a stair or ramp, designed to provide turning and maneuvering space for wheelchair users and as a resting place for pedestrians.

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 can be completely solid;

typically is 4 inches wide (certain applications with respect to bike lanes warrant a 6 inch width).

Load Zone – a designated space reserved for the exclusive use of vehicles during the loading or unloading of property.

Low Impact Development – 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.

Maximum Extent Feasible – from the U.S. Department of Justice, 28 CFR Part 36.402: the phrase "to the maximum extent feasible" applies to "the occasional case where the nature of an existing facility makes it virtually impossible to comply fully with applicable accessibility standard through a planned alteration."

Midblock Pedestrian Crossing (Crosswalk) – see "Crosswalk."

Overflow Infiltration Gallery – a shallow depressed area lined with stream cobbles that allows for minor amounts of stormwater ponding in order for stormwater to recharge into the adjacent permeable ballast; collects overflow water from a permeable surface or gutter pan, and is intended for small contributing areas.

Passenger Load Zone – a designated space reserved for the exclusive use of vehicles while receiving or discharging passengers to/from an associated curb ramp.

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

Pavement Paint – specially formulated material (including retroreflective glass beads) for use on streets; typically sprayed or rolled onto the pavement surface at a thickness specified by the project; either waterborne- or solvent-based composition.

Pedestrian Access Route – a continuous, unobstructed walkway within a pedestrian circulation path that provides accessibility.

Pedestrian Circulation Path – a prepared exterior or interior way of passage provided for pedestrian travel; includes independent walkways, shared-use paths, sidewalks, and other types of pedestrian facilities.

Pedestrian Facilities – walkways such as sidewalks, walking and hiking trails, shared-use paths, pedestrian grade separations, crosswalks, and other improvements provided for the benefit of pedestrian travel. Pedestrian facilities are intended to be accessible routes.

Pedestrian Overpass or Underpass – a grade-separated pedestrian facility, typically a bridge or tunnel structure over or under a major highway or railroad that allows pedestrians to cross without conflicting with the intersecting facility.

Pedestrian Island – an area within the street that physically separates the directional flow of traffic, provides pedestrians with a place to dwell, and allows the total crossing distance to be traversed in stages, if desired.

Pedestrian Signal – a traffic signal indication that advises (graphical) when pedestrians can cross the street at a signalized intersection or pedestrian hybrid beacon.

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 – portion of an improved right-of-way between the street curb or edge of the traveled portion of the street and the property line of the abutting property available and used for the purpose of planting and maintaining street trees and other vegetation.

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.

Proof Rolling – a process in which a loaded vehicle drives slowly over the compacted subgrade of street being constructed in order to indicate areas of insufficient compaction.

Raised Median – a raised area in the center of a road, usually defined by curbing, used to restrict vehicle left turns and side street access.

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

Regulated Trees – those trees which are located within the public ROW and are subject to the standards for management as required by Tacoma Municipal Code and this Design Manual.

Residential (Local/Non-Arterial) Street (Roadway) – City of Tacoma streets, as defined by state law,that are not designationed/classified as an arterial street.

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

Running Slope – a slope measured in the direction of travel.

Shared Lane Markings (Sharrows) – street markings used to explicitly inform road users that the lane (or portion thereof) is intended, in support of what state law already allows, for shared use by bicycles and automobiles.

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.

Sidewalk (Walkway) – the continuous portion of the pedestrian access route that is connected to street crossings by curb ramps.

Sidewalk Café ("Streatery") – a permitted delineated area within the public ROW consisting of tables and/or chairs where patrons may purchase or be served food and/or beverages from an adjacent café or restaurant.

Stop Line/Bar – a sometimes optional transverse pavement marking consisting of solid white line (a minimum of 16 inches wide) extending across approach lanes to indicate the point at which a vehicle is intended or required to stop.

Street (Highway) – an arterial or residential street located in public ROW owned and maintained by the City of Tacoma.

Street Furniture – sidewalk equipment or furnishings including trash receptacles, benches, parking meters, artwork, and signage.

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

Thermoplastic – specially formulated material for use on streets 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.

Traffic Calming – street design elements and techniques, with intended applications in lower volume and lower speed environments, that have been shown to reduce traffic speeds, mitigate excessive traffic use, and encourage safer driving behaviors.

Transitional Segments – segments of a pedestrian circulation path that blend between existing undistributed pedestrian facilities and newly altered pedestrian facilities.

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).

Universal Access – access for all persons regardless of ability or stature.

Walk Interval – the phase of a traffic signal cycle during which the pedestrian is to begin crossing, typically indicated by a 'WALK' message or the walking person symbol and its audible equivalent (see Accessible Pedestrian Signal).

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 TMC 12.08 to enter the Municipal Sewer System. Wastewater sewers are also referred to and have the same definition as sanitary sewers, wastewater pipes, and are part of the wastewater system or wastewater conveyance system.

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