Street Design Standards

City of Oregon City

OREGON CITY

January 2024

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1.0 INTRODUCTION

Chapter 1 introduces the *Oregon City Street Design Standards (Standards)* by describing the purpose, intended use, and project team roles. Additional relevant resources support the material provided in the *Standards*. Chapter 1 also includes an overview of overarching topics, such as performance-based design, context-based design, equitable development of climate friendly neighborhoods, and green streets.

1.1 PURPOSE AND INTENDED USE

The Standards intend to implement Oregon City Municipal Code (OCMC), guide private development, and provide criteria for capital improvement projects. The *Standards* include engineering guidelines for constructing public and private improvements, serving new and future developments, and reconstructing existing facilities to upgrade existing infrastructure. These *Standards* apply to all public improvements within the existing public right-of-way (ROW) or any recorded easements, all improvements from new developments required within the proposed public rights-of-way or public easements, all improvements intended for maintenance by the City of Oregon City (City), and all other improvements that require the City's approval. The City Standard Drawings provide additional construction details required for a permit or a set of plans.

The *Standards* are available online at:
Oregon City Street Design Standards
https://www.orcity.org/1057/Street-Design-StandardsThis website will contain the most recently adopted *Standards*, the Standard Drawings, Americans with Disabilities Act (ADA) design and inspection checklists, the Design Modification Request form, and other materials. The City of Oregon City Municipal Code takes precedence if conflict exists with these *Standards*.

All webpage links throughout the document are active as of January 2024.

1.2 CHAPTER OVERVIEW

Table 1-1 provides an overview of each chapter in the *Standards*.

Table 1-1: Chapter Overview

Chapter	Overview
Chapter 1: Introduction	Provides purpose and intended use, references to support the Standards, and includes encouragement and guidance to use green street designs and climate friendly approaches to future designs.
Chapter 2: General Policies and Standards	Discusses the modification process, the permitting process, as well as overviews of right-of-way management, survey monumentation, and a note about historic districts.
Chapter 3: Geometric Design	Provides technical requirements for curves, intersections, and cul-de-sacs. Safety items such as sight distance, roadside clearance and traffic calming are also discussed. Private improvements such as driveways, alleys, and private streets follow public improvement design standards. There is also a section on Fire Department Standards.
Chapter 4: Multimodal Design	Includes guidance on how practitioners should include all modes of transportation when designing new or expanded roadways. This includes shared use paths, bicycle facilities, sidewalks, transit, and freight.
Chapter 5: Traffic Engineering	Provides design requirements for speeds, stop signs, traffic signals, signage, pavement markings and any special standards.
Chapter 6: Pavement Design	Includes technical requirements for thickness of pavement.
Chapter 7: Stormwater	References the Stormwater and Grading Design Standards and reminds users that stormwater management must be incorporated into street design.
Chapter 8: Utilities	Provides users technical guidance on how to address electric, gas, telephone, cable, telecom, and fiber networks within the right-of-way and associated easements.
Chapter 9: Street Lighting	Provides design standards for decorative street light fixtures and poles as well as the use of PGE related designs and associated electrical equipment.
Chapter 10: Landscape Design	Describes the furniture zone and reminds designers how to design the right-of-way for stormwater management, pedestrian use, and an urban landscape.
Appendices	Provides references, forms, and checklists that can be used during the design process.

1.3 ROLES

The City's policy requires compliance with Oregon Revised Statute (ORS) 672 for professional engineers.

All engineering plans, reports, or documents shall be prepared by a registered professional engineer or a subordinate employee under the engineer's direction and shall be signed by the engineer and stamped with the engineer's seal to indicate the engineer's responsibility for them. For design and construction projects, a private development or City contracted Engineer of Record is responsible for preparing project documentation and plans based on City standards. The City Project Engineer or City Project Manager is responsible for reviewing any proposed public facility addition, extension, modification, or other type of project within the city to determine if the proposal is permissible, if it meets City standards, and if there are any special requirements before or during engineering or other proposed design work.

City comments or approval of the plans and any related documents for any job does not in any way relieve the Engineer of Record of their responsibility to meet all City requirements or obligation to protect the life, health, and property of the public. The plan for any project shall be revised or supplemented at any time it is determined that the City's full requirements have not been met.

Specific titles and roles of those involved in preparing, reviewing, and approving plans and design decisions for City projects are described below.

A. Development Personnel

1. **Applicant**: Property owner or person designated by the property owner to be the representative for an application for a development proposal, permit, or approval. May be referred to as "owner" or "developer."
2. **Engineer of Record/Inspecting Engineer**: A professional engineer with civil engineering expertise holding a valid license from the State of Oregon that is responsible for stamping plans and documents prepared for a project and/or primary inspection of construction for a project. This person is part of a consulting engineering company working for either the Applicant or the City.

B. City Personnel

1. **City Engineer**: Oversees the Engineering Group and provides final direction and approval for City projects. May designate a subordinate to make decisions required of the City Engineer.
2. **Engineering Group**: A group led by the City Engineer that provides professional engineering services to various City departments and the general public; includes the following groups:
   a. *Engineering Services:* Manages capital projects and right-of-way management; provides erosion control inspection.
   b. *Development Services:* Manages public and private development.
   c. *Construction and Right-of-Way Management:* Provides inspection services for permits and provides permitting and oversight to the right-of-way.
3. **Community Development Department**: A group led by the Community Development Director that consists of Planning and Building.

   a. *Planning*: Staff members who provide planning, zoning, and land use services for the City.

   b. *Building*: Staff members who provide building permit and building inspection services for the City.

4. **Project Engineer/Project Manager**: The staff person who manages a City project or provides oversight and permitting to a private development project.

5. **City Inspector:** Provides secondary oversight and inspection to private development.

1.4 RELEVANT RESOURCES

The *Standards* are supported by and may be used in conjunction with other associated City, Clackamas County (County), Oregon Department of Transportation (ODOT), and national street design resources and publications. Where the *Standards* contained in this document do not address a particular situation, the standards contained in these other associated resources shall apply. The primary City, County, State, and national resources are below. Additional resources are in Appendix A.

City resources include:

A. Oregon City Municipal Code (OCMC)

B. Oregon City Concept Plans

   1. Thimble Creek (Beavercreek Road) Concept Plan
   2. Park Place Concept Plan
   3. South End Concept Plan

C. Oregon City Corridor Plans and Studies

D. Oregon City Standard Drawings (Street Standard Drawings 500 Series)

   NOTE: Standard Drawings will be noted as "Std. Dwg. OC###" throughout the *Standards.*

E. Oregon City Existing Design Standards and Manuals:

   1. Transportation System Plan (TSP)
   2. Sanitary Sewer Design Standards
   3. Stormwater and Grading Design Standards
   4. Water Distribution System Design Standards
   5. Sewage Pump Station and Force Main Design Standards
   6. Pavement Cut Standards
   7. Erosion Prevention and Sediment Control Planning and Design Manual
   8. Trails Master Plan

9. City Transportation Demand Management Plan 2017, Final Report

The *Standards* presented in this document provide technical criteria to support the Oregon City Concept Plans, Corridor Plans, and Studies. The *Standards* do not intend to change the vision and goals presented in existing plans and studies. The *Standards* take precedence over technical criteria presented in other City plans and studies, if conflicts exist. The City Engineer will provide final direction if there are interpretation questions or if there are any conflicts between documents. Projects should also review and consider the information provided in specific Oregon City Concept Plans. City plans and studies may introduce the need for additional design flexibility on projects to meet the vision and goals for the community. In these cases, the City's design modification process presented in Chapter 2, Section 2.1 can support the decision-making process and documentation.

County, State, and national resources include:

A. *Clackamas County Roadway Standards*

B. ODOT *Blueprint for Urban Design*

C. ODOT *Highway Design Manual*

D. ODOT *Traffic Signal Guidelines*

E. American Association of State Highway Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets* (AASHTO *Green Book*)

F. AASHTO *Roadside Design Guide*

G. Federal Highway Administration (FHWA) *Manual on Uniform Traffic Control Devices* (MUTCD) for Streets and Highways with Oregon Supplement

H. Oregon Standard Specifications for Construction and Standard Drawings

I. Chapter 333 Oregon Administrative Rules

J. Oregon Fire Code

K. Oregon Certification Office for Business Inclusion and Diversity (COBID)

L. Oregon Metro Designing Livable Streets and Trails

M. Oregon Highway Plan

N. ODOT *Speed Zone Manual*

O. FHWA Intersection Control Evaluations

1.5 PERFORMANCE-BASED AND CONTEXT-BASED DESIGN

Integrating a performance-based and context-based design approach into project decision-making can verify that each City project meets the City Commission's goals and vision. Performance-based design establishes project goals early in the project and verifies that project decisions throughout the project's various stages align with the original goals.

Goals may address:

A. The vision of the community, including existing characteristics and desired future lane-use patterns and growth.

B. The role and function of the street within the network.

C. The users of the street based on the surrounding land uses, future vision, and role of the street.

Project performance metrics are identified to evaluate alternatives based on the project goals. For each project, performance measures should be tailored to evaluate an alternative's ability to respond to the specific needs of the users and should relate directly to the project's documented goals. For example, a community may want to implement bicycle lanes on an arterial while minimally impacting traffic mobility. Bicycle level of traffic stress (LTS) or multimodal level of service (MMLOS) could be used to measure impacts to bicyclists, while the traditional vehicle volume-to-capacity (v/c) ratio could still be considered for traffic mobility.

The ODOT *Blueprint for Urban Design* provides additional guidance on how to identify project goals and performance metrics and how to implement a performance-based design approach. National activities and associated publications, such as FHWA's Performance-Based Practical Design initiatives and *NCHRP Report 785: Performance-Based Analysis of Geometric Design of Highways and Streets* (NCHRP Report 785), have resulted in a framework for executing this project approach. As presented in the AASHTO *Green Book,* this approach shapes how designers deliver projects in a variety of contexts and project stages. In addition, the ODOT *Blueprint for Urban Design* supports this approach and details how it may apply to a variety of projects.

The following section provides an overview of this approach, consistent with FHWA and ODOT roadway design approaches.

1.5.1 Performance-Based Design

Performance-based design is a decision-making approach for guiding and documenting planning and design decisions. This approach:

A. Emphasizes the outcomes of planning and design decisions as the primary measure for design effectiveness and project success.

B. Guides practitioners to clearly outline intended project outcomes and select performance measures that align with those outcomes.

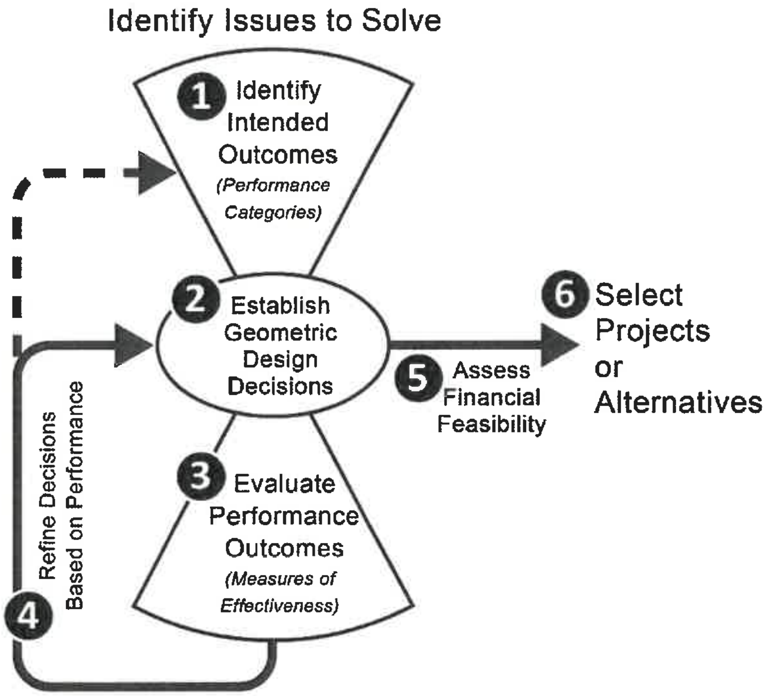
C. Creates a method for documenting planning and design choices to allow agencies to make informed design decisions.

D. Supports risk management and tort liability by providing a decision-making framework for documenting planning and design decisions and solutions.

The performance-based design approach includes frameworks that can help project teams evaluate the trade-offs of various design decisions. Making decisions based on the context and roadway users can help verify that project outcomes align with the current and/or future land use vision.

Figure 1-1 provides an overview of the performance-based approach from NCHRP Report 785.

Figure 1-1: Performance-Based Design Approach



This performance-based approach considers:

1. Identifying desired project outcomes and performance metrics.
2. Establishing design decisions based on the desired outcomes.
3. Evaluating the performance of the design.
4. Iterating and refining the design to align solutions with desired outcomes.
5. Assessing the financial feasibility of the alternatives.
6. Selecting a preferred alternative that aligns with the desired outcomes.
7. Potentially reassessing desired outcomes if no acceptable solution is identified.

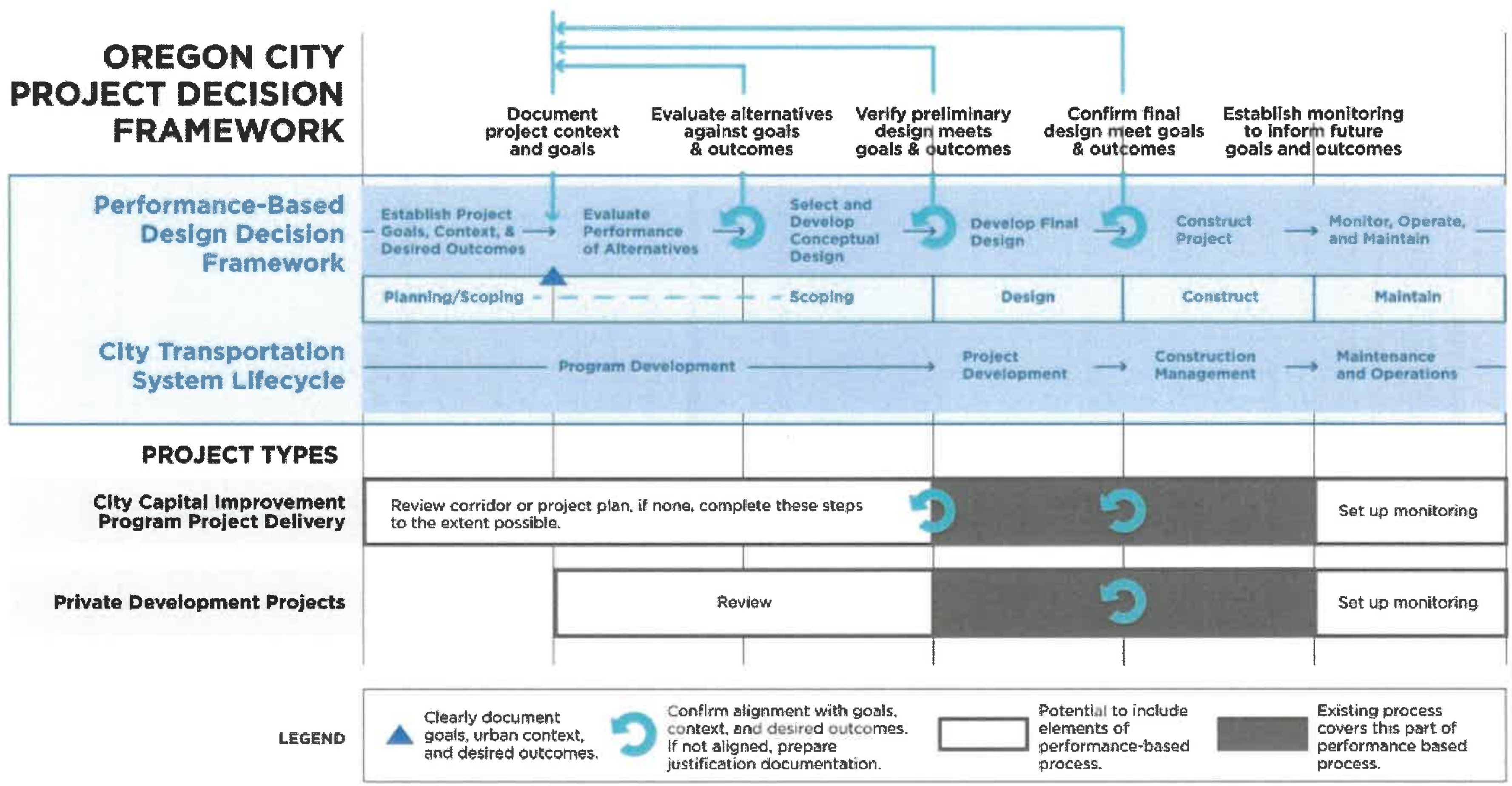
The performance-based framework is founded on three basic steps:

1. **Project Initialization:** Understand context classification (Section 1.3.2 and Section 1.3.3) and project context considerations to help establish intended project outcomes.
2. **Concept Development:** Generate specific alternatives best suited for the identified project needs and outcomes.
3. **Evaluation and Selection:** Use project-specific performance metrics to assess, refine, and advance the alternative.

Figure 1-2 provides a decision-making framework to guide practitioners through an iterative process that allows for flexibility in the design, continuous verification of desired project outcomes, and documentation of design decisions throughout each stage of the process.

The blue circular arrow symbols highlight milestones where the project goals and desired project outcomes should be revisited to verify that the planning and design decisions, alternatives development, and designs align with the original intent of the project and serve user needs. These are also milestones that require documenting planning and design decisions. If design decisions, project team discussions, and alternative evaluations have led to any changes in the performance measures or project goals, this information and the project team decisions should be clearly documented.

Figure 1-2: City Project Decision-Making Framework



1.5.2 City Functional Classifications and Street Types

Oregon City classifies the street system into a hierarchy organized by street function and type. These classifications ensure that streets reflect the neighborhoods through which they pass and consist of a scale and design appropriate to the character of abutting properties and land uses. The classifications also provide for and balance the needs of all travel modes, including pedestrians, bicyclists, transit riders, motor vehicles, and freight. The City's multimodal street system is detailed in the Oregon City TSP.

The functional classifications include:

A. Major arterial

B. Minor arterial

C. Collector

D. Local street

The street types include:

A. Commercial

B. Industrial

C. Residential

D. Mixed-use

1.5.3 Oregon Statewide Context-Based Design

In addition to the functional classifications and street types identified by the City, ODOT has established statewide urban context classifications. Project teams should consider how the City project may fit within the surrounding context established by the state, particularly if state facilities are adjacent to or are intersecting with the City streets within the project.

The ODOT *Blueprint for Urban Design* has identified six urban context classifications, including:

A. **Traditional Downtown/Central Business District (CBD):** Areas with the highest development and building heights in an urban area. Typically, a few square blocks. Buildings have mixed land uses, are built up to the roadway, and are within a well-connected roadway network.

B. **Urban Mix:** Mix of land uses within a well-connected roadway network. May extend long distances. Commercial uses front the street, with residential neighborhoods on top or immediately behind land uses.

C. **Commercial Corridor:** Mostly commercial and industrial uses with large building footprints and large parking lots set within large blocks and a disconnected or sparse roadway network.

D. **Residential Corridor:** Mostly residential uses within a well-connected or somewhat-connected roadway network. May extend long distances. Single-family homes may have direct access to the state roadway.

E. **Suburban Fringe:** Sparsely developed lands, typically at the edge of an urban growth boundary. May be large-lot residential, small-scale farms, or have intermittent commercial or industrial uses.

F. **Rural Community:** Small concentrations of developed areas immediately surrounded by rural, undeveloped areas.

The ODOT *Blueprint for Urban Design* (Chapters 2 and 3) provides additional information about designing roadways within each of the contexts that may help support City decisions for projects within these areas. Projects that integrate context considerations can help project teams:

A. Understand the effects of existing and future land uses.

B. Efficiently serve existing and emerging communities and the various users traveling along and crossing the streets.

C. Provide better tools for streets transitioning between communities.

As projects consider design decisions to align with the project-specific needs, the statewide concepts for context classification should be used to evaluate tradeoffs and inform decision-making. Any decisions that result in designs outside of the City *Standards* need to be processed through a City Design Modification Process for Capital Improvement Program Projects or a Public Improvement Modification Process for Private Development Projects. Additional information on modifications is described in Section 2.1.

1.6 EQUITABLE DEVELOPMENT OF CLIMATE FRIENDLY NEIGHBORHOODS

In alignment with the City Commission goals, the City supports equitable development of climate friendly neighborhoods. Greenhouse gas emissions from motor vehicles and serious traffic crashes are two of the most pressing transportation issues; addressing these issues will require a transportation system designed to serve multiple modes of travel, including walking, bicycling, and accessing public transit. To enhance community livability, streets must function not only as corridors for moving people, goods, and services but as community gathering spots, public spaces, and stormwater management facilities. Street design determines how safe, sustainable, resilient, multimodal, and economically beneficial streets are. All projects should consider how to effectively integrate design features that align with community values.

In addition, the City is supportive of contracts, including those from minority-owned, women-owned, service-disabled veteran-owned businesses as well as emerging small businesses. Certified businesses using the Certification Office for Business Inclusion and Diversity (COBID) are encouraged.

1.7 GREEN STREETS

To limit how much stormwater and pollutants eventually make their way into vulnerable natural waterways, all streets must manage stormwater, treat runoff to reduce pollution, and infiltrate water into the ground. The City encourages projects to incorporate green infrastructure treatments, such as vegetated medians, planters, curb extensions, and street trees. This allows streets to not only manage stormwater but to mitigate the harmful impacts of transportation on air, water, and wildlife habitat and connectivity. This street function supports human and environmental health. Oregon Metro's *Designing Livable Streets and Trails Guide* provides additional information on green streets.

2.0 GENERAL POLICIES AND STANDARDS

Chapter 2 provides an overview of City general policies and standards. Specific information regarding design modification documentation is included to support decision-making.

2.1 DESIGN DECISIONS AND MODIFICATIONS

A performance-based design approach will help the design team consider the project context and the intended project outcomes when establishing the design controls and associated design criteria on a project-by-project basis. The design team for each project within the City is responsible for making every reasonable effort to meet these *Standards*. However, this will not always be practical or appropriate. These *Standards* are not meant to limit creative engineering efforts to provide alternate solutions to specific constrained areas or to relieve the responsibility for professional engineering judgment. When standards are not met, designers can document their design decisions through design modifications. Practical design modifications that preserve the function and safety of the street system and offer benefits to aesthetics, resource protection, ease of maintenance, and livability are encouraged.

Types of modifications are described below.

A. The City's design modification processes should be used for capital improvement projects and represent a means for the design team to identify, justify, and implement design features that do not fall within the designated design standards established by the City.

B. Private development projects should use the Public Improvement Modification process outlined in OCMC 16.12.013.

C. The Americans with Disabilities Act (ADA) Modification Process follows the procedures detailed in Section 2.3.1.

When the City is providing maintenance to existing infrastructure and seeking to complete maintenance in a way that is contrary to the typical standards, it should follow the City Design Modification Process.

2.1.1 Design Modification Process for Capital Improvement Projects

If a capital improvement project cannot meet these *Standards* or those outlined in OCMC, a design modification is required to propose improvements less than or in contrast with the requirements. Requests to modify design standards shall use the City Design Modification form in Appendix B.

2.1.1.1 Criteria for Design Modifications to Standards

The City may grant a modification when doing so does not compromise public safety or the intent of the City's *Standards* if any one of the following conditions are met:

A. The subject standard is deemed not applicable.

B. Topographic, right-of-way, overlay districts (e.g., natural resource overlay district, historic, Willamette Greenway, and geologic hazards), or other geographic conditions impose an environmental concern or constrain constructability and an equivalent alternative that can accomplish the same design intent is available.

C. A minor change to the standard is required to address a specific design or construction constraint that, if not enacted, will result in an undue hardship.

D. The proposed modification does not compromise safety, function, appearance, and maintainability based on sound engineering and technical judgment.

E. The modification does not conflict with land use requirements.

2.1.1.2 Review for Design Modifications to Standards

Design modifications are typically submitted before land use application approval or early in the design process when related to capital improvement projects.

A. Modifications include but are not limited to:

   1. Geometric design and the modification or omission of standard roadway cross section elements
   2. Sight distance
   3. Access spacing
   4. Number of accesses
   5. Intersection angle

B. The City Engineer will review a request to modify design standards and will make one of the following decisions:

   1. Approve as proposed
   2. Approve with changes
   3. Deny with an explanation

C. Design modification approval does not constitute a precedent for use at other locations.

2.1.2 Public Improvement Modification Process for Private Development

If a private development cannot meet these *Standards* or those outlined in OCMC, a public improvement modification is required to propose improvements less than or in contrast with the requirements. Often, this modification is requested to reduce the required right-of-way dedication, reduce the size of the pavement required, eliminate a street parking requirement, or address other requirements outlined in the OCMC 16.12.016.

Land use conditions of approval are commonly written so that there is little flexibility after land use approval, so it is imperative to address design modification requests before land use approval. If a design modification is requested after the land use conditions of approval are issued, an additional application for a modification of the conditions of approval or a new land use application through the Planning and Zoning Division may be required.

2.1.2.1 Criteria for Public Improvement Modifications to Standards

The OCMC 16.12.013 outlines five criteria that shall be met for the City to support a change to the OCMC or these *Standards*:

A. The modification meets the intent of the *Standard*.

B. The modification provides safe and efficient movement of pedestrians, motor vehicles, bicyclists, and freight.

C. The modification is consistent with an adopted transportation and/or utility master plan.

D. The modification is complementary to a surrounding street design.

E. If a modification is requested for constitutional reasons, the applicant shall demonstrate the constitutional provision or provisions to be avoided by the modification and propose a modification that complies with the State or Federal constitution. The City is under no obligation to grant a modification in excess of that which is necessary to meet its constitutional obligations.

2.1.2.2 Review for Public Improvement Modifications to Standards

A. A Public Improvement Modification is processed as a Type I or Type II Land Use Decision.

   1. Type I, including driveways and sidewalks, is processed through Public Works.

   2. Type II is processed through the Planning Division using the Land Use Application Form.

B. If a property seeks a modification to the requirements on driveways found in OCMC 16.12.035 (the number of driveways, width of driveways, or spacing of driveways), the modification is processed through a Type I Decision through the Engineering Group using the Public Improvement Modification Application (see Appendix B).

C. In either case, the five criteria in OCMC 16.12.013 shall be met, or the modification request will be denied. An appeal of denial is allowed per OCMC 17.50.190.

2.1.3 Americans with Disability Act (ADA) Modifications

All project designs shall comply with Title III of the Americans with Disabilities Act (ADA) of 1990 and the Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG). The City uses the PROWAG standards for ADA accessibility within the public rights-of-way and easements under the City's jurisdiction. PROWAG justifies modifications to the standards for new construction and alterations to existing ADA accessibility features. Modifications are required for any accessibility feature that cannot meet the requirements due to a physical constraint identified in the following sections. Crosswalk closures are also reviewed under the ADA modifications process.

2.1.3.1 Modifications for New ADA Accessibility Features

Modifications to full compliance with PROWAG standards can only be granted for a limited number of physical constraints preventing full compliance. If a modification is required for a particular feature, efforts shall be made to ensure that other elements are accessible. Modifications for non-compliance PROWAG standards for new ADA accessibility features can only be approved when full compliance cannot be achieved due to terrain or historic features. Where the Historic Review Board determines that compliance with a requirement would threaten or destroy historically significant features of a qualified historic facility, compliance is required to the extent that it does not threaten or destroy the facility's historically significant features (PROWAG R202.3.4).

2.1.3.2 Modifications for Alterations to Existing ADA Accessibility Features

Where existing physical constraints make it impracticable for altered facilities to fully comply with ADA requirements, compliance may not be required within the scope of the project. Existing physical constraints include but are not limited to underlying terrain, right-of-way availability, underground structures, adjacent developed facilities, drainage, or the presence of a notable natural or historic feature (PROWAG R202.3.1).

2.1.3.3 ADA Modification Request Submittal

Modification requests must be submitted using the ADA Modification Request form (see Appendix B) at the following points in the process:

A. Requests for modifications to waive the requirement for a new ADA accessibility feature as part of a private development should be submitted and acted upon before land use approval since land use conditions are typically written with little or no flexibility.

B. Requests for modifications to requirements for a particular element should be submitted during the first plan review and shall be acted upon before permit issuance.

C. Requests for modification to requirements may be submitted during construction if physical constraints that were not included in the design are identified. In such situations, the Engineer of Record or City Project Manager shall prepare a revised design that maintains accessibility to the greatest extent practicable, and that modification shall be acted upon before constructing the accessibility feature.

D. Modifications should not be provided for non-compliant features after construction.

The City Engineer will review all modification requests and approve or deny the requested modification.

2.2 PERMITTING/APPROVAL PROCESS

2.2.1 Private Development

The contract plans developed for the project act as the permit documentation required. For additional details and requirements on private development, refer to the OCMC 17.50.

Permits for private development are valid for three (3) months. If construction has not begun on site improvements or public improvements within three (3) months of approval, plans and documents are subject to additional review and revisions to meet any standards that have been updated since the time of plan approval. Installation of erosion and sediment control or early grading do not constitute the beginning of construction.

Approval of plans does not constitute a perfect adherence to these standards. Approval constitutes the City's best review of the plans at the time. While revisions are expected to be kept to a minimum, the City may require additional revisions during construction if standards are found to not be adhered to onsite or in the permitted plans.

2.2.2 Capital Improvement Projects

City capital project permitting and bond requirements are contained in the contract documents for each project.

2.3 CONSTRUCTION INSPECTION

2.3.1 Private Development

The Applicant shall provide the City with access to the facility for inspection of the work in accordance with the requirements and intent of the plans, specifications, permit conditions, and land use requirements (collectively known as "the permit"). Refer to the OCMC and Private Development Minimum Inspection Requirements for additional information and the checklist form on the City's website (shown in Appendix C).

2.3.2 Capital Improvement Projects

City capital project inspection requirements are contained in the contract documents for each project.

2.3.3 General Requirements

A. The City's Construction Inspector shall be present at all public improvement inspections as noted on the Private Development Minimum Inspection Requirements.

B. The City's inspection services do not relieve the Engineer of Record or Contractor of their responsibility to properly comply with these *Standards*.

C. City inspection services do not constitute approval of any modification to the approved construction plans.

2.3.3.1 City Responsibilities

Inspection services provided by the City Construction Inspector include:

A. Acting as a liaison between the designated Engineer of Record and the City.

B. Monitoring both work progress and performance testing results.

C. Performing administrative and coordination activities as required for supporting the processing and completion of the project.

D. Issuing a Stop-Work Order by notice to the designated Engineer of Record, Contractor, and Applicant, if required.

2.3.3.2 Applicant Responsibilities

Refer to the Oregon City Minimum Guidelines for Inspection/Observation and Construction of Public Improvements. Inspection services provided by the Applicant include:

A. Obtaining and using a copy of City-approved construction plans and specifications (the permit) and a copy of these *Standards*.

B. Reviewing and approving all pipe, pavement, concrete, and other materials to ensure compliance with City *Standards*.

C. Approving all plan or specification changes in writing and obtaining City approval (see City Inspection Services above). The City must re-approve all changes to the approved plans or specifications before commencing work affected by the revision.

D. Monitoring construction activities to ensure work meets City specifications.

E. Performing (or having performed) material, composition, and other tests required to ensure City specifications are met.

F. Providing inspection reports to the City at the end of each week.

G. Certifying that all necessary public improvements have been installed and accepted in compliance with the City-approved permit construction plans. This certification should take place before requesting building occupancy on commercial, multi-family, and/or other projects with concurrent site development and building permits or before platting of subdivisions or partitions. This certification must also indicate that all items required through the land use process—including but not limited to the payment of all fees, recording of all public utility easements, and obtaining maintenance bonds—have been completed at or before occupancy of the first building or recording of the plat.

2.4 ACCESS MANAGEMENT

This section includes general requirements for access management and the City's access spacing standards. Refer to OCMC 17.52.090 for loading area requirements.

2.4.1 General Requirements

Access management for private accesses or public intersections is required to improve the safety and efficiency of traffic flow for transportation network users and to balance those needs with livability, economic, and community values. Managing roadway access benefits the overall roadway system by increasing safety, reducing conflicts for all users, increasing capacity, and reducing travel times. Controlling access must not become too restrictive; however, local businesses and homeowners deserve access to the roadway system. Overall, access management must balance the needs of through traffic, localized traffic, and pedestrians and bicyclists on a particular roadway.

The location and number of roadway intersections and other access points must be planned, coordinated, and controlled by the City. By the nature of the roadway functional classification system, higher-speed arterial streets require the highest level of access management restriction and tend toward less access. Lower-speed collector streets and connector streets require less restrictive access management. Local streets require very few access management restrictions and tend toward more frequent access.

Accesses are subject to the sight distance standards outlined in Section 3.5, and non-compliant accesses may not be approved. To comply with these requirements, existing accesses may require removal or modification due to safety issues.

2.4.2 Access Spacing Standards

The Oregon City TSP identifies the minimum and maximum street intersection spacing and minimum driveway spacing standards for streets in Oregon City (shown in Table 2-1). Additional information on driveway spacing requirements is described in the OCMC 16.12.035. Per OCMC 16.12.035, the distance from a street corner to a driveway is measured along the right-of-way line from the edge of the intersection (on the same side of the road) to the nearest portion of the driveway. The distance between driveways is measured at the nearest portions of the driveways (or from edge to edge). Block spacing between streets is measured between the right-of-way centerlines.

Any changes to the spacing standards require a Type I Driveway Modification, further described in Section 2.1. Additional City plans, such as the *Beavercreek Road Access Management Plan*, provide additional information on driveways that will be closed and combined.

Table 2-1: Spacing Standards

	Mixed-Use or Residential				Commercial or Industrial			
	Major Arterial	Minor Arterial	Collector	Local	Major Arterial	Minor Arterial	Collector	Local
Maximum Block Size (Street to Street)*	530′	530′	530′	530′	530′	530′	530′	530′
Minimum Block Size (Street to Street)	150′	150′	150′	150′	150′	150′	150′	150′
Minimum Driveway Spacing (Street to Driveway and Driveway-to-Driveway)**	175′	175′	100′	25′	175′	175′	100′	25′

* Maximum except in zones General Industrial (GI), Campus Industrial (CI), Mixed Use Employment (MUE), Institutional (I), and Willamette Falls Downtown District (WFDD), where appropriate street spacing will be determined by the City Engineer. If the maximum block size is exceeded, midblock pedestrian and bicycle accessways must be provided at spacing no more than 330 feet, unless the connection is impractical due to existing development, topography, or environmental constraints. Alternatively, off-street pedestrian and bicycle accessways spaced 500 feet from a street may supplement block lengths exceeding 530 feet.

**Single-family dwellings are exempt from the driveway-to-driveway spacing standard.

When a property is zoned MUC-1, driveways for loading zones shall be separated from customer/employee access driveways when feasible. Access spacing is exempt for those properties and should be coordinated with the City Engineer (as determined by the City Engineer).

2.5 RIGHT-OF-WAY AND PUBLIC EASEMENTS

Refer to the City of Oregon City Municipal Code, which takes precedence if conflict exists within these *Standards*. Projects that do not meet the standards noted in this section and in the Code require a Design Modification (Refer to Section 2.1).

2.5.1 Requirement for Right-of-Way and Public Easements

As a condition of approval for a development, the City may require dedicating additional road right-of-way or other public easements in support of the proposed development to meet standard cross sectional elements. The City will determine the right-of-way and easement widths and types after reviewing the development with the requirements for dedications identified via land use requirements or as identified in the dedication review processes.

2.5.2 Minimum Width Requirements for Rights-of-Way and Easements

A. Definition of standard road right-of-way widths by roadway functional classification is provided in OCMC 16.12.016 for required typical sections.

B. Some corridor plans and concept plans require road designs specific to certain areas. Details specific to these can be found in the respective plans. Contact the City Engineering Group to verify details and standards for those areas.

C. If dedicating a Permanent Public Utility Easement (PUE) or a combination of another easement that includes a PUE is required, an easement must be dedicated along the entire abutting right-of-way of all front lot lines (see Section 8.3).

D. Additional easements for signing, slopes, and pedestrian facilities may be required via land use requirements or during construction plan review. This should also be considered for CIP projects.

2.5.3 Right-of-Way and Public Easement Dedication Process

Refer to OCMC 16.12.085 for details on the public rights-of-way and easement dedication processes and types of easements. Also refer to the Street and Easement Vacation Standard Operating Policy and Procedure. An overview of the process is below.

A. Typical easements that may be required for dedication may include but are not limited to:

1. Permanent Right-of-Way Dedication
2. Permanent Public Utility Easement (see Section 8.3)
3. Permanent Sign, Slope, Public Utility, and Sidewalk Easement
4. Permanent Storm Drainage, Sanitary Sewer, or Water Easement (See Section 8.3)
5. Temporary Construction Easement
6. Unusual Facility Easement
7. Watercourse Easement
8. Resource Protection Easement

B. Depending on the project's requirements, one or more of the above easement dedications may be required.

C. An Applicant may be required to provide proof of recorded access from a public road or public easement through the proposed development to an abutting parcel.

D. If proof of access easement cannot be provided or has not been previously created, then an Applicant will be required to dedicate a permanent public easement for the benefit of the abutting parcel on the face of the plat.

2.5.4 Street, Alley, and Easement Vacations

A street vacation is the termination of the public interest in a right-of-way, and it extinguishes the easement for public travel that the right-of-way represents. Whenever any street, alley, or public way is vacated by official action, the zoning districts adjoining the side of such public way shall automatically be extended to the side or sides to which such lands revert to include the right-of-way thus vacated, which shall henceforth be subject to all regulations of the extended district or districts. Refer to OCMC 17.06.035.

The following factors will be evaluated when considering whether the vacation will impact the public interest:

A. The area proposed to be vacated is not presently needed and is not identified in any adopted plan for public services, transportation functions, utility functions, stormwater functions, view corridors and/or viewpoints, tree planting/retention, pedestrian amenities, community uses, or commercial uses.

B. The vacation does not prevent the extension or retention of public services, transportation functions, utility functions, stormwater functions, view corridors and/or viewpoints.

C. Public services, transportation functions, or utilities can be extended in an orderly and efficient way in another location.

D. The vacation does not impede the future best use of, development of, or access to abutting property.

E. The area of the vacation is not presently (or will not in the future be) needed as part of an interconnected system of public streets that is generally consistent with the street connection and bicycle/pedestrian spacing requirements.

F. The vacation does not impact a Historic District.

When approving a petition to vacate a street, whether fully or in part, the City may make reservations or conditions, including:

A. The maintenance and use of underground public utilities or service facilities in the portion vacated.

B. Limits to using the area above and adjacent to underground utilities or service facilities.

C. Moving the utility or service facilities either below, on, or above the surface at the petitioner's expense.

D. Constructing, extending, or relocating sidewalks and curbs, shared-use paths, trails, or other similar pedestrian or bicycle facilities.

E. Grading or pavement extensions.

F. Dedication for street use or another area instead of the area to be vacated.

G. Replat.

H. Any other matter of like or different nature relating to the vacated area and remaining or relocated street area adjacent to the petitioner's property or area dedicated instead of the vacation area.

See Street and Easement Vacation Standard Operating Policy and Procedure for further information about policy and process of street and alley vacations.

2.5.5 Annexations

All annexations shall include the adjacent existing roadway in total. Annexations shall not stop at the centerline.

2.5.6 Obstructions

It is unlawful for any person to place or maintain any obstruction (permanent obstruction) other than a temporary obstruction in any public street or alley in the city without obtaining approval for a right-of-way permit from the City Commission by passage of a resolution.

A temporary obstruction is defined as an object placed in a public street, sidewalk, road, or alley that is not permanently anchored to another surface, such as the pavement, the sidewalk, or a building. A temporary obstruction includes but is not limited to moving containers, debris dumpsters, and seating. A short-term temporary obstruction is allowed for a period of no more than 60 consecutive calendar days and is permitted with a temporary obstruction in the right-of-way permit. A long-term temporary obstruction is allowed for no more than 1 year, and it is permitted with a renewable right-of-way permit.

To allow the City Commission to adequately consider whether to allow the placement of an obstruction and whether any conditions may be attached, the following information is required:

A. Site plan showing right-of-way, utilities, and driveways.

B. Sight distance per OCMC 10.32, Traffic Sight Obstructions.

C. Traffic control plan including parking per the MUTCD.

D. Alternative routes (if necessary).

E. Minimized obstruction area.

F. Hold harmless/maintenance agreement.

If the City Commission adopts a resolution allowing the placement of a permanent obstruction in the right-of-way, the City Engineer shall issue a right-of-way permit with any conditions deemed necessary by the City Commission. Signage that acts as an obstruction is approved through OCMC 15.28. While awnings are considered an obstruction, they may be allowed if the conditions in the Awning Standard Operating Procedure is met.

In determining whether to issue a right-of-way permit to allow a temporary obstruction, the City Engineer may issue such a permit only after finding that the following criteria have been satisfied:

A. The obstruction will not unreasonably impair the safety of people using the right-of-way and nearby residents.

B. The obstruction will not unreasonably hinder the efficiency of traffic affected by the obstruction.

C. No alternative locations are available that would not require use of the public right-of-way.

D. ADA standards are maintained.

E. Any other factor that the City Engineer deems relevant.

OCMC 12.04.120 outlines requirements for temporary and permanent obstructions.

2.6 SURVEY/MONUMENTATION

The *Oregon Standard Specifications for Construction* and ORS 209.140155 define the requirements for the protection of existing survey monuments during any construction and the setting of new survey monuments following the construction of new roadways.

Refer to the *Clackamas County Roadway Standards*, Section 150 for Survey and Monumentation standards.

2.7 HISTORIC DISTRICTS AND DOWNTOWN

Oregon City has two local historic districts:

A. McLoughlin Conservation District

B. Canemah National Register District

Additional information for each district is provided at the districts' websites. OCMC 17.40 provides information on the Historic Overlay District for the City, including construction details for projects within this area. Refer to the Historic Design Guidelines for New Construction.

Downtown Oregon City is not a Historic District, but the downtown has specific guidelines to preserve this area. According to the 1999 *City Downtown Plan*, the City intends to verify that new construction and improvements are guided by a set of historic design guidelines that enhance and preserve this part of the City. Within this area, pedestrian-oriented design features are emphasized, including:

A. Pedestrian crossings

B. Street furniture

C. Wider sidewalks

D. River viewpoints

E. Decorative railings

3.0 GEOMETRIC DESIGN

Chapter 3 provides the geometric building blocks for planning and designing a road by describing the typical cross section elements, outlining parameters associated with horizontal and vertical alignments, providing an overview of intersection design, discussing various sight distance needs, highlighting the assessment of roadside design, and providing features for traffic calming and additional design features. This chapter is consistent with the geometric design principles outlined in the AASHTO *Green Book* and the ODOT *Blueprint for Urban Design*. If the guidance in this section cannot be obtained, then a design modification is required for approval by City Engineer.

3.1 CROSS SECTION

Typical roadway cross sections vary based on functional classification. Roadway functional classifications are established in the Oregon City TSP. Table 16.12.016 from OCMC 16.12.016 implements the Oregon City TSP and illustrates the maximum design standards. These standards may be reduced with an alternative street design, which may be approved based on the modification criteria in OCMC 16.12.013. For the Downtown District, Washington Street, 7th Street, and Molalla Avenue, refer to Section 5.8. When required as a condition of development, half-street improvements must include the entire area between the centerline and the edge of right-of-way. Table 3-1 provides general guidance and an overview on the typical uses for each cross sectional element and where to find additional information.

Table 3-1: Typical Uses for Cross Sectional Elements

Cross sectional Element	Description
Travelway	Travelway width varies by functional classification—see Std. Dwg. OC 500-OC502. The number of travel lanes is determined by the Oregon City TSP.
Two-Way Left-Turn Lane/Median	Medians are to provide for left-turn lanes (e.g., two-way left-turn [TWLT]) as needed and used only on collector and arterial streets. Medians can be narrower if there is no need for left-turns and/or refuge islands for pedestrian crossings. Medians can be raised and landscaped; rocked medians should be provided in locations that need sight distance and where pedestrian crossings are present. Section 10.0 provides information on landscaped medians. Refer to Oregon City area-specific planning documents for guidance on where medians are required. Medians (and sometimes "pork chop" islands) are also used for access management purposes and to prohibit specific movements (e.g., right-in/right-out).
Parking	On-street parking shall be parallel along the curb per OCMC 16.12.016. Angled on-street parking is discouraged and shall only be implemented on a case-by-case basis with City Engineer approval.
Bicycle Facilities	Bicycle facilities are required on all roads City streets classified as collector streets or higher. The standard bicycle lane width is 6 feet based on the OCMC. However, when possible, it is desirable on collectors and arterials to have on-street buffered bicycle lanes (6-foot bicycle lane with a 2-foot buffer). Separated bicycle facilities may be necessary in higher-speed environments to improve bicyclists' safety and comfort. The minimum bicycle facility requirement is on-street buffered bicycle lanes, but the preferred solution is to provide separated bicycle facilities. Alternative applications may include raised bicycle facilities or shared-use paths. For guidance, refer to Oregon City area-specific planning documents, such as the Oregon City TSP, which outlines future bicycle route connectivity throughout the City.
Curb and Gutter	The Std. Dwg. OC511 requires a 6" curb with an 18" gutter.
Landscaping	When required, landscaping can be installed on medians or between the curb and sidewalk. See Std. Dwg. OC530 for street tree planting details and OCMC 12.08 for street tree requirements. Refer to Chapter 10 for additional landscaping details.
Sidewalks	Typical sidewalk widths shall be per OCMC 16.12.016, Oregon City concept plans or other adopted plans.

3.1.1 Lane Widths

The Oregon City TSP provides guidance on how to determine lane widths based on functional classification. The City has four key considerations when deciding lane widths:

A. Lane widths should be kept as narrow as possible.

B. Wider lane widths should be considered when the mix of heavy vehicles is greater.

C. When no bicycle facility or shoulder is present, a shy distance from a vertical curb should be considered.

D. If the purpose of the design is a lower-speed environment, narrower travel lanes should be selected.

Oregon City TSP provides additional information on determining the lane arrangement and width of the street based on functional classification and potential route designations, such as freight and transit routes, as summarized below.

A. Streets along regional and local truck routes should have a minimum lane width of 12 feet.

B. A minimum lane width of 11 feet is required along a transit route.

C. If the street is not along a designated route, the lane width can be reduced to a minimum of 12 feet along major arterials, 11 feet on minor arterials, and 10 feet along collectors and local streets, as determined by the City.

3.1.2 Constrained Street Section

Constrained street sections may only be considered for local streets with approval by the City Engineer. **Constrained streets may have reduced lane widths per 3.1.1 and may eliminate the following typical street components:**

- **bike lanes**
- **landscape strip and/or furnishing zone**
- **sidewalk on one side of a street**

The following potential scenarios will be evaluated on a case-by-case basis:

A. Constructing the standard street width would cause excessive impacts to adjacent businesses and/or homes.

B. Constructing the standard street width is impractical based on topographical impacts (i.e., retaining walls or cut/fill would be required).

C. Constructing the standard street width would unnecessarily impact environmentally sensitive areas.

For all cases, the City Engineer shall approve documentation through the design modification and public improvement modification process.

The AASHTO *Green Book* provides guidance for vertical and horizontal roadway elements. For constrained areas, the Engineer of Record and/or the City Project Manager should follow the principles from the *Green Book* and consider various dimensions for roadway cross sections to minimize impacts.

In addition, the practitioner should assess the *Oregon Fire Code Applications Guide*, Clackamas Fire District #1 to determine if sufficient width (i.e., 20 feet of unobstructed driving surface) exists to accommodate parked vehicles. Parking should be prohibited accordingly. A design modification from the typical standard widths require approval by the City Engineer.

3.1.3 Parking (On-Street)

On-street parking may be added in urban environments if approved or required by the City. The City standard is parallel parking in public right-of-way along the curb, and it requires the least paved width. Angled on-street parking may only be considered if there is adequate street width; speeds are below 25 mph; and other constraints, such as environmental, topographical, or other unique circumstances exist. Angled parking should be processed as a design modification to be approved by the City Engineer. The location of bicycle lanes should be carefully considered in areas with on-street parking. Separated bicycle facilities or shared-use travel lanes may be considered as discussed in Section 4.2.

On-street parking is required on both sides of the street in all street designations as outlined in OCMC 16.12.016. On-street parking may be restricted for safety and/or functionality. When determining the locations of on-street parking, designers should consider sight distance, delivery access, and emergency access for existing and proposed development along the street. Where on-street parking is provided, curb extensions should be provided at intersections and midblock crossings to minimize crossing distance.

To preserve safe sight distance, on-street parking is prohibited within 15 feet of the intersection and the accessway with public streets (OCMC 16.12.032).

3.2 HORIZONTAL ALIGNMENT

All roadway designs shall comply with the guidance in the current edition of the AASHTO *Green Book*, except as modified by this section. Centerline alignment of improvements should be parallel to the centerline of right-of-way.

3.2.1 Horizontal Curves

Requirements for horizontal curves include:

A. Horizontal curves should meet the minimum radius requirements in Table 3-2.

B. Reversing horizontal curves should be separated by at least 50 feet of tangent (100 feet on arterials).

C. Horizontal curves should be designed using a maximum superelevation rate of 4% (emax=4%). See Section 3.3.2 for superelevation standards.

Table 3-2: Minimum Curve Radii

Design Speed (mph)	Minimum Curve Radius (ft) for Various Cross Slopes			
	(e) -2.5%	(e) 0%*	(e) 2.5%*	(e) 4%*
15	50	45	45	40
20	100	90	85	80
25	185	165	150	145
30	305	275	245	230
35	475	415	370	345
40	700	600	525	490
45	980	830	720	665

*Use of superelevation requires City approval.

3.2.2 Exceptions for Very Low-Volume (≤400 ADT) Local Streets with a Speed of 25 Miles Per Hour (mph) or less

The following are allowed under the listed circumstances on a limited basis:

A. Horizontal curves on local roadways within residential areas may have a minimum centerline radius of 100 feet, as limited in this section.

B. A single 15 mph maneuver is allowed on a local road on a limited basis when physical constraints or property boundary limitations exist.

C. Residential driveways that serve no more than three lots, are less than 400 feet in length, or have topographic constraints may use a 50-foot centerline radius for a 12-foot width or a 40-foot centerline radius for a 20-foot width. Approval from the City Engineer and emergency services provider are required.

3.2.3 Roadway and Marking Transitions

Shifts in roadway alignment, widening, or narrowing within motor vehicle travel lanes are to be accomplished through roadway transitions as described below.

A. Roadway transitions within through lanes:

$$L = S \times W \qquad (S \geq 45 \text{ mph})$$
$$L = WS^2/60 \qquad (S < 45 \text{ mph})$$

where L = minimum taper length (feet)
S = design speed (mph)
W = offset (shift) width (feet)

B. Tapered widening for right-turn lanes at intersections should be designed according to the ODOT *Highway Design Manual* detail for "Right Turn Channelization."

C. Tapered widening for left-turn lanes at intersections should be designed according to the ODOT *Highway Design Manual* for "Left-Turn Channelization."

D. For road widening to develop left-turn lanes, horizontal curves and tangents for the through lane may be substituted for the straight tapered widening noted above, provided that the curves and tangents meet horizontal alignment requirements for the given design speed of the roadway.

E. Along local and connector roads, roadway width transitions are not required if traffic is not expected to use the shifting roadway (e.g., at the beginning or end of street frontage improvements).

3.3 VERTICAL ALIGNMENT

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

A. **Minimum Roadway Gradient:** The minimum tangent roadway gradient should be 0.5% along the crown and vertical curb line. The gradient along the curb return at the sidewalk ramp landing shall be designed to 0.5–1.5%.

B. **Maximum Roadway Gradient:** The maximum roadway gradient is based on the adjacent land use contexts and should be 8% for commercial areas and 15% for residential areas.

C. **Intersection Landing:** At intersections, a landing should be provided on the secondary or subordinate approach or on a stop-controlled approach.

   1. Landings should be 20 feet in length for private driveways, 50 feet in length for local roadways, and 100 feet in length for all other roadways.
   2. Landings should be measured from the edge of pavement of the intersected roadway at full development and shall have an average grade no greater than 5%.
   3. Cross slopes of the landings of both roadways should be flattened so that the pedestrian crossing is ADA compliant.

3.3.1 Vertical Curves

A. Vertical curves should be used when design grade breaks of more than 1% are necessary. Grade breaks may be allowable on the side street and would need to be approved by the City Engineer, depending on a lower road hierarchy.

B. The minimum vertical curve length should be 50 feet for the mainline street and 20 feet for the side street approach.

C. Vertical curves shall conform to the values in Table 3-3 and be calculated according to the formulas below. K-Sag values may be reduced to K-Crest values if adequate street lighting is present along the entire sag vertical curve.

$$K = L / A$$

where

A = algebraic difference in grades (percent)

L = length of vertical curve (feet)

Table 3-3: Design Control for Crest and Sag Vertical Curves

Design Speed (mph)	Minimum Rate of Vertical Curvature (K)	
	Crest	Sag*
15	3	10
20	7	17
25	12	26
30	19	37
35	29	49
40	44	64
45	61	79

*Values are for roadways where street lighting is not present. The City may accept a lower K value for sag vertical curves if the roadway design includes lighting. The Engineer of Record shall calculate for the minimum-length curve based on comfort ($L=AV^2/46.5$).

3.3.2 Cross Slope and Superelevation

A. Roadway cross slope should be no less than 2.5% and no greater than 4%. If existing conditions require different cross slopes, approval by the City Engineer is required. Intersection grading requirements are shown in Section 3.4.1.5.

B. Design elements for superelevation should be based on the AASHTO *Green Book*.

C. Superelevation is not allowed on roadways with a design speed of 35 mph or less.

D. The maximum rate of roadway superelevation for urban conditions should be 4% (e_{max} = 0.04).

E. The use of superelevation in the urban area is discouraged, and the City shall approve its use.

F. Street grades, intersections, and superelevation transitions should be designed to prevent concentrations of stormwater from flowing across the travel lanes.

G. On portland concrete cement (PCC) roadways with an odd number of lanes, the crown should be offset to a lane line to prevent locating a joint in the middle of a traffic lane.

3.4 INTERSECTIONS

The City uses various intersection control types based on the context and projected traffic volumes of the intersecting roadways.

Table 3-4 describes typical intersection control types. See Section 5.3 for additional guidance on analyzing and selecting the appropriate intersection control.

Table 3-4: Typical Intersection Control Types

Traffic Control/Intersection Form	Definitions
Two-Way Stop-Control (TWSC)	At TWSC intersections, the stop-controlled approaches are on the minor street, and the free-flowing approaches are on the major street. At TWSC intersections, drivers must find gaps in the major street traffic to make a turning or through movement. See the Oregon City Public Works *Stop Sign Brochure* for more information.
All-Way Stop-Control (AWSC)	AWSC intersections require every vehicle to stop at the intersection before making a turning or through movement. If other vehicles are present at the intersection, a driver may only proceed after determining that there are no other vehicles in the intersection and that it is their turn. See the Oregon City Public Works Stop Sign Brochure for more information.
Yield	A yield-controlled intersection requires vehicles to slow down and give way to all other traffic going through the intersection. If no other traffic is present at the intersection, a driver may slow down but not stop before entering the intersection.
Traffic signal	Traffic signals are electrically operated traffic control devices that indicate to roadway users when they may advance through the intersection. Traffic signals allow the shared use of road space by separating conflicting movements.
Roundabout	A roundabout is a generally circular intersection form that uses yield-controlled approaches for all legs of the intersection. Drivers must slow down prior to entering the roundabout and give way to vehicles that are in the roundabout.

3.4.1 Intersection Geometry

Intersection geometry outlines design guidance for the following elements:

A. Design vehicle

B. Tangent approach

C. Curb radii

D. Intersection angle

E. Vertical geometry

F. Sidewalk ramps

G. Turn lanes

H. Pedestrian refuge islands

I. Roundabouts

3.4.1.1 Design Vehicle

The Engineer of Record and/or City Project Manager shall determine the appropriate design and control vehicles for a facility. Definitions and information for both vehicles are provided below.

A. **Design vehicle:** Frequently uses a facility and must be designed without encroaching into adjacent and opposing traffic lanes (e.g., turning lane to lane).

B. **Control vehicle:** Infrequently uses a facility, but encroachment into opposing traffic lanes, multiple-point turns, or minor encroachment into the roadside is acceptable (e.g., using available pavement).

C. The project may be required to provide evidence that the designs can accommodate both the design vehicle and the control vehicle.

D. Functional classification, safety, and roadway use all play a role in determining the acceptability of lane encroachment by control vehicles. For example, on a local road, full lane encroachment by a control vehicle may be acceptable if sight distance is adequate. However, on a major arterial, such encroachment may not be permitted.

E. In urban and constrained contexts, coordinate with the City Engineer to determine how trucks will be accommodated and/or designed for at intersections.

Figure 3-1a illustrates the path of a design vehicle. Figure 3-1b illustrates the path of a control vehicle.

Figure 3-1a: Design Vehicle Path

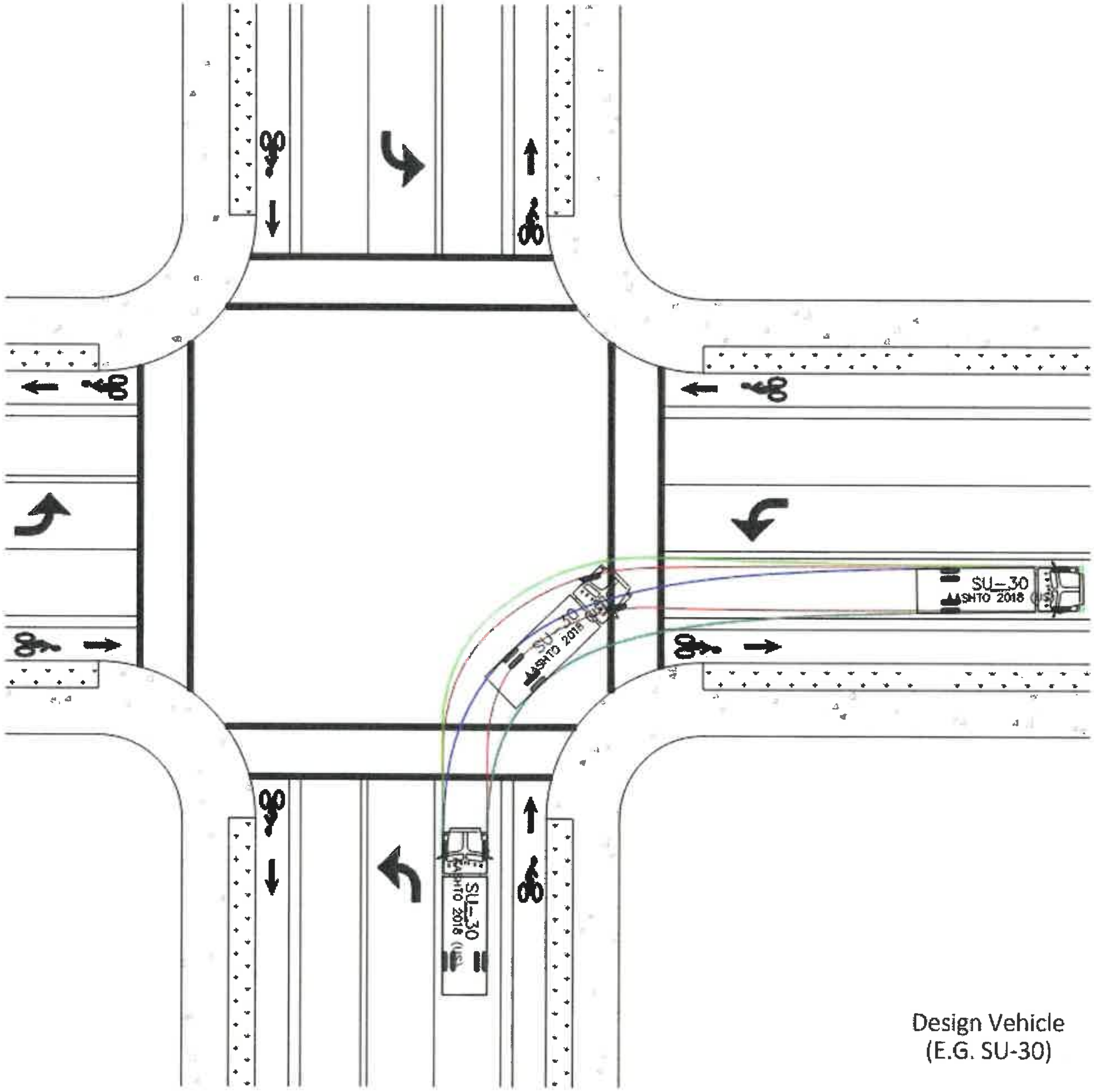
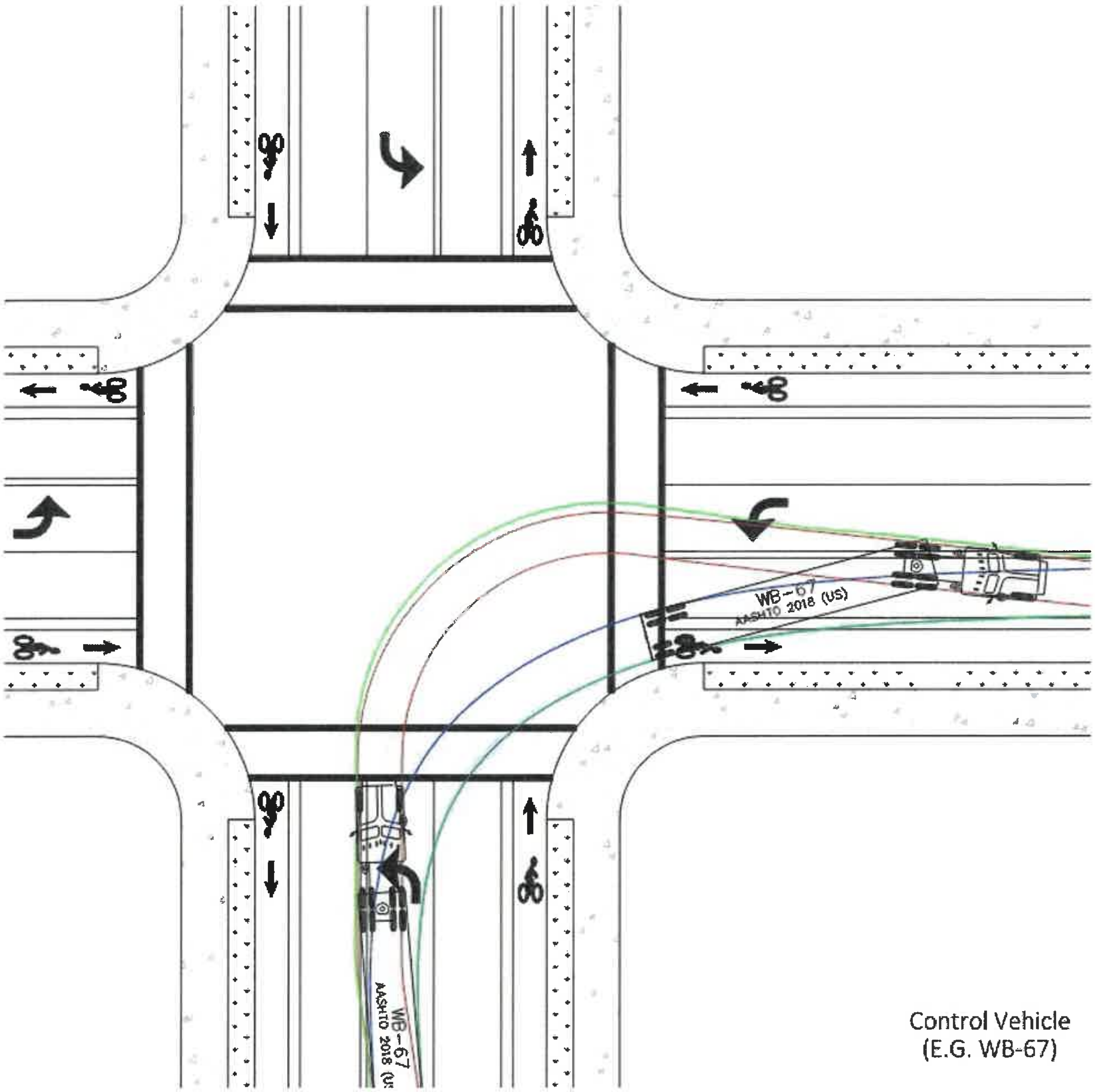


Figure 3-1b: Control Vehicle Path



3.4.1.2 Curb Radii

The minimum curb radii at intersections shown in Table 3-5 are for new roads. Larger curb radii may be required along designated truck routes based on an assessment of design vehicles; smaller curb radii may be allowable based on the land use context. Additional requirements for curb radii are described below.

A. Verify that corner radii provide maneuverability for emergency response vehicles (refer to City Fire Code).

B. Curb radii shall be approved by the City Engineer based on an assessment of design and control vehicle considerations as well as pedestrian and design speed considerations.

C. The minimum right-of-way radii shall maintain at least the same distance from right-of-way to edge of pavement or curb as the lower classified roadway.

D. In Table 3-5, if a designated bicycle lane or on-street parking exists on either intersecting roadway, then the initial radii may be reduced by 5 feet.

Table 3-5: Minimum Curb Radii

Major Roadway	Intersecting Roadway (ft)			
	Major Arterial	Minor Arterial	Collector	Local
Major Arterial	35′	35′	30′	25′
Minor Arterial	N/A	30′	30′	25′
Collector	N/A	N/A	25′	25′
Local	N/A	N/A	N/A	25′

3.4.1.3 Tangent Approach

To improve intersection safety, new intersections should conform to the tangent requirements of OCMC 16.12.020 unless otherwise approved by the City Engineer. Tangent sections are shown in Table 3-6.

Table 3-6: Tangent Sections

Major Roadway	Intersecting Roadway (ft)				
	Major Arterial	Minor Arterial	Collector	Local	Private Access
Major Arterial	100′	100′	100′	100′	100′
Minor Arterial	N/A	100′	100′	100′	100′
Collector	N/A	N/A	100′	50′	50′
Local	N/A	N/A	N/A	50′	50′

3.4.1.4 Intersection Angle

The intersection angle at intersecting roadways shall be as close to 90 degrees as possible. Intersection angles from 80 degrees to 100 degrees may be considered if approved by the City Engineer. Intersections with a skew angle of more than 10 degrees from a right angle are not allowed unless a design modification is prepared and approved by the City Engineer.

3.4.1.5 Vertical Geometry

At stop-controlled intersections, the crown of the major (higher classification) street shall continue through the intersection. The cross slope of the minor street shall flatten to match the longitudinal grade of the major street. A grade break of 5% or less may be allowed in the profile of the minor street as it crosses the crown of the major street. At intersections where both streets have the same functional classification, the City will either determine the controlling roadway or require the intersection to be designed accordingly.

At signalized intersections—and at intersections that may be signalized in the future—the cross slope of the major roadway should be such that the profiles of both roadways are flattened to a cross slope of 0.5%. This creates a 1% grade for the opposing through traffic rather than a 5% grade break (2.5% normal crown).

At intersections, the cross-slope of both roadways should be flattened so that the pedestrian crossing is ADA compliant. Intersection landings shall be provided according to Section 3.3.

3.4.1.6 Sidewalk Ramps

Sidewalk ramps (detailed in the list below) shall be provided for all directions at each corner of every intersection unless pedestrian safety concerns warrant a crosswalk closure, which the City Engineer must approve.

A. Each street corner shall provide two directional ramps. At T intersections, the crossbar of the "T" should have two crossings equipped with ramps. All T intersections should have at least six ramps, with two ramps on each corner of the intersection. See Figure 3-2.

B. Sidewalk ramps shall be designed according to Std. Dwg. OC509.

C. See current ODOT Standard Drawings for additional ramp details. Figure 3-3 provides an example.

D. See Section 5.8.1 for information about stamped street names.

E. Sidewalk ramps shall be a minimum of 5 feet in width and designed and/or constructed according to ADA and PROWAG requirements.

F. All existing sidewalk ramps abutting a street overlay or pavement reconstruction project shall comply with ADA requirements for sidewalk ramps.

G. All crossings protected by a traffic signal shall have marked crosswalks. Marked crosswalks may be provided at other locations only when approved by the City Engineer based on a pedestrian crossing assessment.

H. Ramps located within marked crossings shall be within the striped width of the crosswalk, excluding the flared wings.

I. Where a crossing is not feasible due to topographical or safety concerns, the crossing can be closed through the approval of the City Engineer. Elimination of a crossing shall not conflict with ADA requirements. When a crossing is eliminated, alternative pedestrian routes with minimal out-of-direction travel should be provided.

Figure 3-2: Sidewalk Ramps at T Intersections

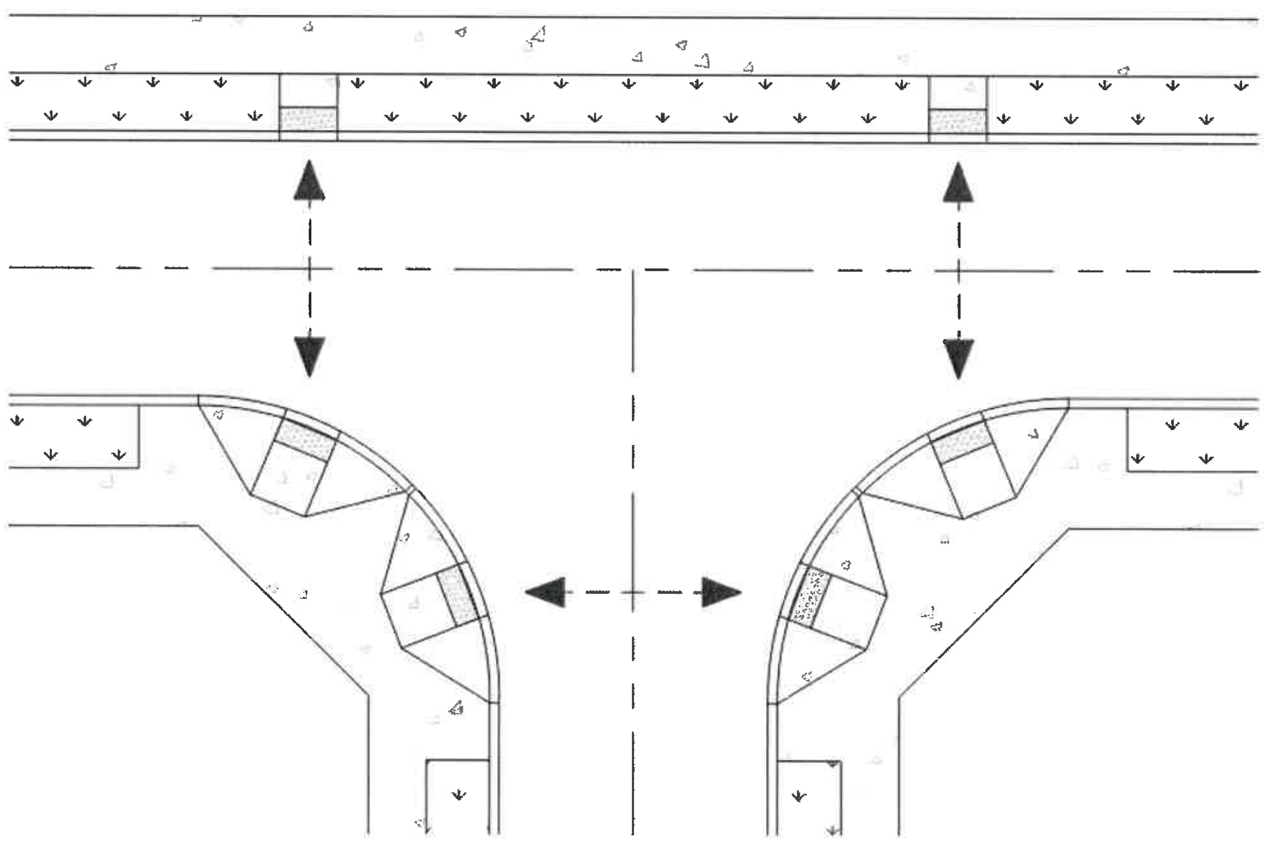
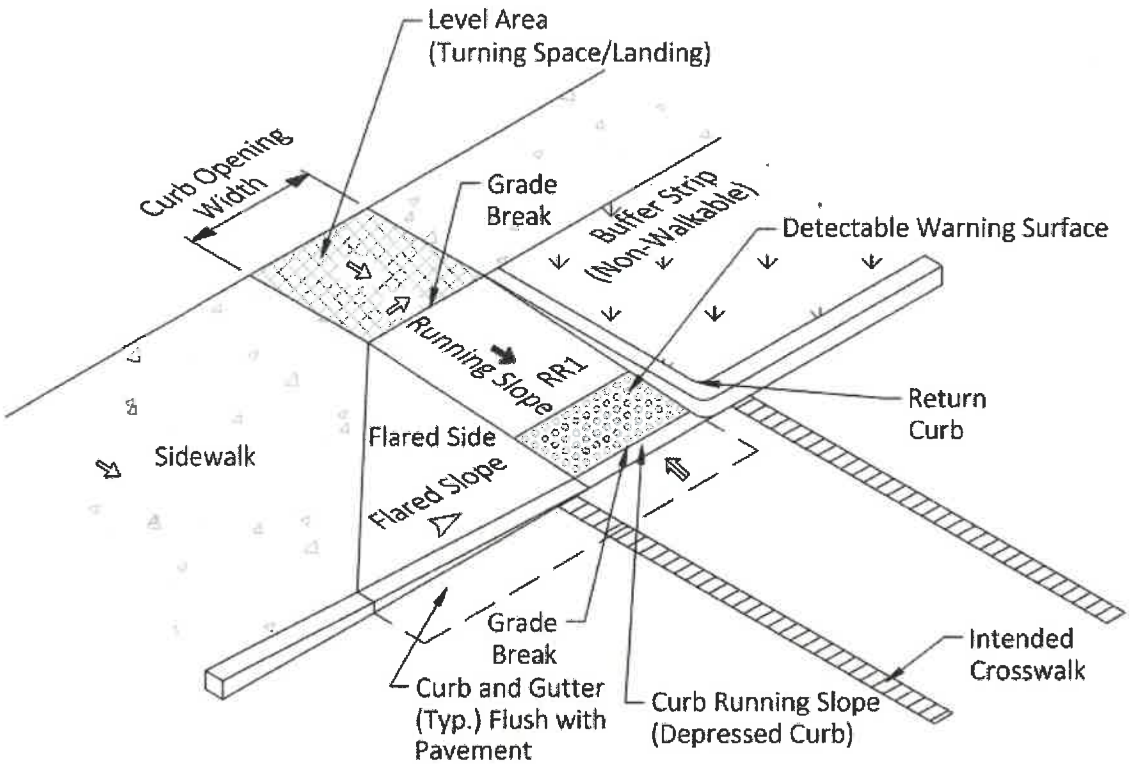


Figure 3-3: Example Ramp Details



3.4.1.7 Turn Lanes

The need for left- or right-turn lanes shall be based on a traffic operational analysis, such as a traffic impact analysis (TIA) (see Section 5.2.1), and/or as dictated by the Oregon City TSP or City Capital Improvement Program (CIP). The following general rules apply:

A. Queue storage estimates shall be based upon a traffic operational analysis.

B. Left-turn lanes, when provided, shall have a storage queue of at least 50 feet.

C. Left- or right-turn lanes shall be based on ODOT's *Highway Design Manual*.

3.4.1.8 Pedestrian Refuge Islands

Medians that are crossed by a pedestrian access route and accessible route islands shall comply with ADA requirements as identified in Oregon City ADA Design Review Checklist—Medians/Traffic Islands (See Appendix C) and depicted in Oregon Standard Drawing RD710.

3.4.1.9 Roundabouts

Roundabout geometric design requires balancing design objectives with design flexibility to achieve multimodal planning and design objectives. When their geometric features promote slow entering and circulating speeds, roundabouts have fewer and less severe collisions. Undesirable roundabout geometry negatively influences roundabout operations by affecting driver lane choice and behavior through the roundabout.

A roundabout's basic form and features are influenced by location, desired capacity, available space, required lane numbers and arrangements, design vehicle, and other geometric attributes unique to each site. Design outcomes depend on the surrounding context and associated speed environment. Compared to other contexts, rural environments may have high approach speeds and low bicycle and pedestrian use. In urban environments, where bicycle and pedestrian safety is a primary concern, roundabouts typically have significantly different design objectives.

Many design techniques are substantially different for single-lane roundabouts than for multilane roundabouts with two or more lanes. Roundabouts in unique, low-volume/speed, or constrained reconstruction locations may include combinations of traversable and non-traversable features, including splitter islands and central islands. These configurations may require special consideration compared to roundabouts with non-traversable central island features.

Roundabout design is an iterative process that must consider and balance a variety of design objectives while working within site-specific constraints. Optimizing roundabout operational performance and maximizing safety require customizing a design rather than relying on a design template.

Roundabout intersections shall be designed according to *NCHRP Report 672 Roundabouts: An Informational Guide*. Roundabout consideration per Section 5.3 should happen before the approval of a traffic signal.

Roundabouts with pedestrian facilities shall comply with ADA requirements as identified in PROWAG Section R306.3. Additional guidance on pedestrian crossings at roundabouts can be found in *NCHRP Report 834: Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities.*

3.5 SIGHT DISTANCE

Sight distance shall be determined and approved according to the procedures in the current AASHTO *Green Book* or AASHTO's *Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400)*. The OCMC includes additional guidance as noted in the following sections.

3.5.1 Intersection Sight Distance

Intersection sight distance (ISD) should be evaluated according to OCMC 10.32. This applies to the design of new streets and driveways as well as to the placement of any object located within or behind the public right-of-way. ISD must comply with the following guidelines:

A. No object taller than 36 inches or plant capable of growing taller than 36 inches is permitted within a sight clearance area. Poles, tree trunks, and similar objects less than 12 inches in diameter may be allowed in the sight clearance area if it can be proven that such obstructions do not prevent the continuous view of the vehicle approaching the intersecting street.

B. Tree locations should be verified so they do not obstruct visibility of signing. Trees that obstruct signing should be removed or located elsewhere.

    1. Maintain existing street tree and tree-sized shrubs located within or overhanging the public right-of-way or visual clearance zone by trimming to a minimum of 8 feet above ground level per OCMC 10.32.030.

2. Existing trees or tree-size shrubs located within or overhanging the public right-of-way shall be kept trimmed to a minimum of 10 feet above local streets or alleys.

3. Existing trees or tree-size shrubs located within or overhanging the public right-of-way shall be kept trimmed to a minimum of 12 feet above collectors and arterials.

4. Trees shall be maintained following OCMC 12.08.025.

C. Adjacent property owners are required to maintain adequate sight distance at intersections and driveways.

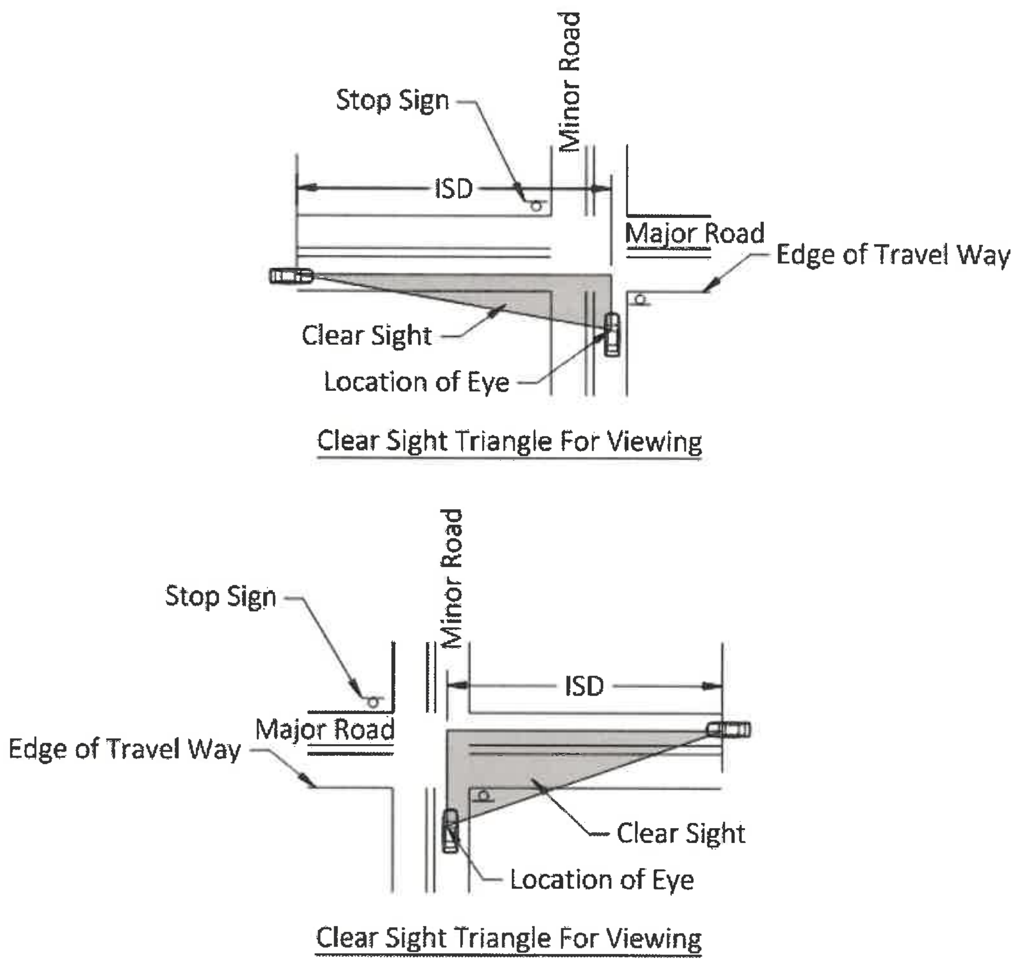
D. ISD is measured from a point on the centerline of the minor road/driveway 14.5 feet from the edge of traveled way of the major road. It is measured from a height of 3.75 feet on the minor road to an object height of 4.5 feet on the major road.

E. The required ISD is based on the posted speed limit of the major road (shown in Table 3-7 and Figure 3-4).

Table 3-7: Intersection Sight Distance

Intersection Sight Distance	
Posted Speed Limit (mph)	Required Sight Distance (ft)
25	250’
30	300’
35	350’
40	400’
45	450’

Figure 3-4: Intersection Sight Triangles



3.5.2 Stopping Sight Distance

Stopping sight distance (SSD) must be evaluated at horizontal and vertical curves, intersections, crosswalks, and any other scenario where a driver's view of the roadway ahead may be skewed. Sight line easements must meet SSD requirements. SSD must be evaluated per the most current AASHTO *Green Book*.

3.6 ROADSIDE CLEARANCE

A roadside clearance shall be provided on all street improvement projects according to guidance for urban areas in the most recent AASHTO *Roadside Design Guide*. The designer should follow the AASHTO *Roadside Design Guide* and key topics below.

A. No fixed object (e.g., new light pole, utility pole, street furniture, trash can, or artwork) can be closer than 2 feet to face of curb.

B. At street corners, no fixed object should be taller than 3 feet to maintain vision sight triangles.

C. Sign placement should follow City Standard Drawings, with a 6-inch clearance between the face of curb and the edge of the sign.

D. Mailboxes within the clear sight area must be constructed according to Std. Dwg. OC519.

3.7 TRAFFIC CALMING

The ODOT *Blueprint for Urban Design,* Section 3.2.4, explains how to achieve target speeds on highways within urban areas. Several traffic calming design treatments may be appropriate based on the context of the road. The City Engineer must approve all treatments. Coordination with emergency providers, transit agencies, Oregon City School District, and the Clackamas Fire District #1 needs to occur before traffic calming treatments are installed to confirm potential impacts to emergency and transit routes.

Traffic calming refers to street design techniques that recreate safe, slow, residential, and mixed-use streets without significantly changing vehicle capacity. The goal is to mitigate the impacts of traffic on neighborhoods and business districts that need greater balance between safety and mobility. Traffic calming seeks to influence driver behavior through physical and psychological means, resulting in lower vehicle speeds or through traffic volumes. Physical traffic calming techniques outlined in the Oregon City TSP include but are not limited to:

A. Narrowing the street by providing curb extensions/bulb-outs or midblock pedestrian refuge islands.

B. Deflecting the vehicle path vertically by installing speed humps, speed tables, or raised intersections (refer to Std. Dwg. OC528).

C. Deflecting the vehicle path horizontally with chicanes or roundabouts.

D. Narrowing travel lanes and providing visual cues (e.g., buildings, street trees, on-street parking, or landscaping) next to the street to create a sense of enclosure that prompts drivers to intuitively reduce vehicle speeds.

The Oregon City Neighborhood Traffic Fact Sheet outlines additional traffic calming techniques and weighs the benefits and drawbacks of each.

3.8 CUL-DE-SACS, EYEBROWS, AND OTHER DEAD-END ROAD TREATMENTS

As outlined in OCMC 16.12.025, the City discourages the use of cul-de-sacs, eyebrows, hammerheads, and permanent dead-end streets. These treatments should only be considered if construction of a through street is found to be impracticable due to topography or some significant physical constraints, such as geologic hazards; wetland, natural, or historic resource areas; pre-existing dedicated open space; pre-existing development patterns; or arterial access restrictions. If one of these treatment options is deemed necessary based on discussions with the City, general requirements include:

A. At dead ends, a cul-de-sac must be constructed per Std. Dwg. OC503. Cul-de-sacs must have a turnaround radius of 48 feet. If a constrained section has been approved, a 41-foot turnaround may also be approved. Refer to OCMC 16.12.025 for additional details and requirements.

B. Temporary dead ends on roads with planned future extensions must have an end-of-roadway marker per Std. Dwg. OC525. The City Engineer can approve street barricades (per Std. Dwg. OC512) in place of an end-of-roadway marker on local streets.

C. Eyebrow corners may be constructed on new local streets per Std. Dwg. OC518. Stopping sight distance must be evaluated at all new eyebrow corners, and sight-line easements may be required.

D. Hammerheads are only allowed on Private Streets.

If these requirements cannot be obtained due to constraints, then approval from the City Engineer is required through the design modification process. Section 3.11 provides additional requirements for street design features based on required access for fire apparatuses.

3.9 DRIVEWAYS

Driveways must meet the requirements in OCMC 16.12.035 and be constructed per Std. Dwg. OC504-OC506. This section provides a starting point for designers considering driveways and is not exhaustive of all information. Minimum driveway spacing is determined by the functional classification of the road (shown Table 3-8). Minimum and maximum driveway widths are determined by the property zoning (shown in Table 3-9). All new and replaced driveways must meet ADA and PROWAG requirements for accessibility. As more types of housing and styles of development change over time, OCMC 16.12.035 shall take precedence if any conflict exists. These charts are provided only as reference guides which mirror City Code at the time of adoption.

Table 3-8: Driveway Spacing Standards

Street Functional Classification	Minimum Driveway Spacing Standards	Distance (ft)
Major Arterial	Minimum distance from a street corner to a driveway and between driveways for all uses other than detached single- and two-family dwellings.	175′
Minor Arterial	Minimum distance from a street corner to a driveway and between driveways for all uses other than detached single- and two-family dwellings.	175′
Collector	Minimum distance from a street corner to a driveway and between driveways for all uses other than detached single- and two-family dwellings.	100′
Local	Minimum distance from a street corner to a driveway and between driveways for all uses other than detached single- and two-family dwellings.	25′

Table 3-9: Driveway Approach Widths

Property Use	Minimum Driveway Approach Width (ft)	Maximum Driveway Approach Width (ft)
Single family	10′	24′
Duplex	10′	24′
3- or 4-plex	10′	36′
Multifamily	18′	30′
Commercial, industrial, office, institutional, mixed-use, and/or nonresidential	One-way: 12′ Two-way: 20′	40′

3.10 ALLEYS

Alleys are only allowed if required by an Oregon City Concept Plan. Alleys must be private.

3.11 PRIVATE STREETS

In certain circumstances, creating a private roadway may be permitted if it is the only reasonable way to provide access that minimizes impact to the proposed lots or parcels. Requirements for private streets include:

A. Design and construction of a private roadway widths, cross section, and design speed must be consistent with the design standards for public roads classified as local streets, except as noted in these *Standards* (Section 3.0).

B. All private streets must meet ADA accessibility standards; sidewalks and sidewalk ramps on private streets must be designed accordingly.

C. The City will not be responsible for maintaining private roads. Formal maintenance agreements or equivalents should be established to ensure private responsibility for future maintenance.

D. Private streets and their respective easements must be distinguished from public roadways. Any reservations, restrictions, and maintenance agreements related to the created private roadways must be described in the land division plat or deed records.

E. The Engineer of Record and/or City Project Manager must consider utilities and roadway drainage.

F. Private streets must also comply with Fire Code for load and fire apparatus access requirements if they are designated fire apparatus access roads. See Section 3.11 for additional information on fire standards.

G. Documents defining ownership, use rights, and allocation for liability for maintenance of private streets must be submitted to the City before or in conjunction with final public facility permit approval.

H. A blue street name sign must be posted at each private street entrance from a public street per OC521-522.

3.12 FIRE STANDARDS

City streets shall be designed and constructed based on the information presented in the 2022 Oregon Fire Code (OFC), which is based on the 2021 International Fire Code, or most recent code if a newer one exists. City amendments to the Oregon Fire Code are outlined in OCMC 15.40.030. Oregon City is located within Clackamas Fire District #1. Additional resources for the design of access roads, fire flow requirements, and hydrant placement include:

A. The *Fire Code Applications Guide*

B. Appendix D of the Oregon Fire Code

C. Clackamasfire.com

If the guidance in this section cannot be achieved, then a design modification is required for approval by City Engineer.

3.12.1 Roadway Cross Section for Fire Apparatus

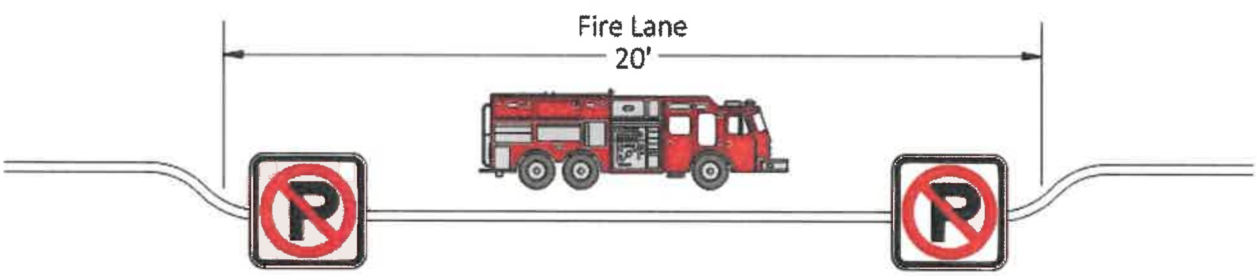
Where fire apparatus roadways are not of sufficient width to accommodate parked vehicles, “No Parking” signs shall be installed on one or both sides of the roadway and in turnarounds as needed. Table 3-10 and Figure 3-5 provide the appropriate guidance.

Table 3-10: Roadway Cross Section for Fire Apparatus

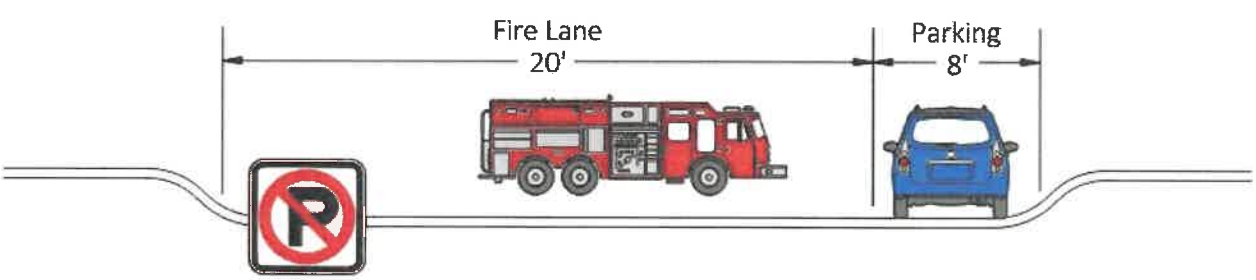
Roadway Paved Width	On-Street Parking
26 ft or less	None
26–32 ft	One side
32 ft or more	Both sides

Figure 3-5: Guidance for Fire Apparatus

Fire Apparatus Access Road Width



Roadway no less than 26'
For Existing Fire Access Roadways, the Minimum Street Width Shall be 20 Feet, With No Parking on Either Side. The Width Shall be Increased to 26 Feet Within 30 Feet of a Hydrant, No Vehicle Parking Allowed.
*Parking is Prohibited and Roadway is Required to be Posted as a Fire Lane.



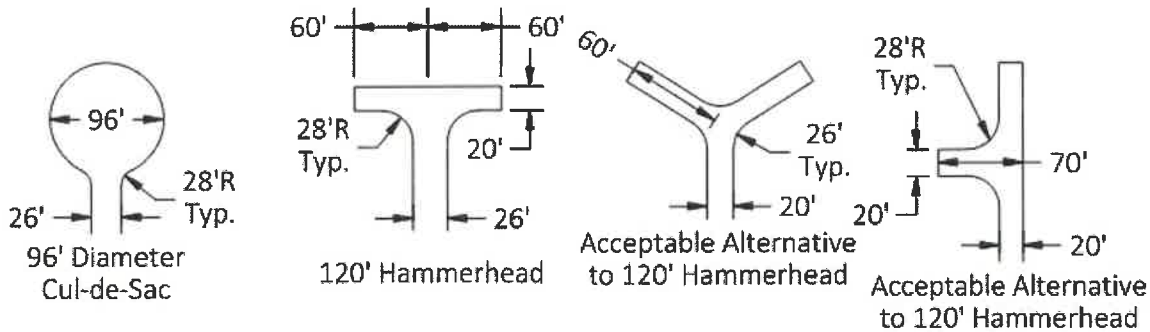
3.12.2 Fire Access Slope

Based on the Oregon Fire Code, Appendix D, D103.2 Grade, fire apparatus access roads shall not exceed 12% in grade, with up to 15% allowed if sprinklers are installed, unless it is approved by the Clackamas Fire District #1 Fire Chief. Intersections and turnarounds have a maximum grade of 5%. OCMC 16.12 provides additional information.

3.12.3 Dead-End Roads and Turnouts

Dead-end fire apparatus access roads in excess of 150 feet in length shall be provided with an approved turnaround. Dead-end fire apparatus access roads in excess of 500 feet in length shall have a driving surface width of no less than 26 feet. Diagrams of approved turnarounds are shown in Figure 3-6 and OFC 503.2.5.

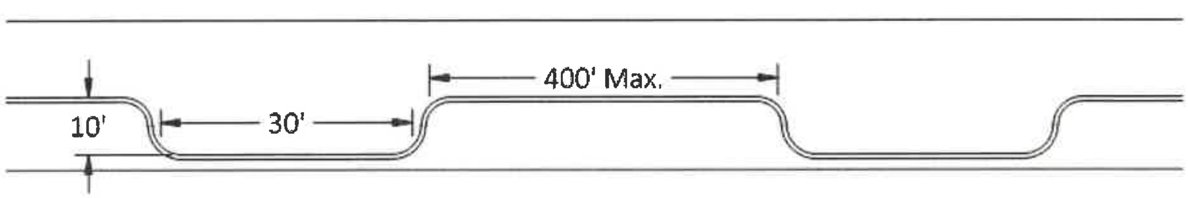
Figure 3-6: Dead End Roads



Source: *Fire Code Applications Guide*

When any fire apparatus access road exceeds 400 feet in length, turnouts 10 feet wide and 30 feet long shall be provided in addition to the required road width and shall be placed no more than 400 feet apart, unless otherwise approved by the City. These distances may be adjusted based on visibility and sight distances. Figure 3-7 provides a diagram of a turnout.

Figure 3-7: Turnouts



Source: *Fire Code Applications Guide*

4.0 MULTIMODAL DESIGN

All streets within the City should be multimodal to serve a range of needs for all street users, including pedestrians, bicycles, motor vehicles, transit, and freight. The adjacent land use and context, functional classification, and street network connectivity can influence the street design and how the transportation system serves each user. To account for this, Oregon City classified the street system into a hierarchy organized by function and street type. These classifications ensure that streets reflect the neighborhoods through which they pass and that they consist of a scale and design appropriate to the character of the abutting properties and land uses. The classifications also provide for and balance the needs of all travel modes, including people walking, biking, using transit, driving, and moving goods. Within these street classifications, context-sensitive design may result in alternative cross sections. The Oregon City multimodal street system is further described in the Oregon City TSP.

Chapter 4 outlines the standards for multimodal design, and the following sections discuss design guidance and standards for each travel mode.

4.1 PEDESTRIAN DESIGN

All pedestrian improvements shall comply with the PROWAG standards for a pedestrian access route. The specific provisions of the PROWAG standards for pedestrian access routes can be found in the Clackamas County ADA Design Review Checklist—Sidewalk/Multiuse Path (see Appendix C). The Oregon City TSP provides a map for future pedestrian connectivity planned throughout the City. Additional requirements for pedestrian design in the public right-of-way are described below.

A. Pedestrian facilities are required on both sides of all City streets per City Code and policies. Pedestrian facilities may include sidewalks and/or a shared-use path.

B. If right-of-way or public easement is adequate, the development is required to connect new pedestrian facilities to existing facilities that are terminated midblock and are within 15 feet of the proposed pedestrian facility. This includes associated improvements, such as curb, drainage, and landscaping.

C. Minimum widths for sidewalks shall be per OCMC 16.12.016, Oregon City Concept Plans, or other adopted plans.

D. Shared-use paths are allowed as an alternative or in addition to sidewalks (see Section 4.3).

E. All pedestrian facilities should be located adjacent to a landscape strip or other physical buffer from vehicular traffic unless otherwise approved. See Chapter 10 for more information on landscape design.

F. All roadway improvements, including sidewalks and shared-use paths, should be constructed within the public right-of-way. Sidewalks and shared-use paths may be located within a public easement if approved.

G. Refer to Chapter 3: Geometric Design for additional details regarding horizontal and vertical clearance and curb ramps.

4.1.1 Pedestrian Crossings

The ODOT *Blueprint for Urban Design* (Chapter 3, Table 3-9) provides target pedestrian crossing spacing that depends on the context classification identified for ODOT urban roadways. A range, rather than a single target, offers flexibility for practitioners to make decisions based on roadway network characteristics (e.g., frequency and spacing of intersections), pedestrian destinations (e.g., transit stops), and a cluster of land uses.

4.1.1.1 Mid-Block Crossings

Marked midblock crosswalks may be considered in the following cases and may be provided if justified per the MUTCD:

A. On arterial or collector roadways with a posted speed of 35 mph or less where existing intersections, proposed intersections, or existing crossing opportunities are more than 330 feet apart.

B. In locations with existing or anticipated moderate-to-high pedestrian volumes.

Midblock crosswalks should be generally pursuant to the recommendations of Institute of Transportation Engineers (ITE) *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities: An ITE Proposed Recommended Practice*. They should be designed and constructed with the following features:

A. A raised concrete median when crossing three or more lanes of traffic.

B. Curb ramps meeting ADA requirements—curb ramps on both sides of the street per these *Standards* (see Appendix C).

C. Curb extensions in areas where on-street parking lanes are present to enhance pedestrian visibility.

The ODOT *Traffic Manual* provides guidance and criteria to determine the appropriate treatment at crosswalk locations based on the number of lanes, refuge island, average annual daily traffic (AADT), and posted speed.

An engineering study documenting the need, location, and proposed treatment for the crossing should be prepared for approval by the City Engineer.

4.2 BICYCLE DESIGN

Encouraging and accommodating bicycles as a transportation mode is a priority for the City. Appropriate bicycle facilities need to be evaluated and included early in project planning and development. The ODOT *Blueprint for Urban Design* (Chapter 3) provides additional information on bicycle facility selection, and the approach is based on FHWA's *Bikeway Selection Guide.*

The ODOT *Blueprint for Urban Design* provides guidance on bicycle facility selection and how it relates to the context classification identified for ODOT urban roadways. It outlines a selection process, provides a tier identification matrix based on volume and speed, and recommends preferred bicycle facility design for the respective context classifications.

Bicycle facilities are required on all City streets classified as collector streets or higher. The standard bicycle lane width is 6 feet based on the City Code. However, when possible, it is desirable on collectors and arterials to have on-street buffered bicycle lanes (6-foot bicycle lane with a 2-foot buffer). Separated bicycle facilities may be necessary in higher-speed environments to improve bicyclists' safety and comfort. The minimum bicycle facility requirement is on-street buffered bicycle lanes, but the preferred solution is to provide separated bicycle facilities. Alternative applications may include raised bicycle facilities or shared-use paths. Refer to Oregon City area-specific planning documents for guidance. For alternative bicycle facility design, refer to FHWA's *Separated Bike Lane Planning and Design Guide.* See Table 3-1 for additional information.

Refer to Std. Dwg. OC529 and OC529A for additional design details.

The Oregon City TSP provides a map for bicycle routes and connectivity planned throughout the City.

4.3 SHARED-USE PATHS

Shared-use paths may be allowed as an alternative or in addition to sidewalk and separated bicycle facilities in constrained environments that require City Engineer approval. The Oregon City Trails Master Plan outlines design guidance for regional community and local trails, including information about shared-use paths for each type of trail. The location of various trails is provided in the Trails Master Plan Map. Integrating shared-use paths can affect the overall street cross section. The Trails Master Plan identifies the path widths depending on the type of trail. The required shared-use path width varies depending on the facility's anticipated use and topography, preservation of significant trees, safety, and right-of-way. Deviation from the cross section identified in the Trails Master Plan must be processed through the modification process. Deviation from the routes identified in the Trails Master Plan must also be processed through the modification process, and the modification request shall include a shadow plat demonstrating how the path will extend through adjacent properties.

The Oregon City TSP provides a map of shared-use paths for existing and future connectivity throughout the City.

Shared-use paths are also identified as "public off-street pedestrian and bicycle accessways" in the OCMC. Pedestrian and bicycle accessways are required through private property or as right-of-way connecting development to the right-of-way at intervals not exceeding 330 feet of frontage, or where the lack of street continuity creates inconvenient or out-of-direction travel patterns for local pedestrian or bicycle trips. Such paths must meet OCMC 16.12.032 requirements.

In some cases, a single path can be implemented to meet the intents and/or requirements of The Trails Master Plan, Oregon City TSP, and OCMC 16.12.032.

4.4 ALTERNATIVE TRANSPORTATION MODES

Alternative transportation modes include micromobility technology, such as e-bicycles, e-scooters, and other modes beyond driving motor vehicles and freight, riding transit, walking, and bicycling. Alternative transportation modes should be considered when planning and designing roadways as emerging technology and new modes become more widely used on the transportation system. Project teams should collaborate and obtain approval from the City Engineer to determine the appropriate place for each user. For example, micromobility technologies, such as e-bicycles and e-scooters, should be planned and designed in coordination with current bicycle facilities.

4.5 TRANSIT

Oregon City is served by TriMet, ClackCo Connector Shuttle, Canby Area Transit (CAT), and South Clackamas Transportation District (SCTD). This section describes information on their specific routes and connections. The TriMet *Bus Stops Guidelines* provides guidance and criteria to plan and design bus stops that are easily identifiable, safe, accessible, and comfortable to wait for and access a bus. The Metro *Designing Livable Streets and Trails Guide* provides guidance for transit stop placement, transit stop and bikeway design configurations, and transit priority treatments.

Transit streets are defined in the OCMC 17.04.1310. Pedestrian/bicycle accessways must minimize the travel distance to transit streets and stops as well as neighborhood activity centers (Refer to Sections 4.1 and 4.2 for design related information for pedestrians and bicycles, respectively.) The City Engineer may require provisions, including easements, for transit facilities along transit streets where a need for bus stops, bus pullouts, or other transit facilities within or adjacent to the development have been identified. The Oregon City TSP outlines lane widths for streets on transit routes based on the optimum street design information.

4.5.1 General Requirements

A. All transit stops, shelters, and associated appurtenances must be designed and constructed per the PROWAG.

B. Placement of waste receptacles, signs, seating, or any other appurtenance must not infringe on an ADA area or the pedestrian access route, as defined by R302 of PROWAG. Placement also must not compromise direct access between the ADA waiting area and the ADA landing area or access between either ADA area and the sidewalk.

C. Any installation of transit stops, shelters, or associated appurtenances requires approval from the transit agencies prior to obtaining approval from the City Engineer. TriMet should be contacted (Development_Review@trimet.org) to confirm improvements to transit stops and shelters. The design and bus zone needs are customized at each location depending upon service levels, amenities, number of routes, ridership, and turning movements.

D. Before installation, the project must evaluate transit stops, shelters, and associated appurtenances for adequate sight distance.

4.5.2 ADA Landing Area Requirements

A. ADA landing areas shall provide a minimum clear length of 8 feet (measured perpendicular to the curb) and a minimum clear width of 5 feet (measured parallel to the roadway).

B. Where rear-door ADA landing areas are provided, they shall comply with this section.

C. Parallel to the roadway, the grade of ADA landing areas shall be the same as the roadway. Perpendicular to the roadway, the designed grade of ADA landing areas shall be 1.5% or less.

D. ADA landing areas shall connect to streets, sidewalks, or pedestrian circulation paths by ADA-accessible pedestrian access routes.

4.5.3 Transit Stop Clearances

All transit stops must meet the standard clearance requirements shown in Table 4-1.

Table 4-1: Transit Stop Clearance Requirements

Description	Requirement
Sidewalk clearance	Minimum of 5.0 ft of sidewalk clearance.
Accessible pathway	Minimum of 5.0 ft wide paths between shelter and any utility object.
Road clearance	2.5 ft minimum clearance between shelter and edge of curb, assuming pedestrian walking path is behind the shelter.
ADA landing area	See Subsection 4.5.2.

4.5.4 Transit Shelters

Transit shelter placement and orientation must provide the following:

A. 5 feet of pedestrian pass-by, including clearance between poles, hydrants, and other obstacles.

B. An ADA landing area adjacent to the bus stop sign and outside of the shelter.

C. A clear pathway from the ADA waiting area inside the shelter to the ADA landing area.

D. A clear pathway from the rear door landing area to the pedestrian access route.

E. Interior lighting at the shelter for passenger visibility and security.

Transit shelters must meet the clearance requirements shown in Table 4-2.

Table 4-2: Transit Shelter Clearance Requirements

Description	Requirement
ADA waiting areas in shelters	A minimum of 2.5 ft × 4.0 ft space must be kept clear for a mandatory waiting area to accommodate mobility devices.
Visibility	Shelter must not block motorists' or pedestrians' lines of sight.
Building clearance	Minimum 12 inches from buildings, fences, and other structures to the bus shelter in order to allow room for maintenance.
Relation to bus stop	Shelter shall be within 25 ft of the ADA landing Area.
Sight distance	The shelter shall be placed so that the passengers waiting in the shelter can see approaching vehicles.

4.5.5 Transit Stop Seating

A. Benches or seats must not be placed closer than 3.5 feet from the curb or 6 feet from the curb when a travel lane exists immediately adjacent to the curb.

B. Clearance requirements for shelters apply to seating.

C. Seating must be oriented toward the roadway or in the direction of approaching traffic.

D. Furniture must be bolted to the sidewalk using stainless steel drop-in anchors sized according to the furniture manufacturer's recommendations.

4.5.6 Pavement Requirements

A. Any damage to the sidewalk surface resulting from transit stop-related furniture is the transit authority's responsibility to repair (even in the event of an automobile crash).

B. Sidewalk repairs must be completed according to Std. Dwg. OC508.

C. In roadway areas where buses start, stop, or turn—or along roadways with high bus volumes—the following requirements must be met (refer to Chapter 6 for more details about pavement design):

1. Concrete pavement must be used on roads carrying more than 150 buses per day.
2. A reinforced concrete pad must be provided at high-volume bus stops and bus pullouts.

4.5.7 Standard Transit Stop Configurations

Standard transit stop configurations are shown in Figure 4-1 through Figure 4-3.

Figure 4-1: Curb-Tight Sidewalk with Bus Shelter

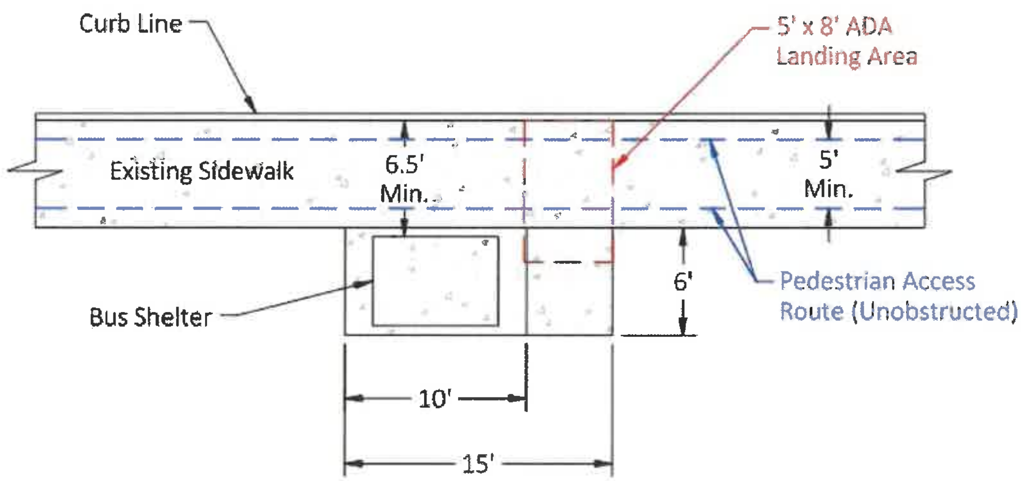


Figure 4-2: Separated Sidewalk with Rear Door Landing Area

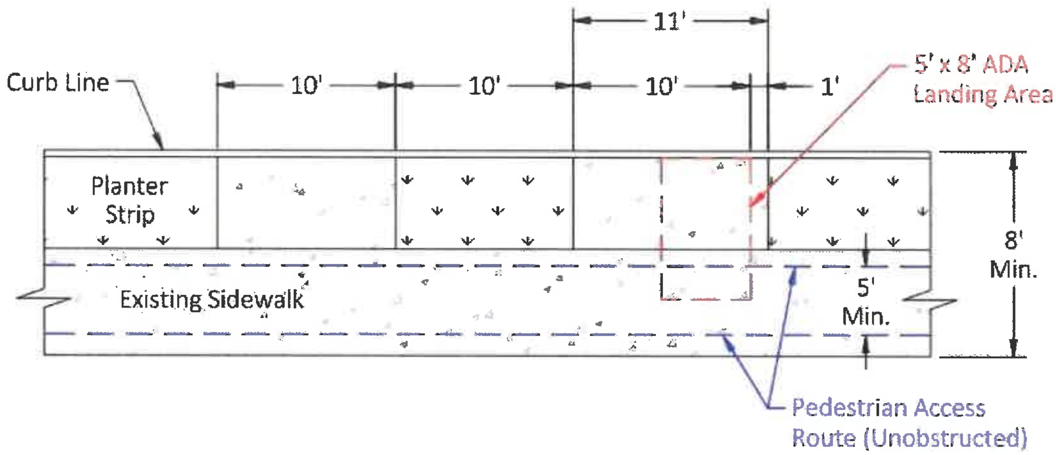
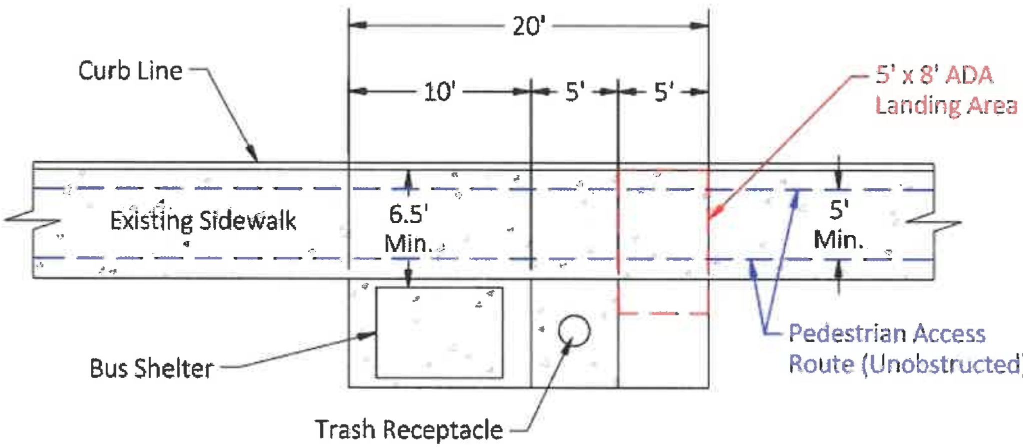


Figure 4-3: Curb-Tight Sidewalk with Shelter and Waste Receptacle



4.6 FREIGHT

Freight routes were designated in the Oregon City TSP to ensure freight trucks can efficiently travel through and access major destinations. The designation of through freight routes provides efficient movement while maintaining neighborhood livability, maintaining public safety, and minimizing roadway system maintenance costs.

The Oregon Highway Plan identifies Interstate 205 (I-205) as a freight route through Oregon City. While ODOT does not classify McLoughlin Boulevard (OR 99E) as a freight route, FHWA does designate it as a truck route.

Much of the freight activity in Oregon City is related to the employment areas located near the southeast corner of the City along Trails End Highway (OR 213), Beavercreek Road, and Molalla Avenue as well as within the Oregon City Regional Center. To allow for efficient movement between these designated areas and regional freight routes, Metro has classified several roadways in the City as freight connectors. The connector roadways link I-205 with the employment areas and include OR 213, Beavercreek Road, and OR 99E. Oregon City has designated these streets as local truck routes to ensure freight is adequately accommodated in the city.

5.0 TRAFFIC ENGINEERING

Chapter 5 provides general traffic engineering requirements and refers to other resources for the following topics:

A. Design speed

B. Operational standards

C. Traffic control

D. Stop control

E. Traffic beacons and signals

F. Signing

G. Pavement markings

H. Special street standards

I. Transportation demand management

J. Construction traffic control

5.1 DESIGN SPEED

The design speed establishes the geometric and roadside design of a road's physical features. Projects should consider street types (commercial, industrial, residential, or mixed-use) when identifying the design speed. The Engineer of Record and/or City Project Manager should coordinate with the City Engineer to confirm the selected design speed. The intent is for the posted speed to be consistent with the design speed.

Design speed is based on Oregon Revised Statutes (ORS) statutory speeds under ORS 801.100 (Definitions) and the criteria as described under ORS 811.105, ORS 811.111, and ORS 810.200. Refer to the ODOT *Speed Zone Manual* for additional information on design speeds for projects.

ORS 810.180 regulates the designation of maximum speeds when they are different from the statutory maximum speed limit of roadways.

Under subsection ORS 810.180 (5)(f), ODOT can delegate authority on low volume roadways to any city or county upon their request. This request can be made for specific roadways or for all low volume roads under the jurisdiction of the requesting agency.

Under subsection ORS 810.180 (5)(g) ODOT can delegate its authority of speed limit setting to any incorporated city.

5.1.1 Changing Speeds

In Oregon, ODOT sets speed limits on all roadways by issuing Speed Zone Orders. The ODOT Speed Zone Manual provides guidance for setting and changing a speed zone. As of January 2023, a state law went into effect that allows cities to set and change speed limits.

At the time of this writing, the City of Oregon City has not determined if it will continue to request ODOT to provide this service or if the City will be taking this service over. Either way, ORS 801.100, 811.105, and 811.111 will remain in effect.

Requests from private citizens are directed to the City Engineer, who will review and assess an applicable approach.

The City can request a speed zone review from ODOT by submitting a request to ODOT. ODOT's Traffic Engineering staff will then use nationally-accepted traffic engineering standards and procedures to review and investigate. Statutes require establishing speed zones on the basis of an engineering study. The engineering study should consider factors such as:

A. Context and functional classifications

B. Speed characteristics

C. Crash history

D. Roadside culture, including pedestrians and cyclists

E. Traffic volumes

F. Roadway alignment, width, and surface

5.2 OPERATIONAL STANDARDS

OCMC 16.12.033 provides mobility standards for City intersections on local roadways and State-owned intersections.

State-owned streets should comply with the mobility targets included in the Oregon Highway Plan. However, some roadways and intersections may be exempt from meeting the State mobility targets for proposed development that is permitted, either conditionally, outright, or through detailed development master plan approval. The Engineer of Record and/or the City Project Manager should review the 2018 Highway 213 Corridor Alternative Mobility Targets for City streets within this corridor area and verify exemptions with the City Engineer.

5.2.1 Traffic Impact Analysis Guidelines

The Oregon City *Guidelines for Traffic Impact Analyses* detail information about the City's required content for a Transportation Analysis Letter (TAL) and a Transportation Impact Study (TIS). In general, the TAL applies to smaller developments that are presumed to have a lesser transportation impact. The TIS applies to larger developments that are presumed to have a greater transportation impact.

5.3 IDENTIFYING TRAFFIC CONTROL

Traffic control at an intersection may include a yield, stop, signal, or roundabout. Section 3.4 provides geometric design guidance for the various types of intersections. Roundabouts should be considered in conjunction with the traffic operational analysis conducted for other traffic control types.

Identifying the appropriate type of traffic control at an intersection can be accomplished through an intersection control evaluation (ICE). ICE is a data-driven, performance-based framework to screen intersection alternatives and identify an optimal solution. The City does not have a specific ICE policy or associated guidance.

However, understanding the fundamental objectives and principles of conducting ICE can guide the decision-making process.

Key objectives when selecting the optimal or preferred intersection control alternative for a given project context include:

A. Understanding the intended context and how operations, safety, and geometry fit that context for each intersection or corridor, including intended users (e.g., pedestrians, bicyclists, passenger cars, transit vehicles, freight, emergency responders, oversize/overweight vehicles).

B. Identifying and documenting the overall corridor or intersection context, including the built, natural, and community environments and the intended performance outcomes of the intersection form.

C. Considering and assessing a wide range of traffic control strategies and other practical improvement concepts to identify a worthy project-level technical evaluation.

D. Comparing engineering and economic analysis results of practical alternatives that consider implementation costs, performance benefits and impacts (e.g., safety, multimodal, operations, environment), and the estimated service life of alternatives.

FHWA's *Intersection Control Evaluations* provides additional guidance to support intersection traffic control decision-making.

5.4 STOP CONTROL

Stop signs are installed where it may be unclear as to who has the right-of-way. Unnecessary stop signs can lead to drivers disobeying signs or creating cut-throughs in neighborhood streets. Before installing stop signs on City streets, the City Project Manager should consult the warrants described in the MUTCD (Section 2B.06 and 2B.07). As outlined in the MUTCD, considerations for stop sign installations include:

A. Traffic volumes

B. Sight distance

C. Crash history

5.4.1 Stop Signs by Facility Type

Requirements for stop signs by facility type include.

A. **Local to Local:** Do not place stop signs at intersections between two local streets unless engineering judgment deems it necessary for safety.

B. **Collector to Local:** Place stop signs on the local street only.

C. **Collector to Collector:** Place four-way stop signs on all approaches.

D. **Collector to Arterial:** Place stop signs on the collector street only.

E. **Arterial to Arterial:** Place four-way stop signs on all approaches, depending on the average daily traffic (ADT).

F. No "except right turn" signs are permitted within the City unless approved by the City Engineer.

G. Stop bars are only painted on collector or arterial streets.

The City Stop Sign Brochure provides general information about stop signs and criteria for two-way and all-way stop control. Criteria for two-way stop signs and four-way or all-way stop signs are provided below. Intersection sight distance requirements and additional information are provided in Section 3.5.

5.4.2 Two-Way Stop Signs

Two-way stop signs are installed at intersections where drivers cannot safely apply the right-of-way rule.

Two-way stop signs are used in the following locations:

A. Where a street enters a through street.

B. Where a safe approach speed is less than 10 mph due to permanent visibility obstructions, such as buildings, trees, or shrubs.

C. Where crash history indicates three or more reported crashes over the past three years that could have been avoided with a stop sign.

D. Where circumstances and crash history indicate that observing the right-of-way rule could still be hazardous and result in safety concerns.

E. Where a local street intersects with a collector or arterial street.

5.4.3 Four-Way or All-Way Stop Signs

A four-way or all-way stop is considered only when an intersection with a two-way stop has a history of crashes and traffic congestion problems.

Four-way stop signs are used in the following locations:

A. Where traffic signals are needed (four-way or all-way stop signs may be used as an interim measure).

B. On local streets where there have been five or more reported crashes in a two-year period that would likely have been prevented by an all-way stop.

C. On through streets where, within a two-year period, the intersection had at least 1.5 crashes per million vehicles entering the intersection that would likely have been prevented by all-way stop signs.

D. Where the number of vehicles entering an intersection averages at least 500 vehicles per hour for any 8 hours of a typical day and the combined vehicular and pedestrian volumes from the minor street average at least 200 per hour for the same 8 hours.

5.5 TRAFFIC BEACONS AND SIGNALS

Traffic beacons and signals may include the following:

A. Traffic signals

B. Pedestrian and bicycle crossing traffic control devices

    1. Midblock pedestrian signals

    2. Pedestrian hybrid beacons (PHBs)

    3. Rectangular rapid-flashing beacons (RRFBs)

5.5.1 General Requirements

Before a traffic signal can be approved, a traffic analysis must take place. Installation and justification of a traffic signal or beacon should be based on operational analysis and warrant analysis outlined in the ODOT *Traffic Signal Guidelines* and the MUTCD. *Clackamas County Roadway Standards* provide additional information on traffic signal analysis in Section 260. FHWA's Safe Transportation for Every Pedestrian (STEP) initiative also provides additional countermeasures to improve pedestrian crossing locations. General requirements are described below.

A. New traffic signals on City roadways should meet at least one of the signal warrants in the MUTCD within 3 years after construction and shall be approved for installation by the City Engineer. Peak-hour volume warrants will only be approved if the intersection serves a special generator with unique peak traffic characteristics.

B. City Project Managers should base the signal cycle length and phasing for a new or modified traffic signal during different times of day on an approved signalized intersection operations analysis. Guidelines for selecting signal phasing are included in the ODOT *Traffic Signal Guidelines*. These guidelines also include warrants for left-turn protected, protected/permissive, and permissive/protected signal phasing as well as for protected right-turn signal phasing.

C. New traffic signals should be separated from existing or planned traffic signals by a minimum of ¼ mile unless evidence supports adequate long-term operations at a lesser spacing.

D. Mixing roundabouts and signals along a corridor requires additional evaluation of the unique intersection control to verify the design, safety performance, and traffic operations of the entire corridor. Evaluations may include addressing the presence of a single adjacent signal or a broader corridor with multiple signals that could affect the roundabout. *NCHRP Report 772: Evaluating the Performance of Corridors with Roundabouts* (NCHRP Report 772) researched corridors containing signals and roundabouts and noted the need to conduct corridor-specific evaluations to determine which form of intersection control is operationally preferred on a given corridor and to understand the effects of mixing various types of intersection control. Refer to NCHRP Report 772 for additional information on performance measurement tools and techniques to assist in the evaluation of a roundabout corridor.

E. All new or modified traffic signals require installation of pan/tilt/zoom (PTZ) cameras.

F. All new or modified traffic signals should include 2-inch conduit. If possible, fiber connections should also be included.

G. Plans must incorporate emergency vehicle signal preemption into the signal operation of all approaches to the intersection. Railroad signal preemption is required when tracks are 200 feet or less from a signalized intersection. A green track clearance by vehicles and pedestrians must be incorporated into the signal preemption design.

H. Separate bicycle detectors should be placed in all striped bicycle lanes and in streets with sharrows. All approaches of a signalized intersection must have pedestrian crossings unless traffic studies show that crosswalks should not be allowed. When pedestrian signal heads are not installed, the crosswalk must be closed by the City, with posted signs indicating that the crosswalk is closed. Sidewalk ramps or pedestrian landings are required for access to pedestrian signal push buttons.

I. Audible pedestrian signals (APS) should be used at all pedestrian crossings.

J. Signalized intersections with pedestrian access routes must comply with ADA requirements as described in the most recent version of ODOT's *Traffic Signal Policy and Guidelines*. This includes accessible pedestrian signals and push buttons that comply with the MUTCD and meet the provisions of PROWAG.

K. RRFBs should be used at midblock pedestrian and bicycle crossings with traffic volumes or crash history that justify this type of device.

L. New or existing schools with an expansion of 20% floor area or greater are required to install school zone flashers on roadways that are classified as arterial or collector roadways if the proposed or existing school speed zone signing supports a school speed 20 mph zone and the City supports a school speed zone installation. In addition to school zone flashers, radar speed signs may be required along arterial roadways. The Applicant is required to provide funds equal to 20 years of the maintenance and power of the school zone flasher and/or radar speed sign.

All traffic signal designs shall be reviewed by Clackamas County, who maintains all City traffic signals on behalf of the City. Clackamas County Standards take precedence for traffic signal design if any conflicts exist.

5.5.2 Design Standards

All new or modified traffic signal and beacon installations on City roadways must be designed based on the following resources and standards:

A. Clackamas Country Roadway Standards, Section 260

B. MUTCD

C. Oregon Supplement to the MUTCD

Specific signal design features to be included in a City signal design include:

A. Signal Poles/Heads

1. Use mast arm poles where possible.
2. Use louvered traffic signal backboards.

3. Use elevated plumbizers for signals on mast arms whenever possible.
4. Use decorative bases and powder coat all signal equipment (e.g., cabinets, poles, mast arms) black.
    a. No decorative bases are used on RRFBs and pedestrian pedestals.
5. Materials used in the construction of traffic signals shall be approved by the City Engineer and comply with the Oregon Standard Specifications for Construction and the *Clackamas County Roadway Standards*.

B. Detection

1. Use radar detection per current ODOT Standard Specifications for Construction and Standard Drawings and Oregon Traffic Signal Guidelines.

C. Wiring

1. Use Clackamas County color coding for signal wires.
2. Use International Municipal Signal Association (IMSA) cable in conduit, poles, and arms.
3. Use single conductors for power service and street lighting.
4. Install electrical meter bases without the meter for power service.

D. Power Source

1. Use electric power sources (coordination with PGE required). Solar options are not allowed.

E. Intelligent Transportation System (ITS)

1. Coordinate with the City Engineering Group regarding applicable ITS applications.
2. Refer to the Clackamas County ITS Action Plan.

F. Maintenance

1. Clackamas County maintains all beacons and traffic signals on City and County facilities. ODOT maintains all beacons and traffic signals on State facilities.

5.6 SIGNING

Signing materials and layout plans should be approved by the City Engineer before installation. City Project Managers must base signing design and construction on the following:

A. *Clackamas County Roadway Standards*, Section 270

B. MUTCD

C. Std. Dwgs. OC521, OC522, OC523, and OC524

5.7 PAVEMENT MARKINGS

The City Engineer must approve all striping materials and layout plans before installation. Striping design and construction must be based on the following:

A. ODOT Standard Drawings TM500 series

B. *Clackamas County Roadway Standards*, Section 280

C. MUTCD

D. Std. Dwg. OC529 and OC529A

City-specific pavement marking design standards that may differ from the ODOT and County standards include:

A. All pavement markings must be thermoplastic, and all longitudinal markings must be Method A extruded, surface, non-profiled, thermoplastic.

B. Green thermoplastic is allowed on arterial streets.

C. Elongated arrows are required.

D. Recessed pavement markers should be used.

E. All intersections that include stop signs shall include painted stop bars.

5.8 SPECIAL STREET STANDARDS

5.8.1 Stamped Sidewalk Street Names

For all projects, stamped street names are required on sidewalk corners at intersections in the following areas:

A. McLoughlin Conservation District

B. Willamette Falls Downtown District Zone

C. Canemah Historic District

D. Downtown Parking Overlay District

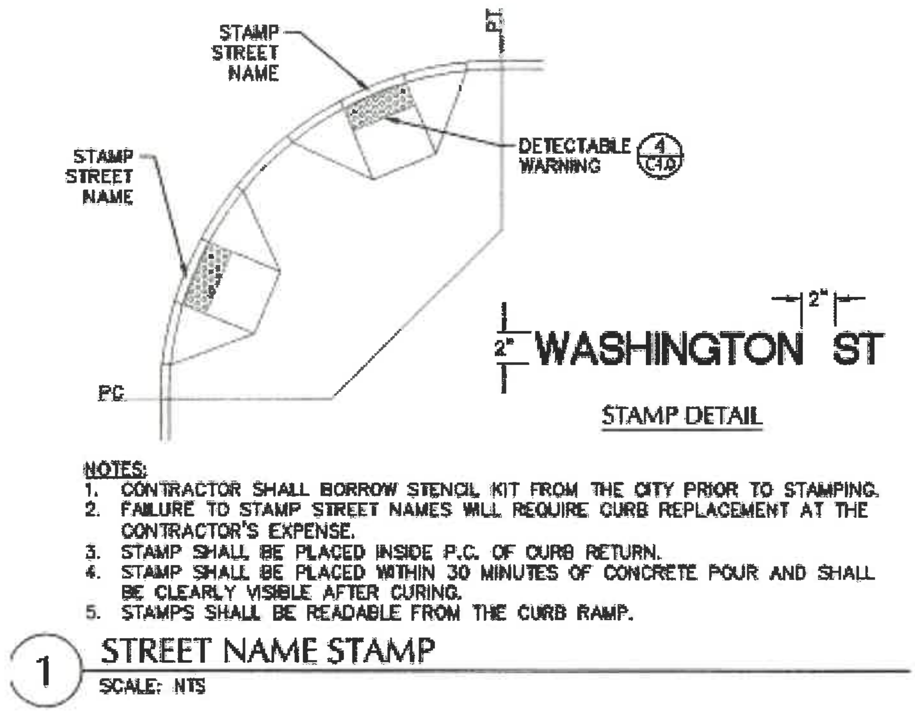
E. "Presidential" Streets not listed in other districts up to Division Street or 18th Street

For sidewalk repairs and/or reconstruction projects, street names in existing sidewalk corners must be preserved or re-stamped into the new concrete.

The Engineer of Record must coordinate with the City regarding borrowing the stencil kit from the City.

Figure 5-1 provides an example of a Street Name Stamp.

Figure 5-1: Street Name Stamp



5.8.2 Sidewalk Scoring

Requirements for sidewalk scoring include:

A. All sidewalk scoring shall follow OC508, except as noted.

B. Decorative sidewalk scoring shall occur in the Downtown District and along Washington Street, 7th Street, and Molalla Avenue.

C. Decorative Sidewalk Scoring Detail applies to all locations, except the Washington Street corridor between Abernethy Road and 7th Street.

5.8.3 Tree Grates

Special tree grates shall be used in the Downtown District and along Washington Street, 7th Street, and Molalla Avenue.

A. **Tree Grates:** Street trees shall have tree grates with frames and tree supporting systems. Tree grates and frames must meet the following requirements:

   1. Two-piece cast iron grate with a natural finish with fitted frame manufactured by FairWeather SF or approved equal. Frame shall include rebar studs on three sides for sidewalk mounting, and one side shall include steel tabs to accept expansion bolts for curb mounting.

2. Where 10-foot sidewalks are being constructed, a tree grate with frame shall be the FairWeather SF CNK 4872, size 48" × 72" (overall dimensions 4 feet × 6 feet). Where 8-foot sidewalks are being constructed, a tree grate with frame shall be the FairWeather SF style IVY 3660, size 36" × 60" (overall dimension 3 feet × 5 feet).

3. Submit to the City for approval.

5.8.4 Benches

A. Benches shall be provided in the Downtown District and along Washington Street, 7th Street, and Molalla Avenue.

B. The type of bench to be used is Model No. 2123-6 Restoration Seat, BLACK CASPAX-7 powder-coated cast iron frames, Alaska yellow cedar slats, surface mount, 6-foot length, manufactured by Outdoor Cathedral, LLC or an approved equal product.

5.8.5 Litter Receptacles

A. Litter receptacles shall be provided in the Downtown District and along Washington Street, 7th Street, and Molalla Avenue.

B. The type of litter receptacle to be used, as of this writing, is Model No. 2816-DT-P, Renaissance litter container, side empty, with dome top, BLACK CASPAX-7 powder-coated steel finish, pedestal mount, manufactured by Outdoor Cathedral, LLC. Designers shall verify the current design to be used when needing to add these to their project.

5.8.6 Decorative Street lighting

Decorative street lights shall be provided in the Downtown District and along Washington Street, 7th Street, 99E, and Molalla Avenue according to Std. Dwg. OC536. Refer to Chapter 9 for additional street light details. While some decorative lighting exists in other neighborhoods, it is the intent of this code to limit decorative street lighting to the listed areas unless a land use decision or concept plan requires something different. In those cases, the design styles shall match those within Chapter 9 unless a specific new design is designated for a new neighborhood during the land use process.

5.9 TRANSPORTATION DEMAND MANAGEMENT

As noted in the *City Transportation Demand Management Plan 2017 Final Report*, transportation demand management (TDM) increases a transportation system's efficiency by shifting trips from single-occupant vehicles (SOVs) to non-SOV modes or from peak to non-peak periods. TDM seeks to increase the universe of trips by expanding travel options, encouraging individuals to modify their travel behavior, and reducing the need for travel through efficient land uses. TDM programs often cost little but yield high impacts and are typically implemented by employers, public agencies, or public-private partnerships. The Oregon City TDM Plan provides a range of strategies to be implemented over time to improve the transportation system's overall efficiency.

5.10 CONSTRUCTION TRAFFIC CONTROL

Traffic control in the public right-of-way is subject to a permit. Preparation of traffic control plans is based on project type, duration of work, and project characteristics and context. The Engineer of Record and/or City Project Manager must coordinate with the City Engineer to determine the need for traffic control plans.

The Engineer of Record and/or City Project Manager must submit a traffic control plan to be approved by the City Engineer before construction. *Clackamas County Roadway Standards*, Section 290, provides additional information on preparing traffic control plans.

Traffic control design in work zones must conform to the MUTCD and the ODOT Supplements to the MUTCD. Additional guidelines for preparing traffic control plans and identifying traffic control plan strategies are below:

A. ODOT *Sign Policy and Guidelines*

B. FHWA *Standard Highway Signs*

C. *Oregon Standard Specifications for Construction and Oregon Standard Drawings* TM800 series

D. *Oregon Temporary Traffic Control Handbook for Operations of Three Days or Less*

E. *Oregon Traffic Control Plans Design Manual*

5.10.1 Control of the Site

Requirements for control of the site include:

A. At no time shall flagging operations delay traffic for a period greater than 20 minutes.

B. Work and activity zones (construction, restoration, and erosion control) shall extend no more than 2,500 lineal feet at any one time unless otherwise approved.

C. Open trenches shall extend no more than 250 lineal feet at any one time unless otherwise approved.

D. No trenches are to be left unprotected between dusk and dawn.

E. Trenches shall conform to the technical requirements of Section 00405 of the Oregon Standard Specifications for Construction.

F. Trench plating shall be positively secured from movement and ramped with anti-skid coated plate ramps.

G. Roadway plates are only allowed on the road for a maximum of 7 days. Pavement patches must be completed in 7 days.

5.10.2 Temporary Pedestrian Accessible Route

If existing pedestrian access will be obstructed by construction, alteration, maintenance, or other temporary conditions, a continuous temporary pedestrian accessible route (TPAR) shall be provided consistent with the requirements of this section. TPARs shall conform to the requirements of Part 6 of the MUTCD and the most recent update of the Oregon Standard Specifications for Construction, Section 00220.02(b). The TPAR plan shall be included in the traffic control plans. The City Inspector will inspect the TPAR. If deficiencies are identified, the City Inspector will stop work until such deficiencies are corrected.

TPAR requirements include:

A. In work zones, do not block pedestrian access with vehicles or equipment parking, materials storage, or for any other reason except construction.

B. Keep the TPAR parallel to the disrupted pedestrian access route and be on the same side of the street where possible.

C. Do not route bicyclists into the TPAR. If it is necessary to divert bicyclists around the work, provision should be made for a separate bicyclist route.

D. If the work impacts the accessibility of pedestrian routes through or around the work zone, limit impacts to one corner of an intersection at a time.

E. Close sidewalks at a point where there is an alternate way to proceed. Provide signing and other traffic control devices directing pedestrians to an alternate pedestrian route.

F. The Applicant must inspect the on a regular basis to ensure it is safe and does not have gaps or surface displacements that create a hazard.

G. The TPAR shall meet the standards of a pedestrian access route as defined in PROWAG:

   1. Keep the minimum width to 48 inches. Provide a 60 x 60 inch passing space every 200 feet along the route.
   2. Keep the surface smooth and nonslip.
   3. Keep vertical clearance of at least 8 feet.
   4. Keep the cross slope at be no more than 2.0% perpendicular to the direction of pedestrian travel.
   5. Keep the grade less than or equal to the grade of the adjacent road.
   6. Provide a minimum turning space of 4 feet x 4 feet shall wherever it is necessary for pedestrians to turn.
   7. If it is necessary to cross a curb, the TPAR shall include a temporary ramp meeting standards for a curb ramp.
   8. If it is necessary for the TPAR to cross a driveway or construction access, provide truncated dome warning. If it is not possible to provide truncated dome warning, provide construction staff whenever construction vehicles are crossing the pedestrian access route.
   9. Provide nighttime lighting.

H. Provide and maintain pedestrian channelizing devices (PCD) through the period in which the permanent pedestrian access route is disrupted. Pedestrian channelizing devices intend to prevent people with disabilities from straying into the vehicular way or into an active construction area. Caution tape is not sufficient to guide people who are blind or have low vision. Use only PCDs that are on the approved ODOT Qualified Products List and are designed to be ADA compliant.

Provide pedestrian channelizing devices:

1. Between the TPAR and any adjacent construction site.
2. Between the TPAR and the vehicular way if the TPAR is diverted into the street.
3. Between the TPAR and any protruding objects, drop-offs, or other hazards to pedestrians.
4. At a curb ramp if the opposite curb ramp is temporarily and completely blocked and no adjacent alternate circulation path is provided.

I. When work briefly or intermittently blocks or restricts the use of a pedestrian route, and a temporary detour route is not practicable due to the short duration of the restriction, provide a temporary means of allowing pedestrian access through or around the work area. Means of providing temporary pedestrian accessibility may include but is not limited to temporarily suspending the work and making the pathway passable or using construction staff to guide pedestrians through or around the area. When a TPAR is created in the public right-of-way, both visual and audible warning shall be provided at both ends of the temporary pedestrian access.

J. When direction signing or warnings are provided, they should be located to minimize backtracking. Provide audible warnings for people who are blind or have low vision and include specific directions allowing them to find the desired path.

5.10.3 Temporary Road Closures

Temporary road closures are not for an Applicant's convenience or cost reduction. Proposed closures shall establish that a clear public safety and convenience benefit would result from a closure.

A. Road closures for construction require the approval of the City Engineer.

B. Projects should be evaluated for one-way flagging or other traffic control options prior to requesting a road closure. All other options must be exhausted before a road closure is reviewed for approval.

C. Temporary road closures on collectors and arterials are only allowed when there are other comparable streets (high-traffic streets) available for a detour.

D. The detour route shall be capable of safely and legally accommodating the detoured traffic.

E. With increasing Average Daily Traffic (ADT), functional classification, and closure duration, an Applicant's burden becomes greater in establishing the benefit of a proposed closure.

F. If a road closure is proposed, the following may be required:

1. Evidence that other methods of traffic control and/or temporary improvements are not feasible to keep the road open.
2. Time-of-day restrictions or extension of normal working hours and days.
3. Contract requirements of incentives/disincentives for completing/not completing a closure on time.

4. A public engagement plan.
5. Off-site improvements to meet the minimum safety of the detour route and/or to return the detour route to its original condition prior to the detour.

5.10.4 Impacts to Traffic Signals

A. In no case may flagging operations take place in conflict with the indications of an operating traffic signal.

B. No flagging operations may take place within 200 feet of an operating traffic signal without a custom traffic control plan subject to a permit.

C. Should traffic control requirements dictate the "turn-off" and/or "turn-on" of a traffic signal, the Applicant shall coordinate with the City Engineer at least two business days prior to turn-off and/or turn-on date.

5.10.5 Temporary Speed Reduction Process

For some projects, it may be necessary or advantageous to implement a temporary speed reduction through a work zone. The duration of the temporary speed zone reduction will vary based on the type and complexity of the work being done and how quickly the constraint or hazardous condition can be relieved or eliminated.

To obtain a temporary speed reduction in a work zone on a City street, the Engineer of Record and/or City Project Manager should complete the Work Zone Speed Reduction Request Form (Appendix B) and submit it to the City Engineer for review and approval.

A variety of circumstances can warrant a speed zone reduction, including:

A. Reducing the number of lanes for traffic.

B. Complex construction staging.

C. Temporary alignments, crossovers, or on-site diversions.

D. Nighttime paving operations on a high-speed, multilane facility.

E. Workers present for extended periods within 2 feet of travel lanes and not behind a barrier.

F. Lane widths (existing or due to construction) of less than 12 feet.

G. Horizontal curves with a safe speed of 10 mph or more lower than the posted speed.

H. Pavement edge drop-offs within 2 feet of the traveled way for more than ¼ mile.

5.10.6 Detour Routes

A traffic detour can be an effective traffic control measure within a traffic control plan. Detours for temporary road closures should follow the requirements outlined in the *Clackamas County Roadway Standards*, Section 290.5. When detours are considered, emergency services, solid waste disposal companies, and mail delivery must be notified.

The ODOT *Traffic Control Plan Design Manual* provides conditions for when a detour may be considered, including when:

A. The physical work area cannot support live traffic and construction activities concurrently.

B. The accelerated completion of a project is desired, and having uninterrupted use of the entire work site can facilitate a time-critical schedule.

C. Construction constraints (e.g., vehicle weight/size restrictions) require specific vehicle classes to be precluded from the work zone.

Routes designated as detours must be able to reasonably accommodate the detoured traffic. An overview of design considerations is below.

A. For signalized intersections along the detour route, consider adjusting signal timing while the detour is operating.

B. Detours that significantly impact unsignalized intersections may require temporary signals.

C. If a single roadway cannot manage the capacity of the detoured traffic, undesignated alternate routes can be offered to disperse traffic.

D. Extended distance detours may inadvertently divert traffic and impact travel time and facility wear and tear on alternate routes.

E. Detours must be designated using appropriate traffic control devices per MUTCD requirements and guidance.

F. Changeable message signs may help supplement fixed signs.

6.0 PAVEMENT DESIGN

Chapter 6 provides detailed City standards for pavement design.

6.1 GENERAL REQUIREMENTS

Pavement materials and construction work must comply with the current *Oregon Standard Specifications for Construction* unless stated herein. Abbreviations and terms used within this section are as defined or used in the *ODOT Standard Specifications for Construction* unless otherwise noted. Additional general requirements are described below.

A. Pavement designs must be developed and documented by an engineering report prepared and stamped by an engineer experienced in pavement design (Refer to Section 1.1.1). The report must include specific pavement design recommendations for materials and construction. Additionally, the report must include sufficient design documentation regarding site conditions, design assumptions, and design parameters to allow for independent peer review of the design recommendations. The engineering report must address considerations for year-round construction, including recommendations for both summer and winter construction.

B. If a pavement design is not provided, default pavement sections identified in Section 6.8 must be used.

C. Pavement materials for roadway construction must be recommended by the Engineer of Record and/or the City Project Manager. The report must describe the pavement type and reasoning behind the selected materials.

D. Street functional classifications specific to Oregon City pavements include arterials (major and minor), collectors, local commercial and industrial, and residential. Additional paved surfaces include alleyways, shared-use paths, and private streets.

E. The City Engineer must approve the use of pervious pavements, and the Engineer of Record and/or City Project Manager must include a stormwater analysis report. Specific pervious pavement design considerations are not included these *Standards.* If approved, the pavement report must include construction considerations, material properties and pavement thickness design calculations.

F. The City Engineer must approve all proposed alternative materials. Benefit analysis and reasoning (e.g., noise) is to be included in the pavement design report.

G. All asphalt pavement should be placed during temperatures that are 40 degrees Fahrenheit and rising.

6.2 DESIGN REQUIREMENTS

Design standards for the following categories can be found in the publications below.

A. **Asphalt concrete pavement (ACP)**: AASHTO *Guide for Design of Pavement Structures* (AASHTO Pavement Guide) and the design guidelines of the latest ODOT *Pavement Design Guide* (ODOT Pavement Guide).

B. **Portland cement concrete (PCC)**: 1998 *Supplement for Rigid Pavement Design* (AASHTO Pavement Supplement) or the StreetPave™ design software by the American Concrete Pavement Association (ACPA).

C. **Overall:** Latest ODOT *Pavement Guide* for general guidelines and inputs, unless specifically described herein.

6.2.1 Pavement Design Period

The pavement design period is for major widening (e.g., adding travel lanes), adding new pavement, or rehabilitating pavement. For minor widening (e.g., bicycle lanes), pavement thickness should match adjacent pavement. Table 6-1 provides a summary of pavement design periods.

Table 6-1: Pavement Design Period

Project Type	Design Period
Newly-constructed streets (including ½ streets and reconstructed streets)	30 years for flexible pavement 40 years for rigid pavement
Roundabouts	40 years for rigid pavement
Rehabilitation	Based on location and available funding
Major widening	20 years

6.2.2 Site Investigation

A. **Explorations:** Conduct sufficient soil and/or existing pavement explorations (at least 1 per 500 feet of roadway and at least 2 total) to visually classify the soils within a minimum of 3 feet below the planned subgrade surface. Conduct laboratory testing on samples of the subgrade soils, including determination of moisture content and soil classification tests (Atterberg Limits, gradation, etc.).

B. The Engineer of Record and/or City Project Manager must evaluate the subsurface exploration logs and the laboratory soils test data to determine if subgrade compaction is feasible, including a consideration of moisture conditions during construction and whether the compacted subgrade will support construction activities and traffic. If subgrade compaction is deemed feasible, the pavement section must be designed based on the subgrade support values determined from the laboratory tests of compacted subgrade. Compaction of the subgrade must be accomplished following the procedures and compaction criteria given in Oregon Standard Specifications for Construction 00330.43, including deflection testing according to ODOT Standard Drawing TM158.

1. If subgrade compaction is not deemed feasible, the subgrade must be designed based on the in-situ subgrade capacity as defined by falling weight deflectometer (FWD), resilient modulus testing of in situ samples, or dynamic cone penetrometer (DCP) testing.

2. The engineering report must include recommendations regarding the need for subgrade separation geotextile.

3. The engineering report must include recommendations for increased subgrade stabilization and/or an additional aggregate base for winter construction. Options for the protection of native subgrade should include haul roads and/or staging plans to reduce vehicle-induced subgrade loads.

4. The Engineer of Record and/or City Project Manager should consult with the City Engineering Group regarding the potential for old market roads, underlying PCC, or historical data that may affect pavement rehabilitation performance.

C. **Subgrade support inputs:** Subgrade support values for the design of flexible pavement (resilient modulus) and rigid pavement (modulus of subgrade reaction or k-value) must be estimated by one or more of the following methods:

1. Estimate in situ subgrade support values by back calculation of FWD deflections measured on paved or aggregate surfaced areas within the project limits. FWD testing must be conducted following the American Society for Testing and Materials (ASTM) D 4694 and D 4695 with a deflectometer that has been calibrated within 12 months preceding the testing. Back calculate the elastic modulus of the subgrade soil for flexible pavement design per the back-calculation procedures described in the AASHTO *Pavement Guide* or other procedures meeting the guidelines of ASTM D 5858. Use the modulus correction factors given in the ODOT *Pavement Guide* to convert back-calculated elastic moduli into equivalent saturated laboratory resilient moduli. Back calculate the dynamic k-value of the subgrade for rigid pavement design per the back-calculation procedures described in the AASHTO Pavement Supplement and correct the dynamic k-value to static k-value using a factor of 0.5.

2. Estimate in situ subgrade support values by measuring subgrade soil penetration resistance using the DCP per ASTM D 6951. Estimate the subgrade resilient modulus for flexible pavement design from DCP Index (mm/blow) using the correlation given in the ODOT *Pavement Guide*. Use the modulus correction factors given in the ODOT *Pavement Guide* to convert DCP-determined resilient moduli into equivalent saturated laboratory-resilient moduli. Estimate the subgrade static k-value for rigid pavement design from DCP Penetration Rate (inches/blow) using the correlation given in the AASHTO Pavement Supplement.

3. Determine in situ resilient modulus by laboratory testing of push tube samples of subgrade soil. Conduct the resilient modulus testing in general accordance with AASHTO Pavement Supplement T-307. Evaluate resilient modulus at a deviator stress of 6 pounds per square inch (psi) at a confining pressure of 2 psi.

4. Determine the resilient modulus of compacted subgrade by testing laboratory compacted subgrade soil. Compact the subgrade sample to 95% of standard Proctor maximum dry density at a moisture content of 1-2 percentage points above standard Proctor optimum moisture content. Conduct the resilient modulus testing using the ODOT testing protocol. Evaluate resilient modulus at a deviator stress of 6 psi at a confining pressure of 2 psi.

5. For rigid pavements, estimate the k-value of compacted subgrade by California Bearing Ratio (CBR) testing of a laboratory compacted subgrade soil. Compact the subgrade sample to 95% of standard Proctor maximum dry density at a moisture content of 1-2 percentage points above standard Proctor optimum moisture content. Conduct the CBR testing per ASTM D 1883 using surcharge weight equivalent to the proposed pavement section. Estimate the static k-value from the CBR value using the correlation given in the AASHTO Pavement Supplement.

6. In place of testing to establish subgrade support values, presumptive design values of 3,500 psi for resilient modulus and 50 pci for k-value may be used.

6.3 TRAFFIC LOADING ANALYSIS

A. The pavement design traffic loading is the total number of 18-kip equivalent single axle load (ESAL) repetitions that the pavement is expected to experience during the design period. The pavement design report must include a detailed description of design traffic loading and calculation steps used to generate the design ESAL. Traffic data or traffic studies used for generating pavement design ESAL must be no more than 4 years old.

B. For rehabilitation and widening, ESAL is to be determined by daily traffic volumes, heavy vehicle percentage, traffic growth, and traffic classification counts with the distribution of heavy vehicle volumes according to the FHWA axle classifications and projected growth rate in heavy vehicle volumes during the design period. For local residential, the classification counts can be assumed if a valid basis for assumptions is presented in the pavement report. Widening design must consider the potential for new traffic volumes and additional lanes.

C. For new roads, the Engineer of Record and/or City Project Manager must complete a traffic study that identifies the distribution of heavy vehicle volumes, traffic growth, and the expected types of trucks and truck frequencies. For specific heavy truck generation sites, a detailed account of trucks, truck types, and per-truck ESAL calculations are to be provided in the pavement design report.

D. Daily heavy vehicle volumes must be multiplied by the conversion factors for FHWA heavy vehicle classes shown in the ODOT *Pavement Guide*, with the exception that buses should be broken down into school buses, two-axle transit buses, and articulated buses. Specific site traffic should have a site-specific per-truck ESAL if appropriate. (See Table 6-2).

E. The presumptive traffic loadings shown in Table 6-3 may be used as design values instead of a detailed traffic analysis. Lower assumed values than those shown in Table 6-3 may be used for rehabilitation if the reasoning is provided in the pavement design report and the values are accepted by the City Engineer.

F. The traffic loading for circulatory lanes within roundabouts must be calculated as two times the highest traffic loading on the approach lanes to account for the combined loading from the approaches. An alternative turning movement analysis can be conducted to calculate the roundabout quadrant with the highest traffic.

G. If using StreetPave™-based rigid design, load spectrum traffic analysis is required. The Engineer of Record and/or City Project Manager should use site-specific total truck traffic, with the default typical traffic category corresponding to the road type. For transit bus routes, default to the major arterial traffic category.

H. In no case shall the design ESAL be less than 40,000 for new or reconstructed pavement.

Table 6-2: Bus ESAL Conversion Factors

Bus Type	Daily Bus Volume to Annual ESAL Repetitions Conversion Factors	
	Flexible Pavement	Rigid Pavement
Weight-restricted buses, school buses	246	269
2-axle transit buses	780	1170
Articulated transit buses	1550	2320

Table 6-3: Presumptive Traffic Loadings

Road Type	Flexible Pavement 30-Year ESAL Repetitions	Rigid Pavement 40-Year ESAL Repetitions
Local Residential[1]	40,000	70,000
Local Commercial/Industrial	1,200,000	2,100,000
Collector	1,000,000	1,800,000
Arterial	2,000,000	3,500,000

[1] Use Commercial/Industrial Functional Classification traffic loadings if street will be used by a TriMet bus line or similar shuttle buses.

6.4 FLEXIBLE PAVEMENT THICKNESS DESIGN CRITERIA

Use the design parameter values in Table 6-4 for flexible pavement design.

Table 6-4: Flexible Pavement Design Parameter Values

Parameter	Design Value
Design Reliability Level	90% Arterial, Collector, Local Commercial/Industrial & Bus Routes; 80% Local Residential & Neighborhood Routes
Initial Serviceability, Po	4.2
Terminal Serviceability, Pt	2.5
Standard Deviation	0.49
New Asphalt Concrete Layer Coefficient	0.42
New Aggregate Base Layer Coefficient	0.10
New Aggregate Base Resilient Modulus, psi	20,000
New Aggregate Base Drainage Coefficient	1.0
New Aggregate Subbase Layer Coefficient	0.08
New Aggregate Subbase Resilient Modulus, psi	11,200
New Aggregate Subbase Drainage Coefficient	1.0

A. The pavement section must be designed using the Layered Design Analysis method described in Part II of the AASHTO *Pavement Guide*. The calculated pavement thickness should be rounded up to the nearest 0.5 inch.

B. The minimum roadway asphalt concrete (AC) section thickness is 4 inches, consisting of a 2-inch-thick base lift and 2-inch-thick wearing course. The minimum AC section for shared-use paths and alleys is 3 inches placed in a single lift.

C. The minimum thickness of the aggregate base is 6 inches. A geotechnical engineer should provide analysis of rock sections' suitability to support construction traffic. Analysis should consider the construction time of year. A design acceptance may be provided for pavement in areas with shallow basalt.

D. Full-depth reclamation or amended subbase with cement can be included if laboratory testing and design are provided in the engineering report. The layer coefficient must be 0.16, where at least 50% (by weight) of the existing material to be treated is granular. Otherwise, the layer coefficient must be considered equal to the aggregate subbase (0.08).

E. The asphalt concrete pavement (ACP) should be ½- or ¾-inch dense, according to City modifications to Oregon Standard Specifications for Construction 00744. A request can be made for a lower nominal maximum aggregate size for thin lift paving if accepted by the City Engineer.

F. Minimum and maximum lift thicknesses are 2 and 3 inches, respectively, for ½- or ¾-inch-dense ACP.

G. Compact asphalt concrete to a minimum of 92% of moving average maximum density (MAMD) all lifts.

H. Default binder for ACP is PG 64-22 for local, commercial, and collectors and PG 70-22 for arterials; however, the binder grade should be adjusted depending on aggregate gradation, traffic levels, and the amount of recycled asphalt material. The use of PG 64-22 binder for base paving lifts below the top 4 inches on arterials should be considered. Binder grade discussion and reasoning must be submitted in the engineering report.

I. Rigid pavement with impact slabs is required for public transit bus stops. Flexible pavement at bus stops will only be considered with prior City Engineer approval and will require a separate pavement design to address bus loading.

J. Impact slabs are required for all transitions from flexible pavement to rigid pavement, including rail crossings.

K. For newly-constructed residential streets, pavement design and construction should include all asphalt layers placed before building construction. If staged flexible pavement (first lift placed, then building construction, then final lift) is preferred, the pavement design must take construction vehicles, time of year, and drainage into account. The staging of street construction in this manner must be approved by the City Engineer.

L. Tack coat must be used for all paving lifts unless paving occurs on same day.

6.5 RIGID PAVEMENT THICKNESS DESIGN CRITERIA

Refer to Table 6-5, Table 6-6, and the following criteria for rigid pavement thickness design.

A. Rigid pavement cannot be used for half-street or widening design when adjacent to flexible pavement.

B. Rigid pavement must be used for widening design when adjacent to rigid pavement. Joints must either line up, or isolation joints must be used. No-load transfer should be used for widening.

C. Rigid design is to be completed according to the AASHTO Pavement Supplement or StreetPave™ system. Other design methodology can be used only if accepted by the City Engineer.

D. The minimum portland cement concrete slab thickness is 6 inches—except for streets with transit or shuttle bus traffic, for which the minimum slab thickness is 8 inches.

E. The minimum thickness of the aggregate base is 4 inches. A geotechnical engineer analyze the aggregate base suitability to support construction traffic and should consider the construction time of year.

F. The slab thickness design must consider the slab edge support condition as defined within the AASHTO Pavement Supplement and/or StreetPave™.

G. Requirements under Oregon Standard Specifications for Construction 00756.60 must be met before opening to traffic.

Table 6-5: Rigid Pavement Design Parameter Values (AASHTO Pavement Supplement)

Parameter	Design Value
Design Reliability Level	90% arterial, collector, commercial, and bus routes. 80% local residential and neighborhood routes.
Initial Serviceability, Po	4.5
Terminal Serviceability, Pt	2.5
Standard Deviation	0.40
28-day Flexural Strength, psi	600
Modulus of Elasticity of Concrete, psi	3,600,000
Modulus of Elasticity of Base Material, psi	Median value from Table 14 of AASHTO Supplement for the base type.
Drainage Coefficient for Faulting Analysis	0.80
Poisson's Ratio of PCC	0.15
Edge Support Adjustment Factor	As recommended in AASHTO Supplement for the type of edge support.
Friction Coefficient between Slab and Base	Median value from Table 14 of AASHTO Supplement for the base type.
Mean Annual Wind Speed, mph	7.9
Mean Annual Temperature, °F	53.6
Mean Annual Precipitation, inches	36.3
Moisture Gradient a Construction Temperature Differential in Slab	1 °F per inch of slab thickness.
Mean Annual Freezing Index	33-degree (F) days
Annual Temperature Range, °F	46.6
Number of Days with Maximum Temperature above 90 °F	10.8

Table 6-6: Rigid Pavement Design Parameter Values (StreetPave™)

Parameter	Design Value
Design Reliability Level	90% arterial, collector, commercial, and bus routes 80% local residential and neighborhood routes
Terminal Serviceability	2.5
28-day Flexural Strength, psi	600
Modulus of Elasticity of Concrete, psi	3,600,000
Slabs Cracked	5%
Drainage Coefficient for Faulting Analysis	0.80
Poisson's Ratio of PCC	0.15
Edge Support	Default no edge support.
Macro Fibers in Concrete	Default to no. maximum of 15% residual if approved by City.

6.6 RIGID PAVEMENT JOINTING DESIGN CRITERIA

A. For rigid pavements, the pavement design report must provide maximum joint spacing. A jointing plan must be included in the project plans and must show the construction joints and transverse/longitudinal joints in the concrete pavement to control cracking. The jointing plan must show, at a minimum, the following: manholes, valve boxes, inlets, joint layouts, dowels, tie bars, and other required reinforcement and joint details (including sawing depths).

B. The joint layout must be designed per American Concrete Pavement Association (ACPA) recommendations and the criteria described herein. Projects must avoid or minimize joints that intersect another joint or the pavement edge at an angle of fewer than 60 degrees, interior corners (L-shaped slabs), slabs less than 1 foot wide, and odd shapes (keep slabs rectangular, trapezoidal, or triangular). Isolation joints shall box out utility fixtures and isolate them from the main slab. Fixtures must be located so the joints are centered on the box-outs or coincide with the isolation joints around the box-outs.

C. Gutter joints must align with the transverse joints on the adjoining slab unless an isolation joint is placed between the gutter and the slab. Design with isolation joints can allow offset of transverse to gutter joints; however, the pavement design must take edge conditions into account.

D. Longitudinal joints must coincide with lane lines. Note that on streets with an odd number of lanes, this will require an offset crown. Spacing between longitudinal joints cannot exceed 15 feet or 24 × slab thickness on unbound base or 21 × slab thickness on stabilized base—whichever is less.

E. Transverse contraction joints must be spaced at relatively equal intervals and be close to the same spacing as the longitudinal joints so that the panels are relatively square. The ratio of the maximum to minimum slab dimensions (aspect ratio) formed by joints must not exceed 1.25.

   Spacing between transverse joints must not exceed 15 feet or 24 × slab thickness on unbound base or 21 × slab thickness on stabilized base—whichever is less. If the aspect ratio cannot be met, the slabs must be reinforced with the #5 bar at 12 inches on centers.

F. Transverse joints (sawed or construction) in plain concrete pavement slabs 7 inches thick or greater must be dowelled. All joints within intersections must be dowelled when dowels are needed on the transverse joints in one of the approach lanes. Plate dowels are allowed. Dowel installation must be per Oregon Standard Specifications for Construction 00756.43(a).

G. All joints must be sealed with joint sealant listed on the ODOT Qualified Products List (QPL) and placed in a joint reservoir sized in accordance with the recommendations of the joint sealant manufacturer. (Typically, the reservoir width should be twice the sealant depth for silicone sealant). The sealant must be supported by a backer rod of the size and material recommended by the joint sealant manufacturer. The top of the sealant must be recessed below the slab surface by 0.125–0.375 inch.

6.7 STRUCTURAL REHABILITATION DESIGN

A. Pavement coring performed at representative locations shall be used to determine the thickness and composition of the pavement materials and evaluate the cracking depth, investigate the cracking mode (top-down or bottom-up), investigate for moisture-induced damage (asphalt stripping damage), determine delamination within the pavement. Areas of moderate-to-severe distress that are structural must be identified. Additional cores should be obtained if there are multiple travel lanes in one direction.

B. Field investigation with falling weight deflectometer (FWD) testing of existing industrial, collector, and arterial pavement is recommended to determine the structural condition and remaining structural life.

   1. FWD testing will be conducted following ASTM D 4694 and D 4695.

   2. The FWD test data must be analyzed to delineate analysis units representing segments having distinctly different structural characteristics.

   3. The in situ resilient modulus of the subgrade and the effective structural number of the existing pavement structure must be estimated from back-calculation analysis of the FWD test data using the back-calculation analysis procedure described in the AASHTO *Pavement Guide* or other procedures meeting the guidelines of ASTM D 5858.

C. The investigation must also include a visual survey of pavement distress. A distress survey must identify the pavement condition concerning rehabilitation needs. Areas of moderate-to-severe distress that are structural must be identified.

D. If the FWD test is not used, resilient modulus should be determined by one of the options listed under the "Subgrade Supports Inputs" section of these *Standards*. Layer coefficients for surfacing should be based on a visual condition assessment and the values listed in Table 5.2 of the AASHTO *Pavement Guide*. Layer coefficients for the base should be based on dynamic cone penetrometer (DCP) testing in conjunction with Figure 2.7 in the AASHTO Pavement Guide.

E. Design for structural rehabilitation of existing pavement must be accomplished using the procedures described in Part III of the AASHTO *Pavement Guide* and the rehabilitation design guidelines in the ODOT *Pavement Guide*. Rehabilitation recommendations must consider measures for mitigation of reflective cracking, layer delamination, and stripping.

F. Rehabilitation design must include detailed information regarding pavement repair through dig-out and variable grind depths. Design must also include design section as well as location and approximate quantities.

6.8 DEFAULT PAVEMENT SECTIONS

The default pavement sections are based on conservative design criteria, including anticipated traffic and construction vehicle loading under poor soil conditions. These assumptions may not be representative of typical conditions for many locations. For local roads, use the commercial/industrial pavement section if a transit bus line or similar shuttle buses will use the street. Roundabout design must be site specific and cannot use the below default values.

Materials, construction practices, and general information from Sections 6.4 (Flexible Pavement) and 6.5 (Rigid Pavement) should be followed.

Table 6-7 provides default asphalt concrete pavement section information. Table 6-8 provides information for standard rigid pavement section.

Table 6-7: Default Asphalt Concrete (AC) Pavement Section

Functional Classification	Thickness				AC Mix Design Level[6]
	AC Wearing Course[1]	AC Base Course[2]	¾-inch – 0 Leveling Aggregate	Aggregate Base Course[3,4,5]	
Arterial	2”	7”	2”	14”	3
Collector	2”	6”	2”	14”	2
Local Commercial/Industrial	2”	6”	2”	12”	3
Local Residential	2”	2”	2”	10”	2
Alley	3”	N/A	2”	8”	2
Shared-Use Path[9]	3”	N/A	6” of ¾-inch – 0 Aggregate		2

[1]Use ½-inch-dense ACP. Place in one lift. Conform to mix design levels as shown in the table. Use PG 70-22 binder for arterial and PG 64-22 binder otherwise.

[2] Use ½-inch-dense ACP. Place in lift thicknesses from 2 to 3 inches. Conform to mix design levels as shown in the table. Use PG 70-22 binder for asphalt concrete surfaced pavement for top 4 inches on arterials and PG 64-22 binder elsewise.

[3] Use ¾-inch-0 or 1 1/2-inch-0 dense graded base aggregate meeting the requirements of Oregon Standard Specifications for Construction 00641.

[4] Aggregate base thickness may need to be increased for constructability in areas of soft or wet subgrade.

[5] Subgrade geotextile is required below the aggregate base for silt and clay subgrade types.

[6] Collector may require Level 3 for roads identified as transit or trucking routes and with ESAL 1,000,000 or greater. Arterial may require mix design level 4 for ESAL in excess of 10,000,000.

[7] A pavement design to accommodate anticipated traffic loadings and existing soil conditions shall be submitted to the city engineer for approval. ACP shall be compacted to 92% max density (rice density) per AASHTO T-209.

[8] Subgrade and base rock shall be compacted to 95% relative density per AASHTO T— 180.

[9] See Trails Master Plan for additional information.

Table 6-8: Standard Rigid Pavement Section

Functional Classification	Thickness		
	PCC [1, 2]	AC Base Course[3]	Aggregate Base Course[4,5,6]
Arterial	9"	4"	8"
Collector	8"	4"	8"
Local Industrial/Commercial	8"	4"	8"
Local Residential	8"	N/A	6"

[1] Use Class 4000, 1.5-inch paving concrete.

[2] Use epoxy-coated 18-inch-long smooth circular stainless steel dowel bars at 12-inch spacing along all transverse joints. Bars should be coated with a bond breaker to be approved by the City Engineer. For 7- to 8-inch-thick PCC slab, use 1-inch diameter bars, for 9- and 10-inch-thick PCC slab, use 1.25-inch diameter bars. For slabs less than 7 inches thick, joints should be un-doweled.

[3] Refer to Section 6.6 for further jointing criteria.

[4] Use ½-inch-dense ACP. Place in lift thicknesses from 2 to 3 inches. Conform to mix design levels as shown in the table. Use PG 64-22 binder for asphalt concrete.

[5] Use ¾-inch-0 or 1 1/2-inch-0-dense graded base aggregate meeting the requirements of Oregon Standard Specifications for Construction 00641.

[6] Aggregate base thickness may need to be increased to 12 inches or more for constructability in areas of soft or wet subgrade.

[7] Subgrade geotextile is required below the aggregate base for silt and clay subgrade types.

7.0 STORMWATER

Chapter 7 provides an overview of City stormwater standards and primarily refers to the City *Stormwater and Grading Design Standards* for detailed requirements.

7.1 GENERAL DESIGN REQUIREMENTS

Stormwater design must include provisions to adequately control runoff development as defined by the City. The design must ensure the future extension of the stormwater drainage system to the entire drainage basin in conformance with the adopted City Stormwater Master Plans as well as the *Stormwater and Grading Design Standards*.

Design requirements include the following:

A. The approved point of disposal for all stormwater must be discharged at the existing natural drainage outlet or outlets. Runoff is not allowed to flow over adjacent public or private property at a rate, volume, or location materially different from that which existed before development occurred.

B. The peak runoff from all applicable designs must not be more than what existed before development. Retention and/or detention facilities are required where necessary to meet this requirement. Additional flow control requirements, as stated in the *Stormwater and Grading Design Standards* and adopted Stormwater Master Plan, must also be met as applicable.

C. Vegetation must be established on areas disturbed or on areas of construction, as necessary, to minimize erosion per the City's *Stormwater and Grading Design Standards*.

D. Stormwater facilities must control the discharge of pollutants according to the City's *Stormwater and Grading Design Standards*.

E. All stormwater drainage system designs must make adequate provisions for collecting all stormwater runoff. The system must be able to accommodate all runoff from upstream tributary areas, and the amount of runoff to be accommodated will be based on the ultimate development of all upstream tributary areas.

F. Swale breaks must be provided in stormwater planters around light poles.

G. For information on drainage curbs, refer to ODOT Specifications and ODOT Standard Drawings.

H. Green street infrastructure is encouraged when applicable to manage stormwater, treat runoff to reduce pollution and infiltrate water into the ground, and limit how much stormwater and pollutants eventually make their way into vulnerable natural waterways.

7.2 MINIMUM DESIGN CRITERIA

Refer to the *Stormwater and Grading Design Standards* for the minimum stormwater design criteria.

7.3 ALIGNMENT AND COVER

Refer to the *Stormwater and Grading Design Standards* for standards on alignment and cover.

7.4 PIPE MATERIAL AND SIZE

Pipe material and size must meet the requirements in the *Stormwater and Grading Design Standards.*

7.5 STRUCTURES

Refer to the *Stormwater and Grading Design Standards* for requirements for stormwater structures.

7.6 CULVERTS

Water crossing structures on all creeks and tributaries must not impede or eliminate a native fish species' access to habitat or ability to migrate. In general, projects should use bridge crossings rather than culverts wherever possible. If culverts are used, install slab, arch, or box type culverts, preferably using bottomless designs that more closely mimic stream bottom habitat. Proposed culvert crossings, regardless of tributary size or whether they are intermittent or perennial, must conform to Oregon Department of Fish & Wildlife and National Marine Fisheries Service's regulations and stream crossing guidelines. In addition to designing stream crossings for fish passage, culverts should include shelves and other design features to facilitate terrestrial wildlife passage.

Culverts within roadside ditches not deemed jurisdictional waterways and 18 inches in diameter or larger must have riprap installed at the inlets to protect from erosion. All riprap must be lined with drainage geotextile. Riprap for culvert outlets must be in accordance with the *Stormwater and Grading Design Standards*.

Cross culverts require headwalls in accordance with the *Stormwater and Grading Design Standards*.

Additional requirements may apply to meet State and Federal permitting requirements, which depend on the type of permit (Refer to Section 2.2).

7.6.1 Inlet and Outlet Control Analysis

The headwater depth for pipes under inlet or outlet control must be determined using the nomographs contained in the ODOT *Hydraulics Manual.*

7.6.2 Headwalls and Endwalls

Pipe headwalls, endwalls, or other approved end protection are required (1) where pipe material other than concrete or ductile iron is exposed in the design of an outlet or inlet pipe; (2) where required to provide slope stability; or (3) if properly-sized riprap cannot provide sufficient energy dissipation. Headwalls and endwalls must meet the requirements in the *Stormwater and Grading Design Standards*. In addition, the locations of the headwalls and endwalls relative to the edge of travel should be evaluated to meet roadside clearance (See Section 3.6).

7.7 CONVEYANCE SYSTEMS

Conveyance systems must be designed according to the *Stormwater and Grading Design Standards.* If a project uses an existing, undersized storm conveyance system, there must be a 1-foot minimum freeboard between the hydraulic grade line and the top of the structure or finish grade above pipe for the conveyance design storm post-development peak rate of runoff.

7.8 STORMWATER FLOW CONTROL

Stormwater flow control must comply with the *Stormwater and Grading Design Standards*.

7.9 STORMWATER QUALITY TREATMENT

Stormwater quality treatment must comply with the *Stormwater and Grading Design Standards.*

7.10 EROSION PREVENTION AND SEDIMENT CONTROL

Erosion prevention and sediment control must comply with the *Stormwater and Grading Design Standards*.

8.0 UTILITIES

Chapter 8 provides information on public and private utilities and the requirements for each type.

8.1 PUBLIC-OWNED UTILITIES

A. Public-owned facilities include the sanitary sewer, storm drainage, and water distribution system.

B. Refer to the *Sanitary Sewer Design Standards* and *Sewer Pump Station & Force Main Design Standards* for detailed design information and to Std. Dwg. OC513 for utility line placement.

C. Refer to the *Water Distribution System Design Standards* for detailed design information and to Std. Dwg. OC513 for utility line placement.

D. Refer to the *Stormwater and Grading Design Standards* for detailed design information and to Std. Dwg. OC513 for utility line placement.

E. Utilities must not be located under the curb or on ADA ramps; refer to Std. Dwg. OC513 for utility line placement.

8.2 PRIVATE UTILITIES IN PUBLIC RIGHTS-OF-WAY

A. Existing Facilities

1. All private utility construction should adhere to OCMC 13.34 Utility Facilities in Public Rights-of-Way and established City franchises.

2. Private utility systems shall not impede public infrastructure. All facilities shall abide by National Electric Safety Code, the ADA, and the locations outlined below.

    a. Utility facilities shall be placed in the public utility easement. The City Engineer must approve locations outside of easements.

    b. No utility shall cause a safety hazard in City right-of-way (ROW), including crash hazards, ADA non-compliance, and sight distance issues.

    c. Support structures shall be used jointly in City ROW; no double pole locations are allowed.

B. New Facilities

1. New facilities refer to new installations and relocation of existing utilities.

2. All new development installations should adhere to OCMC Chapter 16.12.095.

    a. Poles must be relocated to the abutting development property line.

3. All new utilities shall be placed in a public utility easement (PUE) unless approved by the City Engineer.

All utilities shall abide by Oregon State statutes. The use of City right-of-way is subject to national joint-use notification regulations and Oregon joint-use association requirements.

8.3 PUBLIC UTILITY EASEMENTS

8.3.1 Public Utility Easement

The minimum width for a public utility easement (PUE) must be 10 feet or 5 feet, as shown in Std. Dwg. OC513 and OCMC 16.12.085 or as approved by the City Engineer. The PUE shall be located along all property lines adjacent to public rights-of-way. The City may require a larger PUE in commercial and industrial areas and where right-of-way widths are constrained. See Std. Dwg. OC513 for easement grading requirements.

8.3.2 City-Owned Easements

A. Public water lines shall be located in the public right-of-way. A public water line may only be located on private property upon approval and at the sole discretion of the City Engineer. A public water line on private property shall be centered within a permanent water facilities easement granted to the City. The easement shall have a minimum width of 15 feet along its entire length when placed in a roadway, parking area, or another hardscaped surface. The easement shall have a minimum width of 20 feet in unimproved or landscaped areas where vehicular access is not normally available. Table 8-1 provides minimum easement widths consistent with the City *Sanitary Sewer Design Standards* and City *Water Distribution System Design Standards*.

Table 8-1: Minimum Easement Widths

Easement Type	Width (ft)
Public Utility Easement (PUE)	10'/5'
Public Water Easement (paved surface)	15'
Public Water Easement (un-paved surface)	20'
Public Sewer or Storm Easement (paved surface)	15'
Public Sewer or Storm Easement (un-paved surface)	20'
Public Sewer Easement (15-inch diameter and greater and/or 15 ft sewer depth and greater)	20'
Shared (Parallel) Public Sewer Easement	25'
Access and Maintenance Easement	20'

B. Public sanitary sewer lines shall be located in the public right-of-way. A public sanitary sewer line may only be located on private property upon approval and at the sole discretion of the City Engineer. A public sanitary sewer line on private property shall be centered within a permanent sanitary sewer easement granted to the City.

C. Public storm and sanitary sewer located on private property shall be located within a permanent public storm and/or sanitary sewer easement granted to the City, with a minimum width of 15 feet along its entire length. Parallel public storm and sanitary sewer sharing an easement require the easement width to be increased to a minimum of 25 feet. Shared easements require City Engineer approval.

D. The required width of an easement may be greater than the minimum requirement based on the surrounding conditions and property line configurations. There may be additional restrictions on the setback of structures near an easement to comply with building codes.

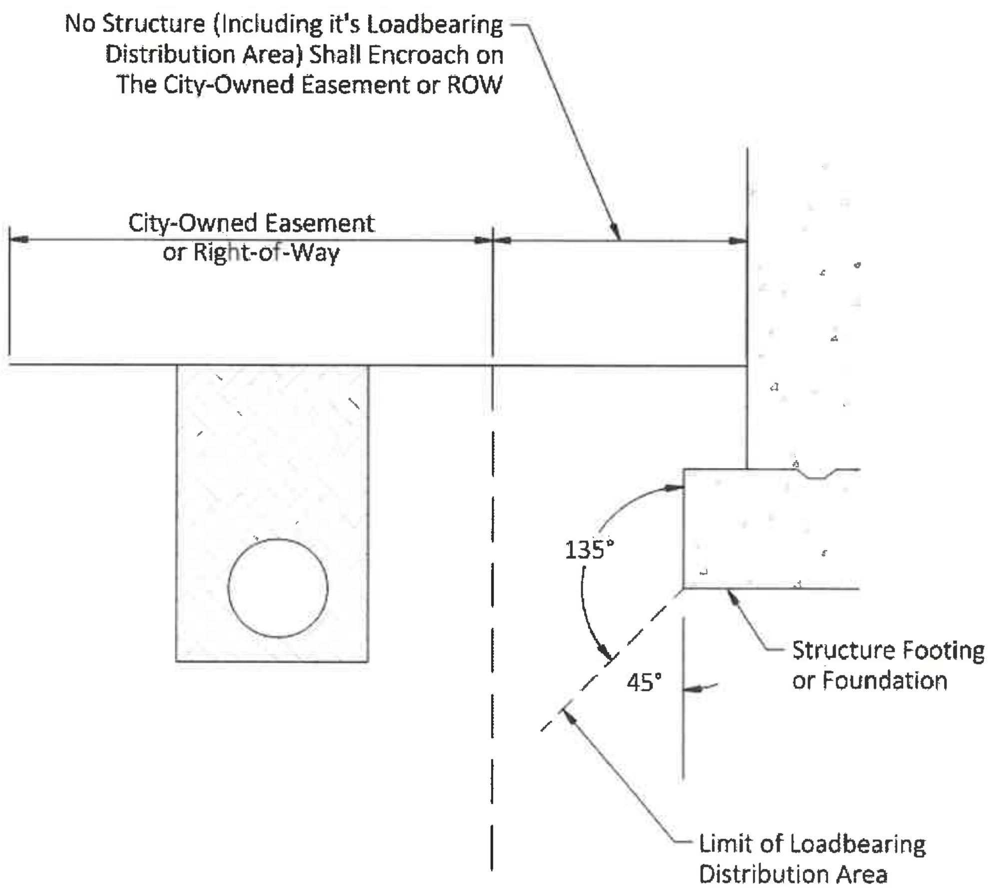
E. A 20-foot-wide permanent access and maintenance easement to benefit the City may be required in instances where City-owned infrastructure is inaccessible by way of the permanent easement. The access and maintenance easement shall be along a route that the City's maintenance vehicles can access.

F. Encroachments

1. There shall be no encroachment within a City-owned easement by a privately-owned structure, building, building overhang, retaining wall, monument sign, or any other object (including a structure's loadbearing distribution area as defined in Figure 8-1) that would adversely affect the City's ability to maintain public utilities.

2. There shall be no parallel encroachment within a City-owned right-of-way or easement (including a PUE) by a private utility facility or structure (including a structure's loadbearing distribution area as defined in Figure 8-1) without prior written approval by the City. Private utilities shall cross City-owned easements at right angles. Private utility facilities and structures shall not be placed within the pipe zone. The City will not approve any encroachment that would adversely affect the City's ability to maintain public utilities.

Figure 8-1: Loadbearing Distribution Area



G. Easement forms are subject to the approval of the City before recording.

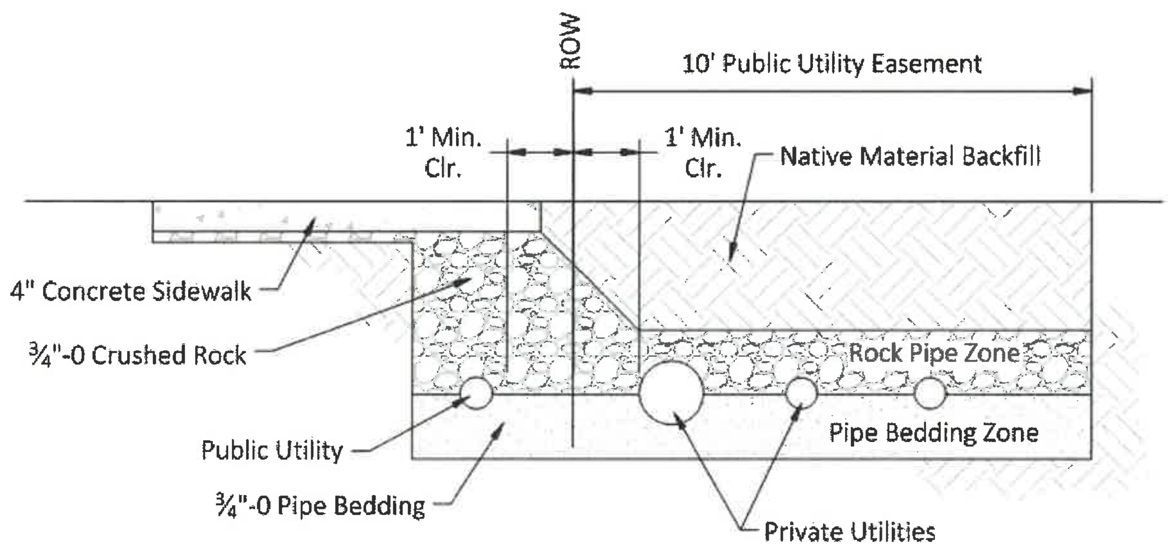
H. All recording costs for easements created by private development shall be borne by the developer.

I. The construction plans must show all existing and proposed easements. This includes the easement type and recorded document information. All proposed easements shall include a blank space for final recording numbers to be added to the record drawings.

J. Overhead utilities must meet the clearances as outlined in the National Electrical Safety Code (NESC) 234 Clearances to Other Structures.

K. Figure 8-2 provides an example of the shared utility trench option.

Figure 8-2: Shared Utility Trench Option



9.0 STREET LIGHTING

Chapter 9 provides street lighting standards for the City. Street lighting levels shall follow PGE standards for all PGE-owned lights. For City lights, a lighting analysis should be completed during the design and approved by the City Engineer.

9.1 PORTLAND GENERAL ELECTRIC (PGE) AND CITY AGREEMENTS

PGE and City Agreements are described in Table 9-1.

Table 9-1: PGE and City Agreements

PGE Option	Description
A	Developer to pay line extension fee, install PGE-provided light pole foundations, developer-provided junction boxes, and conduits with tracer wire. PGE to install the remaining equipment and own and maintain the street lighting system.
B	This option is **not** allowed within the City.
C	Developer to install the street lighting system, pay the line extension fee, and maintain the system through the maintenance period. Beyond the maintenance period, the City will own and maintain the street lighting system. Option C includes streets in the Downtown District and Washington Street, 7th Street, 99E, and Molalla Avenue.

9.2 PGE-RELATED DESIGN

A. The Engineer of Record and/or City Project Manager is responsible for arranging with PGE to connect the street lighting system to the local distribution system and for locating the service cabinet.

B. Street lights and poles shall be designed to be PGE Schedule 95 (by City direction only) or Option A (PGE-owned and maintained) or Option C (City-owned and maintained) light emitting diode (LED) lights. All Option C lights must be connected to a City-owned service and meter. The City has the final approval authority on which luminaire to use based on the specific lighting application. For Option C, luminaire information is shown on OC 536.

C. For Option A, refer to PGE's Approved Equipment List for all items, including luminaires, foundation, poles, junction boxes, photocell, etc.

9.3 LIGHTING DESIGN CRITERIA

The lighting design criteria noted below applies to both Option A and Option C.

A. All street lighting shall be designed by a licensed professional engineer (See Section 1.1.1) using the provisions in these *Standards*, and, where applicable, the current version of ANSI/IES RP-8 *American National Standard Practice for Roadway Lighting*.

1. Pedestrian-scale lighting should be adequate to illuminate pedestrian facilities that are a part of transit-oriented districts, town centers and plazas, off-street pathways and shared-use paths, or other areas identified in the Oregon City TSP or other area-specific plans. Typically, this lighting is positioned over the sidewalk rather than the street and is equal to or less than 16 feet above the sidewalk. All pedestrian-scale lighting equipment shall be approved by the City Engineer. Accessway lighting shall be to a minimum level of one-half (0.5) foot candle, a one and one-half (1.5) foot candle average, and a maximum to minimum ratio of seven-to-one (7:1) and shall be oriented not to shine upon adjacent properties. Street lighting shall be provided at both entrances.

2. Illumination shall be provided and evaluated at midblock crossings per ANSI/IES RP-8.

B. All electrical components shall be Underwriters' Laboratories (UL)-approved and testing lab-approved from labs accepted by the State of Oregon.

C. Street illumination design and installation shall conform with the Oregon Standard Specifications for Construction, Oregon Standard Drawings, and City Standard Drawings.

D. All street light plans shall include pole location by station, wiring, conduit, junction boxes, photocells, controller cabinets, power source location, lighting analysis output points, driveway locations, trees, and any other pertinent information. All backup lighting analysis, line loss, and service cabinet circuit load calculations shall be submitted for review along with the plans.

E. All street lights shall be LED.

F. The lighting plans shall include general installation notes, including the type, manufacturer, catalog number, number of LEDs, wattage, mounting height, arm length, and specification of the proposed equipment. Plans shall also include the wiring and circuit diagrams. The lighting color/temperature, and dark sky characteristics are per the PGE approved list and City standard drawings.

G. The lighting plans shall include photometric data, such as average foot-candles, average to minimum ratio, maximum to minimum levels, and lamp lumen depreciation factor. Photometric calculations shall be provided using separate calculation zones for roadway, intersection, and pedestrian facilities. The plans shall indicate the roadway and intersection functional classifications and pedestrian conflict assumed for calculations. An electronic file of the photometric calculations shall be provided as a PDF file.

H. Circuits and cable runs shall be designed to provide separate and independent circuits for street lights. Wire size shall be determined by the loading and distance of each circuit. Loading calculations shall be based on the maximum loading possible for the circuit, assuming all fixtures are operating at the maximum output for the highest drive current for the fixture. Wire shall be sized to limit voltage drops to a maximum of 2% between the utility service connection and the control panel and a maximum of 3% from the control panel to the most distant fixture served. The Engineer of Record or City Project Manager must submit an electronic file of the voltage drop/line loss calculations for the City Engineer to approve.

I. Photometric analysis shall include only light fixtures that are within the right-of-way. Light sources on private property cannot be included in the street lighting analysis.

J. Photometric analysis shall include only light fixtures installed as part of the project for which the analysis pertains and existing light fixtures within the right-of-way. Street lighting analysis shall not include future light fixtures for roadways planned to be 2-3 lanes wide, but it is allowed for roadways planned to be greater than 4 lanes wide.

K. Lighting design shall account for a modified photometric distribution when glare shields are used.

L. A 10-day burn-in period shall be completed before the City's final acceptance of the street lights that are either metered or fall under PGE's Option C standard.

M. The Engineer of Record or City Project Manager shall submit items for materials review to the City Engineer before ordering any street lighting equipment (poles, light fixtures, lighting controls, control nodes, junction boxes, foundations, services, cabinets, etc.) and pass applicable manufacturer warranties along to the City. Specific requirements for light fixtures are further described in Section 9.4.

N. In systems with existing lights on both sides of the street, the circuitry shall be configured so that the lights on one side of the street can be "de-energized" without affecting the operation of the lights on the opposite side of the street. A maximum of 72 hours (3 days) of outage is permissible for existing street lighting. Where work would result in an outage for all existing lights, temporary lighting in a manner acceptable to the City shall be provided. Temporary lighting of up to 1 month (30 days) is allowed, and the Engineer of Record or City Project Manager shall strive to complete all street lighting work and energize lights within that timeframe.

O. A minimum of 2-inch conduit shall run between junction boxes. Between each light pole and the adjacent junction box, there must be 1 conduit that is 2 inches in size. All conduit runs shall be marked with an underground marking tape per 00960.42(e) of the Oregon Standard Specifications for Construction. All conduits shall be Schedule 40 PVC, and all elbows shall be fiberglass. The Engineer of Record or City Project Manager must install bushings on all conduit ends and seal the ends with an approved conduit plug. See City Standard Drawings for additional details.

P. The Engineer of Record or City Project Manager is responsible for locating street light poles so that no portion of the pole, mast arm, or luminaire is within 10 feet of an energized line. Installation shall conform to OAR 437-002-0047 and 437-002-2316.

Q. Table 9-2 provides lighting levels for streets and parallel on-street bicycle facilities.

R. Table 9-3 provides intersection lighting standards. Table 9-4 provides unsignalized pedestrian/bicycle crossing target lighting values.

Table 9-2: Lighting Levels for Street and Parallel On-Street Bicycle Facilities (ANSI/IES RP-8)

Average Maintained Illuminance on the Horizontal				
Roadway Classification	Pedestrian Conflict Area	Minimum Average Maintained in Foot Candles [1]		
		Concrete Street	Asphalt Street	Uniformity Ratio Avg. to Min.
Arterial	High	> 1.2	> 1.7	< 3:1
	Medium	> 0.9	> 1.3	< 3:1
	Low	> 0.6	> 0.9	< 3:1
Collector	High	> 0.8	> 1.2	< 4:1
	Medium	> 0.6	> 0.9	< 4:1
	Low	> 0.4	> 0.6	< 4:1
Local Road	High	> 0.6	> 0.9	< 6:1
	Medium	> 0.5	> 0.7	< 6:1
	Low	> 0.3	> 0.4	< 6:1

[1] Do not design roadways more than 1.3x above the minimum average foot-candlelight levels.

Table 9-3: Intersection Lighting Standards (ANSI/IES RP-8)

Average Maintained Illuminance on the Horizontal				
Intersection Classification	Pedestrian Conflict Area	Minimum Average Maintained in Foot Candles [1 2]		
		Concrete Intersection	Asphalt Intersection	Uniformity Ratio Avg. to Min.
Arterial/Arterial	High	> 2.4	> 3.4	< 3:1
	Medium	> 1.8	> 2.6	< 3:1
	Low	> 1.2	> 1.8	< 3:1
Arterial/Collector	High	> 2.0	> 2.9	< 3:1
	Medium	> 1.5	> 2.2	< 3:1
	Low	> 1.0	> 1.5	< 3:1
Arterial/Local Road	High	> 1.8	> 2.6	< 3:1
	Medium	> 1.4	> 2.0	< 3:1
	Low	> 0.9	> 1.3	< 3:1
Collector/Collector	High	> 1.6	> 2.4	< 4:1
	Medium	> 1.2	> 1.8	< 4:1
	Low	> 0.8	> 1.2	< 4:1
Collector/Local Road	High	> 1.4	> 2.1	< 4:1
	Medium	> 1.1	> 1.6	< 4:1
	Low	> 0.7	> 1.0	< 4:1
Local Road/Local Road	High	> 1.2	> 1.8	< 6:1
	Medium	> 1.0	> 1.4	< 6:1
	Low	> 0.6	> 0.8	< 6:1

[1] Do not design intersections more than 1.3x above the minimum average foot-candlelight levels.
[2] Intersection analysis area includes curb ramp landings and crosswalks.

Table 9-4: Unsignalized Pedestrian/Bicycle Crossing Target Lighting Values (ANSI/IES RP-8)[6]

Average Maintained Illuminance on the Horizontal and Vertical [5] Maintained Illuminance Values for Walkways in Foot Candles High Pedestrian Conflict Areas [4]			
Location	**Eavg [1]**	**EVmin [2]**	**Uniformity Ratio [3]**
Mixed Vehicle and Pedestrian	> 2.0	> 1.0	< 4:1
Pedestrian Only	> 1.0	> 0.5	< 4:1
Maintained Illuminance Values for Walkways in Foot Candles Medium Pedestrian Conflict Areas [4]			
Location	**Eavg [1]**	**EVmin [2]**	**Uniformity Ratio [3]**
Pedestrian Areas	> 0.5	> 0.2	< 4:1
Maintained Illuminance Values for Walkways in Foot Candles Low Pedestrian Conflict Areas [4]			
Location	**Eavg [1]**	**EVmin [2]**	**Uniformity Ratio [3]**
Rural/Semi-Rural Areas	> 0.2	> 0.06	< 10:1
Low Density Residential (< 2 dwelling units per acre)	> 0.3	> 0.08	< 6:1
Medium Density Residential (2.1–6.0 dwelling units per acre)	> 0.4	> 0.1	< 4:1

[1] Eavg—Minimum maintained average horizontal illuminance at the pavement surface.

[2] EVmin—Minimum vertical illuminance at 5 feet above the pavement.

[3] Ratio of Eavg to the minimum horizontal illuminance at the pavement surface.

[4] Refer to ANSI/IES RP-8 for additional guidance regarding these tables.

[5] Vertical illuminance is measured at a height of 5 feet in both directions and parallel to the main pedestrian flow.

[6] Target values for midblock and RRFB enhanced crossings.

9.4 LIGHT FIXTURES

PGE light fixtures are the standard, which includes different types.

- The *decorative acorn light fixture* includes two City standards.
- The *tear drop light fixture* includes two City standards.
- The *decorative post top fixture* includes one PGE standard.

Designs should include the same type of fixture on both sides of the street.

Table 9-5 provides a summary of the light fixtures that shall be used on various streets throughout the City. Table 9-6 provides example photos for each type of light fixture presented in Table 9-5.

Table 9-5: Types of Light Fixtures By Street

Location	Tear Drop Style*	King Acorn Style*	Lumecon Acorn Style*	Town & Country Style*
99E : Clackamette Park to Tunnel	X			
Main Street : 99E to 15th St plus Side Streets			X	
Washington Street: 7th Street to Metro/Home Depot			X	
Washington Street: Home Depot to Prairie Schooner	X			
Molalla Avenue: Hwy 213 to Holmes		X		
Molalla Avenue: Holmes to Division			X	
7th Street: Division to High	X			
Holcomb Boulevard: Front Avenue to Winston Drive				X

*See Standard Detail OC536 and OC536C for more information

Table 9-6: Examples of Light Fixtures

Tear Drop Style	King Acorn Style	Lumecon Acorn Style	Town & Country Style
			

Note : The pictures above are for reference only and may not be identical to the specified fixture.

9.5 STREET LIGHT EQUIPMENT & PLACEMENT

Any work performed under permits issued by Oregon City Public Works shall be in accordance with the Oregon Standard Specifications for Construction as prepared by ODOT and the Oregon Chapter of American Public Works Association (APWA) and as modified and adopted by the City. Additional guidance for street light equipment and placement is described below.

A. **Option A**: PGE street lighting equipment must be included in the most current PGE-approved street lighting equipment list.

B. **Option C**: Street lighting equipment shall be as shown according to Std. Dwg. OC536.

   1. Street lighting along Molalla Avenue shall only be Option C and as shown according to Std. Dwg. OC536.

C. Light poles and junction boxes shall be located per Std. Dwg. OC536.

D. The Engineer of Record or City Project Manager is responsible for locating street light poles so that no portion of the pole, mast arm, or luminaire is within 10 feet of an energized line. Installation shall conform to OAR 437-002-0047 and 437-002-2316.

E. Street lighting conduit shall be placed under the sidewalk where feasible.

F. If the approved equipment is no longer available, the Engineer of Record or City Project Manager should coordinate with the City Engineer to obtain approval of the currently available alternative street lighting system.

G. Solar-powered equipment is not allowed within the City unless approved by the City Engineer.

9.5.1 Junction Boxes

Standards below apply to Option A and Option C.

A. Junction boxes shall be no more than 3 feet from each pole served, and there shall be 1 junction box for each street light pole. The Engineer of Record or City Project Manager must install 1 junction box for each lighting controller and include one spare 2-inch conduit installed to the controller with a pull string. See Std. Dwgs. OC536-OC536A.

B. All junction boxes and lids shall be open bottom polymer concrete or polymer fiberglass with a skid-resistant cover marked "Street Lighting."

C. The Engineer of Record or City Project Manager must not install junction boxes in sidewalk ramps or ramp wings. Junction boxes shall be placed in the following locations in order of preference or as approved by the City:

   1. Landscape strip
   2. Back of sidewalk with a concrete apron (within the public utility easement)
   3. Sidewalk (outside of primary walking route; i.e., furniture zone); see Std. Dwg. OC536A

9.5.2 Cable and Wire

Option A wiring shall conform to PGE standards. The following is for **Option C** only.

A. A single-phase, 3 wire, 240-volt, dedicated metered service shall be provided for street lighting.

B. All wires shall be stranded copper, single conductor, type XHHW, with 600-volt insulation (unless no insulation is provided as noted below). Solid wiring is not permitted. The minimum wire size for the lighting circuit is #10 AWG wire, and the maximum wire size is #1 AWG wire. All wire splices shall occur inside the junction boxes.

C. Street lighting circuits shall be designed to ensure that no section of roadway shall end up completely unlit with the loss of a single circuit. The following circuit configurations apply:

   1. When lighting is provided on both sides of the street, each side of the street shall be on a different circuit.

D. Wire insulation color shall conform to the following:

   1. **120-volt photoelectric circuit wires:** A black wire from the controller to the photocell or a red wire for the return to the cabinet shall be used.
   2. **240-volt line distribution wires:** Install circuit wire pairs as shown below, with each pair of wires sharing the same insulation color. If additional circuits are required, insulation color shall be approved by the City.
      a. 1st circuit pair—black
      b. 2nd circuit pair—red
      c. 3rd circuit pair—blue
      d. 4th circuit pair—brown
      e. 5th circuit pair—yellow
      f. 6th circuit pair—orange
   3. Grounded (neutral) conductors, if needed, shall be white or natural gray.
   4. Grounding electrode conductors from the light pole to the adjacent junction box shall be green insulated or bare stranded wire.
   5. Equipment ground conductors in the conduit raceways shall be green insulated.

E. Color coding of each conductor shall remain consistent throughout the entire system. Factory supplied striping of conductors will be accepted when the required color insulation is not available. Color tape will not be accepted as an alternate for insulation color coding.

9.5.3 Poles and Foundations

A. All poles shall be grounded. The Engineer of Record or City Project Manager must install a ground rod in the junction box located at each pole. This includes a 1-inch schedule 40 PVC conduit with a #6 green insulated or bare wire from the pole to the ground rod located in each junction box. (See *Oregon Standard Drawings*.)

B. All light poles shall be constructed with a nominal 2-½-inch x 5-inch hand hole placed approximately 2-4 feet above the ground line. In plan view, the handhole shall be at 90 degrees from the mast arm or curbside of the pole. The hand hole must be secured with cast aluminum or galvanized steel cover painted to match the pole and held in place with a stainless-steel, tamper-resistant set screw.

C. All poles should include flower basket irrigation.

D. Breakaway designs shall be used for light poles located along roadways with posted speeds greater than 35 mph and within the clear zone as defined by Table 3-1 of the AASHTO *Roadside Design Guide*, except for those located in drainage ditches, near bus shelters, or in areas with extensive pedestrian concentrations.

E. An inline fuse shall be installed between the circuit and each light fixture depending on whether it is metered or falls under PGE's Option C standard.

F. Poles shall be located a minimum of 15 feet from street trees as shown on Std. Dwg. OC536A.

G. Poles shall be located a minimum of 5 feet from driveway wings, fire hydrants, and other utilities.

9.5.4 Lighting Controller

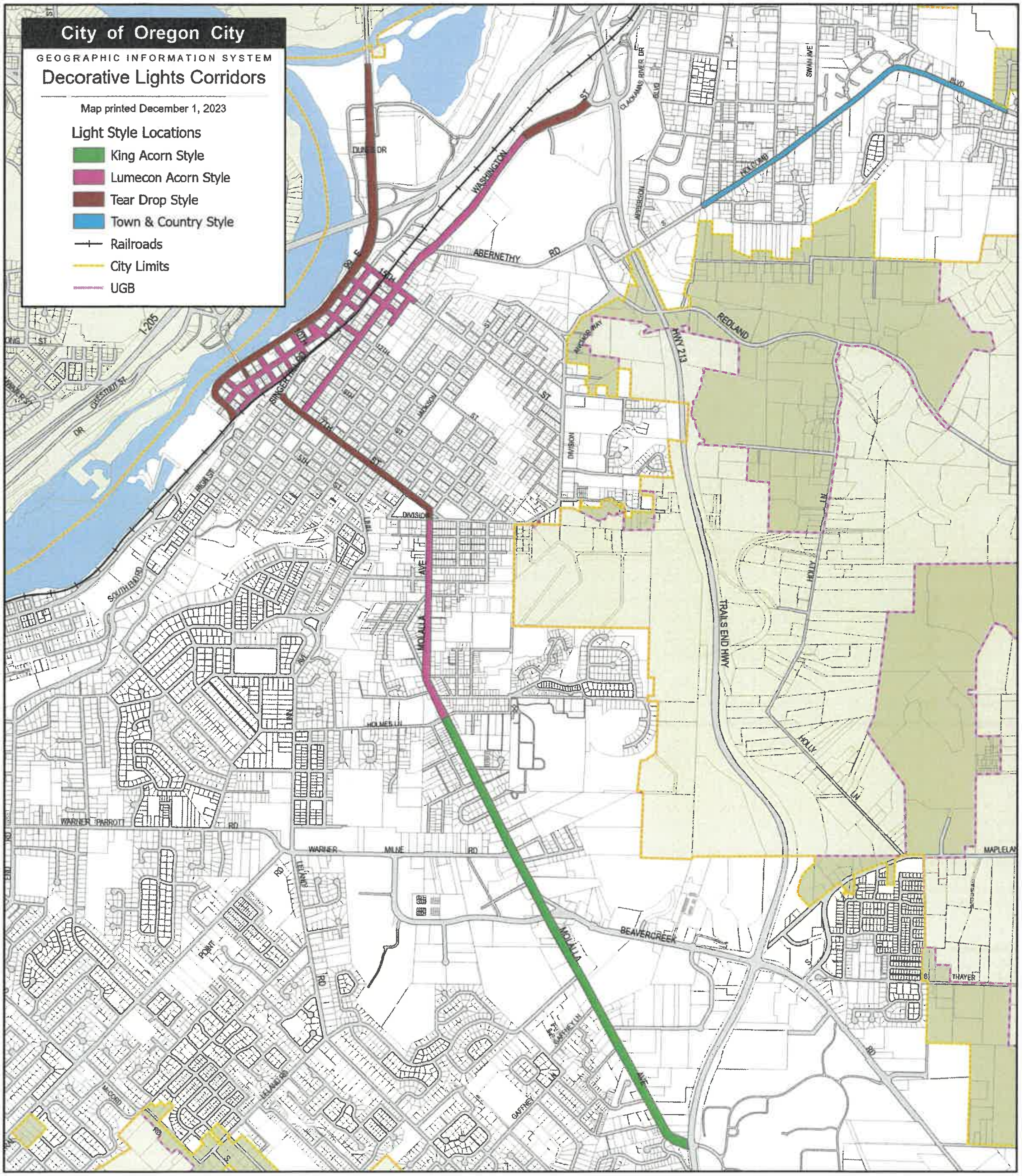
A. The controller cabinets shall be installed away from intersections and locations where an errant vehicle could damage the cabinet. The cabinet location should be near a side property line and should not detract aesthetically from the adjacent properties. In residential areas, locating cabinets within side yard frontages is preferred to locating them in front yard frontages. Cabinet locations should also consider future system growth. The Engineer of Record or City Project Manager should consult with the City Engineer and PGE regarding cabinet location at the beginning of design.

B. The cabinet shall have a service panel that has a "Service Equipment" rated UL label attached to the panel. A 100-amp, single-phase, 3-wire, 240-volt, dedicated metered service is to be provided by the developer. Each street lighting circuit shall be wired 240 volts. The street light base-mounted controller shall be installed per ODOT's Std. Dwg. TM485 and shall be on *Clackamas County Roadway Standards* and details. The controller shall be made of stainless steel and include circuit breakers, a test switch, and neutral and ground bars. When only one illumination breaker is being installed, there shall be space for three additional illumination breakers. Designers shall follow NFPA 70E standards for arc flash, provide the required labeling for the controller cabinet, and attach available fault current to the inside of the door with a permanent label.

C. The cabinet shall be stainless steel.

D. A single, 3-inch spare conduit shall be installed from the controller cabinet to the nearest junction box with tracer wire and pull line.

E. When designing or installing Option C, a single photocell shall be provided at the BMCL. Photocell model shall be from ODOT Qualified Product List or PGE Approved Equipment List.



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N W E S

0 1,000 2,000 3,000 Feet

1 inch = 2,100 feet

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OREGON CITY

Date: 12/1/23
Map Name: Decorative Lights.aprx|Decorative Lights Corridor - 8.5x11P
Plot Name: Decorative Lights Corridor - 8.5x11P - 20231201.pdf

10.0 LANDSCAPE DESIGN

Chapter 10 provides information on landscape design for City streets and intersections. Additional design standards are provided OCMC 12.08. For roundabout landscape design considerations, refer to *NCHRP Report 672: Roundabouts, An Informational Guide.*

10.1 PLANT TYPES

A. Trees

1. Tree species type selections should comply with Section 10.2 Street Trees below.

B. Shrubs and Groundcovers

1. Shrub and groundcover species type selections should be drought-tolerant, suitable to the available space, and adapted to street-side environments. Shrubs and groundcover plants are to be selected from the Oregon City Native Plant List unless the City Engineer approves otherwise.

C. Plants found on the Oregon City Nuisance Plant List or other invasive species should never be used.

10.2 STREET TREES

A. Street tree species selection must be in accordance with OCMC 12.08.015—Street Tree Selection, Planting, and Maintenance Requirements. Section 3.5 provides additional information on sight distance considerations for tree planting and maintenance.

B. Types

1. The City will approve street tree species based on specific site conditions. Street tree species are to be selected from the Oregon City Street Tree List. Alternative species may be acceptable with prior City Engineer approval.

C. Clearance Distances

The following distances shall be maintained between trees and street elements, as measured from the center point of the tree:

1. 5 feet from driveways as measured from edge of driveway apron.
2. 5 feet from any regulatory signs.
3. 15 feet from street lights.
4. 5 feet from fire hydrants.
5. 20 feet from intersections as measured from the right-of-way boundary of the intersecting street.
6. 5 feet from all public utilities (e.g., sewer, storm, and water lines, utility meters, etc.).

D. Planting Requirements

1. Refer to OCMC 12.08.015—Street Tree Selection, Planting, and Maintenance Requirements.
2. Plant street trees according to Std. Dwg. OC530, Street Tree Planting in Planter Strip.

E. Distance to Street Light Poles

1. Trees shall be located a minimum of 15 feet from street light poles, as shown on Std. Dwg. OC536A.

F. Irrigation

1. Irrigate new street trees by permanent or temporary means if required by the City Engineer. The City Engineer must approve all irrigation requirements and design/construction methods.
2. In urban conditions, especially when planting in pavement (including median islands and sidewalk cutouts), a permanent irrigation system may be necessary to sustain living plants. The City Engineer must review and approve selection.
3. Implement wise water-use techniques that include water distribution devices that apply water with no runoff or overspray onto pavement or buildings. Incorporate 'smart' controllers and sensors to synchronize water application with changing weather conditions.
4. A qualified designer should prepare irrigation plans and specifications.
5. Irrigation systems using an automatic controller shall have the ability to reduce water application over time to promote plant independence and sustainability.

G. Street trees and their limbs and foliage must comply with OCMC 10.32.030—Sight Line Requirements. Other maintenance requirements related to landscape trimming are included in OCMC 12.08.025.

10.3 MEDIAN DESIGNS

A. Style

1. Street medians should be landscaped with City Engineer approval. Rocked medians should be used for medians near pedestrian crossings and when required for sight distance.
2. Street medians 4 feet wide or less (measured from back-of-curb to back-of-curb) must be designed with hardscape elements including but not limited to rocked areas, textured concrete, or modular unit pavers. This should not include trees, shrubs, or groundcover. Bark mulch may be used in street medians 4 feet wide or less, except for anywhere within a left-turn lane pocket taper.
3. Street medians wider than 4 feet (measured from back-of-curb to back-of-curb) must be planted with trees, shrubs, and groundcovers, including bark mulch, unless otherwise approved by the City Engineer. Median planting design must be in accordance with OCMC 12.08.015. Street medians wider than 4 feet may be designed without plants if unique site conditions warrant it. Median design without plant materials will require the City Engineer's approval.

B. Location

1. Locate street median designs in accordance with OCMC 16.12.016—Street Design. Street trees in planted medians must be spaced 35 feet on-center, and shrubs and/or groundcovers must be spaced 4 feet on-center.

2. Median plant materials must have size and shape characteristics that are appropriate for the available spaces.

3. Street trees shall not be planted closer than 15 feet from street light poles.

C. Pedestrian Refuge Islands

1. For pedestrian and motorist safety, trees, shrubs, and groundcover plants are not recommended in pedestrian refuge islands. Rocked medians should be used instead.

10.4 PLANTING STRIP DESIGNS

Planted landscape strip design shall be in accordance with OCMC 16.12.016.F. Street tree species shall be selected from the Oregon City Street Tree List. Alternative species may be accepted by the City Engineer.

10.5 FURNITURE ZONE

The future zone includes the area from the edge of curb to the right-of-way and may consist of landscaping and other objects associated with adjacent land uses.

A. Planting may be permissible, with City approval, in street section furniture zones.

B. Planting within furniture zones likely means plants in open tree wells, sidewalk cutouts, or tree grates. When planting in paved areas, if approved by the City, consider using structural soils (CU-Structural Soil™) beneath the adjacent pavement to promote healthy root spread and root access to subsurface air and water.

C. For pedestrian and motorist safety, trees, shrubs, and groundcover plants must not restrict access to or compete aesthetically with other amenities located in the furniture zone.

D. Beyond landscape features, items in the furniture zone may include hydrants, benches, trash containers, decorative tree lights, and electric outlets.

E. All items in the furniture zone need to be evaluated together to maintain appropriate access to parking and other land uses.

F. Items in the furniture zone must not impact ADA accessibility.

10.6 GREEN STREETS AND STORMWATER TREATMENT

Landscaping of stormwater treatment facilities must comply with the Oregon City Stormwater and Grading Design Standards. Metro's Designing Livable Streets and Trails Guide provides additional reference information for green streets.

The City encourages projects to incorporate green infrastructure treatments, such as vegetated medians, roadside swales, rain gardens and infiltration planters, permeable pavements, bioretention curb extensions, and street trees. These treatments allow streets to not only manage stormwater but to mitigate the harmful impacts of transportation systems on air, water, noise, and habitat function and connectivity. The goals of green streets are generally to provide stormwater source control, confine stormwater transport and pollutant conveyance to a collection system, restore pre-development hydrology to the extents possible, and provide environmentally enhanced roads. The successful application of green street techniques will promote soil and vegetation contact and onsite infiltration and retention of stormwater.

Examples of green street infrastructure include:

A. **Street trees** support stormwater management, offer wildlife habitat, improve air quality, reduce heat island effects by providing shade, improve roadway aesthetics, promote human well-being through enhanced levels of interaction and carbon sequestration, and calm traffic. On streets with high levels of walking and bicycling, street trees provide buffers from traffic and air pollution.

B. **Planters** are structured facilities with hard walls, generally flat bottoms, growing media, topsoil, and vegetation. They can be designed to promote infiltration directly into the native ground below or designed to be impermeable with liners when infiltration is either not desired or not feasible. When designed for impermeability, planters must be plumbed to a stormwater collection system. Planters are often used as one of a series of facilities within a streetscape to meet stormwater requirements.

C. **Curb extensions with landscaping** have hard edges, generally flat bottoms, soil, vegetation, and the option of permeability or impermeability. Landscape extensions can also be combined with adjacent planters to further reduce runoff volumes, attenuate peak flows, and maximize resident stormwater storage capacity before discharging into a collection system.

D. **Basins** (or rain gardens) are facilities that are depressed relative to the street and sidewalk elevations, and they may have hard edges or bermed side slopes, flat bottoms, topsoil and/or growing media, and vegetation. Basins are generally used when and where modeled infiltration rates into the site are acceptable and are not harmful to either the roadway pavement or base. They are typically used as a single facility to handle larger volumes of water within a catchment area.

E. **Swales** are depressed landscape strips with sloped earthen sides. Swales take up more room within the right-of-way than planters because swales lack a hard edge and require side slopes to match adjacent street and sidewalk grades. Swales also convey water parallel to the roadway along their sloped surfaces, which can reduce subsurface collection system pipe needs.

F. **Permeable Pavement** comes in four forms: permeable concrete, permeable asphalt, permeable interlocking concrete pavers, and grid pavers. Permeable concrete and asphalt are similar to their impermeable counterparts but are open graded. Concrete and grid pavers are modular systems installed with gaps between paver units to allow stormwater to infiltrate through to the aggregate base. Grid pavers are typically a durable plastic matrix that can be filled with gavel or vegetation. Grid pavers are commonly designed to accommodate emergency vehicle or fire truck access on private properties. ADA compliance must be verified in applicable areas.

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APPENDIX A—ADDITIONAL RESOURCES

The *Standards* strive for consistency with the most recent versions of the City Relevant Resources described in Section 1.2.

If the *Standards* do not address a specific design issue, the most recent version of the following documents should be referenced. In all situations, engineering shall determine the appropriate design reference and its applicability.

American Association of State Highway and Transportation Officials (AASHTO), *A Guide for Achieving Flexibility in Highway Design*

AASHTO, Guide for the Development of Bicycle Facilities

AASHTO, Guide for the Planning, Design, and Operation of Pedestrian Facilities

AASHTO, Guidelines for Geometric Design of Very Low-Volume Local Roads

AASHTO, LRFD Bridge Design Specifications

AASHTO, A Policy on Geometric Design of Highways and Streets

AASHTO, Roadside Design Guide

AASHTO - Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals

American Society for Testing and Materials (ASTM)

The Asphalt Institute, *The Asphalt Handbook*

The Asphalt Institute, Thickness Design - Highways and Streets

Federal Highway Administration (FHWA), Manual on Uniform Traffic Control Devices (MUTCD)

FHWA, Standard Highway Signs

FHWA, Roundabouts: An Informational Guide

Institute of Transportation Engineers (ITE), Traffic Control Devices Handbook

ITE, Traffic Engineering Handbook

ITE, Trip Generation Manual

ITE, Trip Generation Handbook

International Building Code (IBC)

International Plumbing Code (IPC)

National Association of City Transportation Officials (NACTO), *Urban Bikeway Design Guide*

NACTO, *Urban Street Design Guide*

ODOT, Highway Design Manual

ODOT, Hydraulics Design Manual

ODOT, Oregon Temporary Traffic Control Handbook for Operations of Three Days or Less

ODOT, Traffic Control Plans Design Manual

ODOT, Traffic Line Manual

ODOT, Traffic Manual

ODOT, Traffic Signal Policy and Guidelines

ODOT, Sign Policy and Guidelines

ODOT, Oregon Standard Drawings

ODOT and American Public Works Association (APWA), *Standard Specifications for Construction*

Oregon Fire Code, Appendices B and D

Oregon Fire Code Metro Code Committee *Fire Code Applications Guide*

Oregon Supplement to the MUTCD

Other local fire codes

Transportation Research Board (TRB), *Highway Capacity Manual*

TriMet Bus Stops Guidelines

APPENDIX B—FORMS

1. Design Modification Form
2. Public Improvement Modification Application
3. ADA Modification Form
4. Work Zone Speed Reduction Request Form

DESIGN MODIFICATION FORM

City of Oregon City

Design Modification Request

For Capital Improvement Program Projects

Per Oregon City Street Standards Section 2.1

City Use Only
Reference #:

Request submitted by (name, title, contact email and phone number):

Engineer of Record (License number):

Date:

PROJECT INFORMATION

Project name:

Nearest address or intersection:

City map and tax lot number(s):

Functional classification of road:

Posted speed:

DESIGN MODIFICATION

Applicable roadway standard:

Description of modification and reason for request:

Supporting documentation *(photos showing features requiring exception, plan sheets, other items that support the need for the exception)*:

Mitigation for modification:

Public benefit:

Submitted By

Name:

Signature:

Date:

Space provided for Engineer of Record stamp.

City Use Only

Approved by the City Engineer or their designee:

Name and Title:

Signature:

Date:

PUBLIC IMPROVEMENT MODIFICATION APPLICATION

OREGON CITY

Public Works – Development Services

13895 Fir St | Oregon City OR 97045
Ph (971) 204-4601 | Fax (503) 908-1128

DEVELOPMENT SERVICES
TYPE I PUBLIC IMPROVEMENT MODIFICATION APPLICATION

Application Date:

Project Name:	
Proposed Land Use or Activity:	
Physical Address(es) of Site:	
Clackamas County Map and Tax Lot Number(s):	

Applicant(s)

Applicant(s) Signature:		
Applicant(s) Name Printed:		Date:
Mailing Address:		
Phone:	Fax:	Email:

Property Owner(s)

Property Owner		
Property Owner Signature		
Property Owner Name Printed:		Date:
Mailing Address:		
Ownership Address:		
Phone:	Fax:	Email:

All signatures represented must have the full legal capacity and hereby authorize the filing of this application and certify that the information and exhibits herewith are correct and indicate the parties' willingness to comply with all code requirements.

Please respond to Oregon City Municipal Code (OCMC) Section 16.12.13.A below. Note that, to be processed as Type I per 16.12.013.B., Public Improvement Modifications reviewed by Development Services must regard a modification to driveway location, size, and sharing standards in 16.12.035. Resources available from the City include OCWebMaps, OCMC Chapter 16.12, Public Works standards, and Public Works Master Plans. Please attach additional pages as needed.

16.12.13 - Modifications.
The applicant may request and the review body may consider modification of the standards in this chapter resulting from constitutional limitations restricting the City's ability to require the dedication of property or for any other reason, based upon the criteria listed below and other criteria identified in the standard to be modified. All modifications, except for adjustments approved by the City Engineer for tree preservation purposes pursuant to 16.12.013.B, shall be processed through a Type II Land Use application and may require additional evidence from a transportation engineer or others to verify compliance.

A. Compliance with the following criteria is required:

1. The modification meets the intent of the standard;

2. The modification provides safe and efficient movement of pedestrians, motor vehicles, bicyclists and freight;

13895 Fir St | Oregon City OR 97045
Ph (971) 204-4601 | Fax (503) 908-1128

3. The modification is consistent with an adopted transportation or utility plan; and

4. The modification is complementary with a surrounding street design; or, in the alternative;

5. If a modification is requested for constitutional reasons, the applicant shall demonstrate the constitutional provision or provisions to be avoided by the modification and propose a modification that complies with the state or federal constitution. The City shall be under no obligation to grant a modification in excess of that which is necessary to meet its constitutional obligations.

City Use Only:

Approved by the City Engineer or their designee:

____
Name and Title

______________________________ _______________
Signature Date

ADA MODIFICATION FORM

City Use Only
Reference #:

City of Oregon City

Americans with Disabilities (ADA) Modification Request

Per Oregon City Street Standards Section 2.1

Request submitted by (name, title, contact email and phone number):

Engineer of Record (License number):

Date:

PROJECT INFORMATION

Project name:

Nearest address or intersection:

City map and tax lot number(s):

Functional classification of road:

Posted speed:

DESIGN MODIFICATION

Type of accessibility feature:

curb ramp
pedestrian signal push button clear space
pedestrian signal push button

New or Alteration:

New accessibility feature (there was no accessibility feature at the location prior to the project)
Alteration of an existing accessibility feature (there was an accessibility feature at the location of the project)

Description of modification and reason for request *(PROWAG 202.3.1: Where existing physical constraints make it impractical for altered elements, spaces, or facilities to fully comply with the requirements for new construction, compliance is required to the extent practical within the scope of the project. Existing physical constraints include, but are not limited to, underlying terrain, right-of-way availability, underground structures, adjacent developed facilities, drainage, or the presence of a notable natural or historic feature)*:

Mitigation for modification *(How does the design strategy accomplish accessibility to the maximum extent practical?):*

Supporting documentation *(photos showing features requiring exception, plan sheets, other items that support the need for the exception)*:

Submitted By

Name:

Signature:

Date:

Space provided for Engineer of Record stamp.

City Use Only

Approved by the City Engineer or their designee:

Name and Title:

Signature:

Date:

WORK ZONE SPEED REDUCTION REQUEST FORM

City of Oregon City

Temporary Speed Reduction Request

City Use Only
Reference #:

Request submitted by (name, title, contact email and phone number):

Engineer of Record (License number):

Date:

PROJECT INFORMATION

Project name:

Project Start Date:

Street Name:	Start and End Mile Post:

City map and tax lot number(s):

EXISTING STREET INFORMATION

Functional classification of road:

Posted speed:

Annual Average Daily Traffic (AADT):

Additional notes on street features (e.g., limited sight distance due to horizontal/vertical alignments, etc.):

DESCRIPTION OF NEED

Describe in detail the scope or work, and condition or operations that would merit a construction speed reduction. Identify portion(s) of the traffic control plan that would benefit from a speed reduction.

REQUESTED SPEED REDUCTION

Describe the speed reduction requested for each condition or operation and provide the location of the request, including beginning and ending mileposts.

TIMING

Describe when the condition or operation will be in place using the stage/phase, specific activity, project milestone, or time of day.

FACTORS

Select the work type and factor(s) for the construction speed zone reduction and provide explanation.

General Conditions:

Temporary horizontal curve is designed and includes an advisory speed >10 mph below pre-construction posted speed.

Reduced safe speed for stopping sight distance.

Condition conflicts wit normal driver expectancy.

Shoulder Activity:

Uninterrupted traffic flow with workers present for extended periods, with 10 feet of the traveled way, unprotected by barrier.

Lane Encroachments, Centerline Encroachments, or Lane Closures:

Uninterrupted traffic flow with workers present for extended periods, with 10 feet of the traveled way, unprotected by barrier.

Barrier within 2 feet of the traveled way.

Pavement edge drop-off (>2 inches) within 2 feet of the traveled way.

Lane width reduction resulting in a lane width of $\leq$ 10 feet.

Temporary On-Site Diversion:

Temporary on-site diversion lane width $\leq$ 11 feet.

Advisory speed for temporary on-site diversion's horizontal curvature >10 mph below the pre-construction posted speed.

Submitted By

Name:	*Space provided for Engineer of Record stamp.*
Signature:	
Date:	

City Use Only

Approved by the City Engineer or their designee:

Name and Title:

Signature:

Date:

APPENDIX C—CITY WEBSITES AND CHECKLISTS

Websites and checklists associated with the *Standards* are provided below with associated sections in the *Standards.*

Section 2.2: Permitting/Approval Process

City Permits and Associated Checklist Information

https://www.orcity.org/1111/Permits
https://www.orcity.org/1065/Engineering-Development-Services-Checkli

Development Forms & Checklists
https://www.orcity.org/1058/Development-Forms-Checklists

Performance Bonds, Cost Estimates and Agreement Forms
https://www.orcity.org/1076/Performance-Guarantee

Engineering Fees
https://www.orcity.org/1088/Engineering-Fees

Section 2.3 Construction Inspection

Private Development Minimum Inspection Requirements
https://www.orcity.org/1072/Inspection-Observation-Minimum-Guideline

Section 3.4 Intersections

ADA Design Review Checklist—Medians/Traffic Islands
https://dochub.clackamas.us/documents/drupal/6d27b366-4418-4dda-b3b9-d8bfc22161d1

Section 4.1 Pedestrian Design

Clackamas County ADA Design Review Checklist—Sidewalk/Multiuse Path
https://dochub.clackamas.us/documents/drupal/b4efebc9-754d-4506-89bd-6b09660384dc

Clackamas County ADA Assessment Checklist—Curb Ramps
https://dochub.clackamas.us/documents/drupal/18d3d081-2838-4186-8010-e5c690778f1f