Washington State Department of Transportation

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What's Changed?
See the back of this form for a summary description of the major policy changes.

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Instructions:
Page numbers and corresponding sheet-counts are given in the table below to indicate portions of the *Design Manual* that are to be removed and inserted to accomplish this revision.

Chapter	Remove		Insert	
	Page #s	**Sheets**	**Page #s**	**Sheets**
Letter's List	N/A	N/A	N/A	1
Contents	1–27	14	1-23	12
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Chapter	Remove		Insert	
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340 – Minor Operational Enhancement Projects	340-1 – 340-13	7	340-1 – 340-15	8
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520 – Design of Pavement Structures	520-1 – 520-14	7	520-1 – 520-14	7
530 – Geosynthetics	530-1 – 530-4	2	530-1 – 530-4	2
640 – Geometric Cross Section	640-1 – 640-2	1	640-1 – 640-2	1
642 – Superelevation	642-1 – 642-15	8	642-1 – 642-16	8
820 – Signing	820-1 – 820-9	5	820-1 – 820-10	5
840 – Illumination	840-1 – 840-41	21	840-1 – 840-44	22
910 – Intersections At Grade	910-1 – 910-40	20	910-1 – 910-49	25
915 – Roundabouts	915-1 – 915-2	1	915-1 – 915-2	1
1435 – Managed Access	1435-1 – 1435-14	7	1435-1 – 1435-17	9
Index	1-18	9	1-18	9

SUMMARY OF CHANGES – NOVEMBER 2007

NOTEWORTHY CHANGES

110 – Design-Build Projects (NEW): Emphasizes that the *Design Manual* and design documentation requirements apply to design-build projects.

330 – Design Documentation, Approval, and Process Review: Added guidance to 330.08 and 330.09 related to design-build projects and WSDOT's design milestones, as well as several other changes throughout the chapter.

430 – Modified Design Level: 430.03(4), Superelevation, revised to 2004 AASHTO values and to allow ball bank analysis (related to the larger revision in Chapter 642).

510 – Soils, Rock, and Surfacing Materials: Rewritten to coincide with the *Geotechnical Design Manual*. Emphasizes project-level coordination.

520 – Design of Pavement Structure: Updated reference to the WSDOT Pavement Policy.

640 – Geometric Cross Section: Clarified statement about cross slopes in 640.04.

642 – Superelevation: Revised to incorporate 2004 AASHTO values. Clarified the selection of the superelevation chart.

820 – Signing: Rewritten to incorporate *Design Manual Supplement* "Overhead Sign Illumination" and other changes.

840 – Illumination: Rewritten to reflect the current requirements of the National Electrical Code (NEC) and highway design, to correct inconsistencies revealed in WSDOT Illumination training, and to incorporate *Design Manual Supplement* "Overhead Sign Illumination." Figures have been reordered and emphasis is made on the minimum number of luminaires required for illumination design areas.

910 – Intersections At Grade: Revised guidance requires the State Traffic Engineer's approval for new rural expressway intersections. Changes to sight distance requirements include: new intersections located where stopping sight distance exists; provide stopping sight distance to sidewalks at crosswalks; removes 2 seconds from the t_g factor (see Fig 910-22a); added intersection configurations; and added nongeometric considerations.

915 – Roundabouts: Deleted first sentence of second paragraph in 915.01 (there are no revision marks with this deletion).

1435 – Managed Access: Rewritten/updated to provide statewide consistency regarding managed access.

ADDITIONAL INFORMATION

With this revision, the *Design Manual* is starting its change to a new single-column format, which makes it easier to read online and is consistent with most other WSDOT manuals. Most of the chapters in this revision have been reformatted to the new style. Some chapters are simply being reprinted in the new layout and the footer will say (Reformatted Only).

- **Revision Marks:** Underlines and side bars are often used as a convenience to show designers what has changed. Rewritten chapters (510, 820, 840, and 1435) have no revision marks; however, a new date appears in the footer. In other cases, every attempt has been made to highlight policy changes using revision marks.

- **Web Page Updates:** If you use the Design Policy or the Project Development Internet pages, note that those web addresses are changing. When completed, the updated links will be:

  Design Policy Page:
  www.wsdot.wa.gov/design/policy

  Project Development Page (contains the Design Documentation Checklist):
  www.wsdot.wa.gov/design/projectdev

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Washington State
Department of Transportation

TECHNICAL MANUAL

Design Manual

M 22-01.02

November 2007

Environmental and Engineering Programs

Design Office

Americans with Disabilities Act (ADA) Information

Materials can be provided in alternative formats: large print, Braille, cassette tape, or on computer disk for people with disabilities by calling the Office of Equal Opportunity (OEO) at 360-705-7097. Persons who are deaf or hard of hearing may contact OEO through the Washington Relay Service at 7-1-1.

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Washington State Department of Transportation

Design Manual Supplements and Instructional Letters

November, 2007

In Effect	Chapter	Date	Type	Subject/Title
No Yes	820 850	8/5/2005	DM Supplement	Overhead Sign Illumination (Lighting)
Yes	860	12/30/2005	DM Supplement	Systems Engineering for Intelligent Transportation Systems
Yes	1360	8/06/2007	DM Supplement	Public Art

Notes:

- Changes since the last revision to the *Design Manual* are shown in bold print.
- The listed items marked *yes* have been posted to the web at the following location:

Contents

Division 4 Project Design Criteria

Division 5 Soils and Paving

Division 6 Geometrics

Division 10 Auxiliary Facilities

Division 13 Roadside Development

Division 14 Right of Way and Access Control

Figures

Division 4 Project Design Criteria

Division 5 Soils and Paving

Division 6 Geometrics

Division 9 Interchanges and Intersections

Division 10 Auxiliary Facilities

Division 11 Structures

Chapter 110 Design-Build Projects

110.01 General

This chapter emphasizes that the *Design Manual* applies to the delivery methods of all WSDOT capital projects, including design-build projects. Certain terms are defined herein to coincide with WSDOT design-build project delivery; however, it is beyond the scope of this manual to extensively define design-build projects. Design-build projects are based on their own contractual documents, such as a Request for Proposal (RFP), which present directive language intended to legally define the project and identify requirements and controls, roles and responsibilities, and procedures and outcomes.

Design-build is a method of project delivery in which WSDOT executes a single contract with one entity (the design-builder) for design and construction services to provide a finished product. In a traditional WSDOT design-bid-build contract, the design process is completed independent of the construction contract. Chapter 150 provides background on this traditional delivery method. Note that much of Chapter 150 also applies to design-build projects, particularly the discussions on project planning and preliminary design, since those functions typically occur prior to hiring a design-builder.

Delivering a project using design-build contracting eliminates *very few steps* when compared to the typical WSDOT design-bid-build process. The same project work tasks and products are typically required whether performed by WSDOT or the design-builder. The timing, order, and level of task detail performed are what make design-build contracting different than design-bid-build. The design-build process may shift many tasks and responsibilities from WSDOT to the design-builder depending on the project's scope risk analysis. The shift changes the order and development detail of the tasks and thus must be reflected in the process through contractual documents.

According to state law, to be considered for design-build designation in Washington State, a project must be greater than $10 million and provide the opportunity for one of the following:

- Highly specialized construction activities requiring significant input into the design
- Greater innovation and efficiencies between the designer and the builder
- Significant savings in project delivery time

110.02 References

(1) Design-Build Guidance

The Design-Build Guidance Statements listed below are available at:
www.wsdot.wa.gov/Projects/delivery/designbuild/

Design Quality Control, Quality Assurance, and Quality Verification on Design-Build Projects

Project Basic Configuration Development

Use of Reference Documents on Design-Build Projects

110.03 Terminology and Language Used

(1) Application of Terminology

Several terms are encountered throughout the *Design Manual* that are not normally applicable to design-build project delivery. They are expanded in this chapter to provide appropriate meaning for design-build projects and design-build personnel. It is intended that design-build personnel acknowledge these expanded meanings and that they apply throughout the manual, eliminating the need to restate them each time they are encountered.

design-builder The firm, partnership, joint venture, or organization that contracts with WSDOT to perform the work.

designer This term applies to WSDOT design personnel. Wherever "designer" appears in this manual, design-build personnel shall deem it to mean: Engineer of Record, Design Quality Assurance Manager, design-builder, or any other term used in the design-build contract to indicate design-build personnel responsible for the design elements of a design-build project, depending on the context of information being conveyed.

Project Engineer This term applies to WSDOT personnel. Wherever "Project Engineer" appears in this manual, the design-builder shall deem it to mean "Engineer of Record."

Request for Proposal (RFP) The document package issued by WSDOT requesting submittal of proposals for the project and providing information relevant to the preparation and submittal of proposals, including the Instructions to Proposers, Contract Documents, bidding procedures, and Reference Documents.

Additional terms are presented in each chapter of the *Design Manual*.

(2) Language Used for Design Flexibility

The *Design Manual* is primarily written for WSDOT engineering personnel; however, design-builders, local agencies, and developers also use it for state and local agency projects. As stated in the Foreword, the intent of this manual is to provide recommended values for critical dimensions. Flexibility is permitted to encourage independent design tailored to individual situations. However, when flexibility is applied to a proposed design and the critical dimensions do not meet *Design Manual* criteria, additional documentation is required to record the decision-making process.

With the exclusion of this chapter, the *Design Manual* is intentionally written to avoid or minimize the use of directive words like "shall" and "should" in order to retain this important flexibility for the larger set of users.

In the case of design-build projects, design flexibility applies to the extent allowed by the contract. The design-builder shall refer to the project-specific RFP for design guidance. The RFP will identify design decisions and provide technical specifications relating to the project's design.

110.04 Design and Documentation Responsibility

In the traditional design-bid-build format, WSDOT bears the entire responsibility and risk for any design-related issues. As the owner, all responsibility for design decisions and conformance to standards rests with WSDOT.

In design-build, many design responsibilities shift to the design-builder once the Notice to Proceed is issued. WSDOT is still responsible for establishing the scope, performance measurements, and existing conditions of the site as part of preliminary design. Any preliminary design done by WSDOT would be filed and documented in the Design Documentation Package (DDP) and/or the Project File (PF), which are provided to the selected design-builder to maintain throughout the design-build project design phase and then returned to WSDOT for retention.

Design guidance applies to design-build projects

It is important to note that design guidance presented in this manual has valid application based not on delivery method, but on roadway classifications, traffic volumes, and other route characteristics discussed in Chapter 325 (and other chapters). For example, a design-build Improvement project on an Interstate facility would be based on the Interstate matrices in Chapter 325, which direct the designer/Engineer of Record to apply the appropriate Design Level presented in Division 4.

Design documentation is required on design-build projects

It is also important to specify that design documentation is a requirement for WSDOT Improvement projects, regardless of delivery method. WSDOT still holds the valid requirement to have an organized design documentation file as well as as-constructed plans for future reference after the project is built.

Plan accuracy, conformance with established design guidelines, and constructibility of the project rests with the design-builder.

The DDP and the PF include all the elements identified in the project RFP. The RFP specifies various submittals to WSDOT of the DDP and PF, identifying how each item will be submitted (report, plan sheet element, Design Parameter element, etc.) and who is responsible for the development status (such as *complete*, *in progress*, or *not started*) of each item. The RFP also indicates that some of the DDP and PF items have components that were started by WSDOT and that the design-builder shall complete or update the item(s). It is the design-builder's responsibility to obtain copies of the information from WSDOT for use in completing the DDP and PF items.

The DDP and the PF require retention of original, signed documents—not copies.

The RFP typically specifies that the design-builder shall provide WSDOT with updates to the DDP and PF items throughout construction of the project.

For further guidance on design documentation and WSDOT acceptance thereof, see Chapter 330, the project RFP, and the Design Documentation Checklist.

With the exclusion of this chapter, the *Design Manual* is intentionally written to avoid or minimize the use of directive words like "shall" and "should" in order to retain this important flexibility for the larger set of users.

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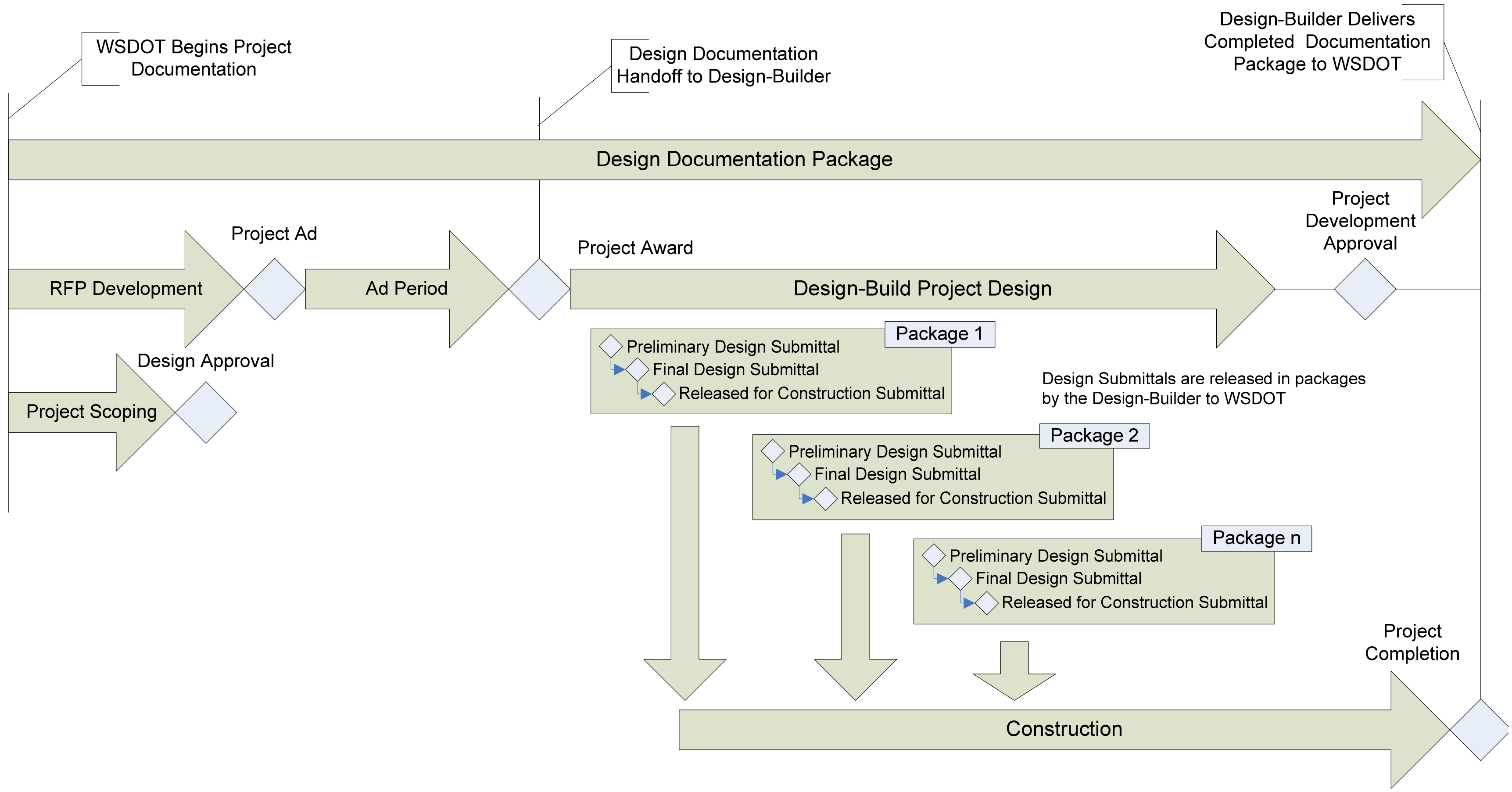


Notes:

The Design Documentation Package (DDP) is started by WSDOT during scoping/pre-RFP design. The design-builder completes the DDP as the project proceeds.

The design-builder shall refer to the RFP for specific review and approval processes. The RFP will specify procedures for design submittals, including notifications to WSDOT and the time allowed for reviews.

WSDOT will review design submittals for conformance with requirements of the contract.

Design Documentation Sequence for Typical Design-Build Project
Figure 110-1

Chapter 141 Project Development Roles and Responsibilities for Projects With Structures

141.01 General

This chapter presents the project development process used by WSDOT, the Regions, and the Headquarters (HQ) Bridge and Structures Office to determine the roles and responsibilities for projects with structures during the project development phase of a project. This chapter complements the Project Management Online Guide:
www.wsdot.wa.gov/Projects/ProjectMgmt

For design procedures, see Division 11 chapters and the *Bridge Design Manual*.

The primary objective of this process is to provide a consistent means of selecting a bridge design team to perform all or part of the structural design work, whether it be a consultant or the HQ Bridge and Structures Office.

If the local agency will be requesting any services from WSDOT, the local agency will contact WSDOT's Local Programs Engineer, who will help define the level of WSDOT's involvement in design and construction.

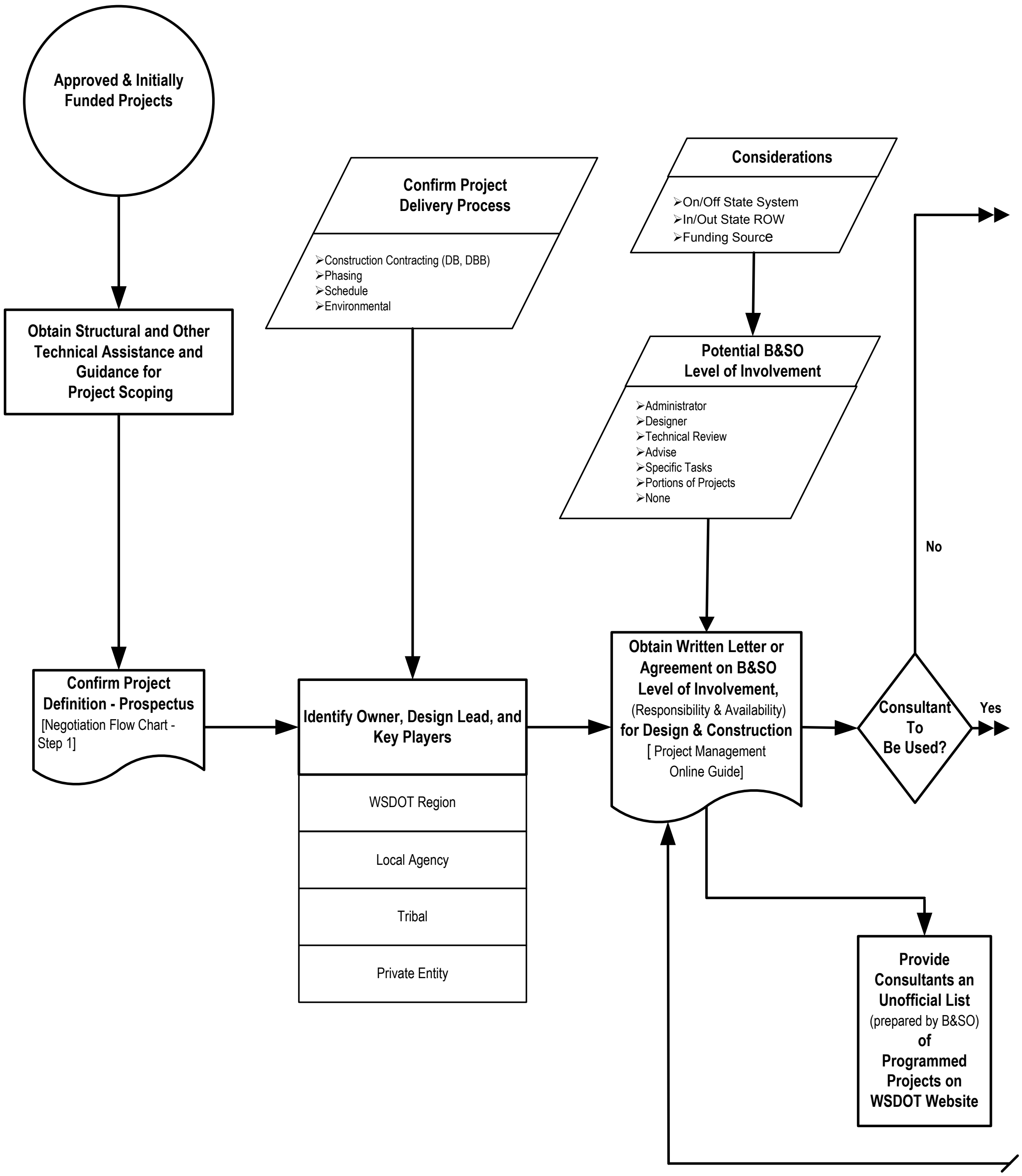
141.02 Procedures

The flow diagram (see Figure 141-1) begins at the left with the initial approval and funding of the project and ends at the right with the start of the project delivery process.

After a project is programmed, WSDOT is tasked with confirming the project scope and defining the structural team's level of involvement in design and construction. If a consultant is not used, all bridge design work will be performed by the HQ Bridge and Structures Office. If a consultant is used, the Region and the HQ Bridge and Structures Office will determine the level of involvement and responsibility for the design.

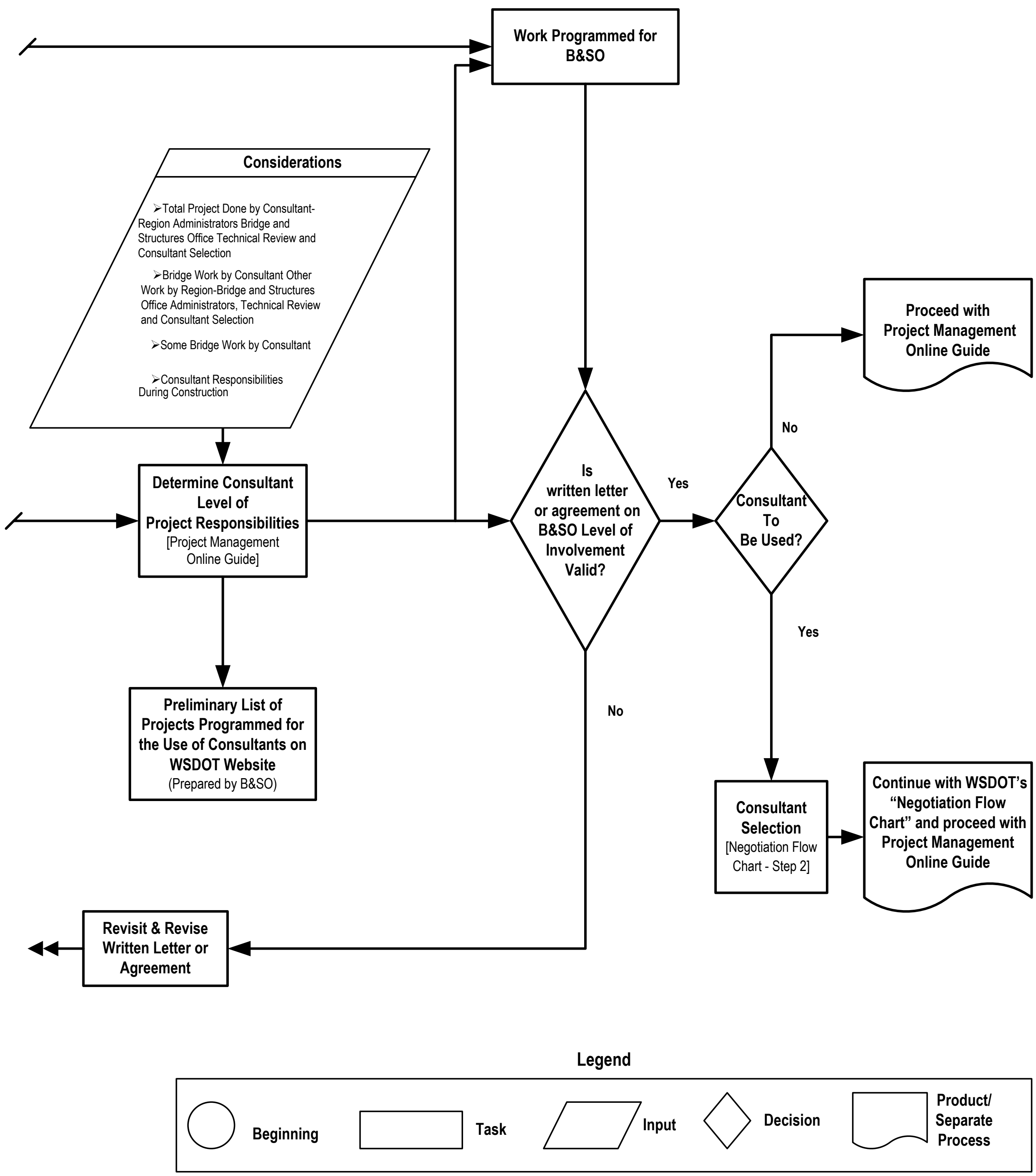
Agreements defining the level of involvement and responsibility will be developed and executed between the Region office responsible for project development and the HQ Bridge and Structures Office, and the appropriate project delivery process will be implemented.

More information on this process and the desired outcomes is available on the HQ Bridge and Structures Office's home page: www.wsdot.wa.gov/eesc/bridge/



FHWA - Federal Highway Administration
WSDOT - Washington State Department of Transportation
DB - Design Build
DBB - Design Bid Build
B&SO - Bridge & Structures Office
ROW - Right of way

Determination of the Roles and Responsibilities for Projects With Structures (Project Development Phase)
Figure 141-1



Determination of the Roles and Responsibilities for Projects With Structures (Project Development Phase)
Figure 141-1 (continued)

Chapter 210 Public Involvement and Hearings

210.01 General

WSDOT strives to involve the public in transportation decision making and make transportation decisions based on the public's best interests.

One of the best ways to achieve WSDOT's goals is to collaborate with the public, community groups, and various agencies. These participants often have differing, sometimes conflicting, perspectives and interests. In addition, many participants and organizations are not able to spend the time and effort required to fully engage in transportation decision making. Despite these challenges, active collaboration:

- Gives us access to important information and ideas that might otherwise be overlooked.
- Puts WSDOT in a position to help solve problems and resolve conflicts.
- Creates a sense of community.
- Fosters greater acceptance of projects.
- Helps build and sustain a credible and trusting relationship between WSDOT and the public.
- Ultimately leads to transportation improvements that better meet public needs and desires.

Public involvement techniques are used to collaborate with the public when making decisions about a transportation project or issue. Examples include more formal techniques like public hearings, direct mail, and presentations to city councils and legislators; and less formal but equally important techniques, like telephone and e-mail discussions, meetings with community groups, media relations, project Internet pages, and more.

Law requires that many types of capital transportation projects undergo a formal public hearing process. The primary focus of this chapter is the legal procedures for public hearings. The basics of public involvement plans are briefly discussed and supplemented with referrals to WSDOT's communications resources to further guide their development and implementation.

210.02 References

(1) Federal/State Laws and Codes

USC Title 23 – Highways, Sec. 128, Public Hearings

USC Title 23 – Highways, Sec. 771.111, Early coordination, public involvement, and project development

23 CFR 200.7 – FHWA Title VI Policy

23 CFR 200.9(b)(4) – Develop procedures for the collection of statistical data of participants and beneficiaries of state highway programs

23 CFR 200.9(b)(12) – Develop Title VI information for dissemination to the general public

23 CFR 450.212 – Public involvement

28 CFR Part 35 – Nondiscrimination on the basis of disability in state and local government services

49 CFR Part 27 – Nondiscrimination on the basis of disability in programs or activities receiving federal financial assistance

Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 36, Appendix A)

Civil Rights Restoration Act of 1987

Title VI of the Civil Rights Act of 1964

Section 504 of the Rehabilitation Act of 1973, as amended

Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 13166 – Improving Access to Services for Persons with Limited English Proficiency

RCW 47.50, Highway Access Management

RCW 47.52, Limited Access Facilities

(2) Design Guidance

Design Manual, Chapter 220, for environmental references and Division 14 chapters for access control and right of way references

Environmental Procedures Manual, M 31-11
www.wsdot.wa.gov/fasc/EngineeringPublications/Manuals/EPM/EPM.htm

WSDOT HQ Access and Hearings Engineer, (360) 705-7251, and Internet page:
www.wsdot.wa.gov/EESC/Design/Access/default.htm

(3) Supporting Information

Improving the Effectiveness of Public Meetings and Hearings, Federal Highway Administration (FHWA) Guidebook:
www.ntl.bts.gov/card_view.cfm?docid=4020

Public Involvement Techniques for Transportation Decision-Making, FHWA September 1996; provides tools and techniques for effective public involvement:
www.fhwa.dot.gov/reports/pittd/cover.htm

Relocation brochures:
www.wsdot.wa.gov/realestate/

WSDOT *Communications Manual* for public involvement:
wwwi.wsdot.wa.gov/Communications/

WSDOT Context Sensitive Solutions Internet site and national context sensitive site:
www.wsdot.wa.gov/biz/csd/ExecutiveOrder.htm
www.contextsensitivesolutions.org/

210.03 Definitions

affidavit of publication A notarized written declaration stating that a ***notice of hearing*** (or a ***notice of opportunity for a hearing***) was published in the legally prescribed manner.

affidavit of service by mailing A notarized written declaration stating that the limited access hearing packet was mailed at least 15 days prior to the hearing and entered into the record at the hearing.

auxiliary aids and services (1) Qualified interpreters, notetakers, transcription services, written materials, telephone handset amplifiers, assistive listening devices, assistive listening systems, telephones compatible with hearing aids, open and closed captioning, telecommunications devices for deaf persons (TDDs), videotext displays, or other effective methods of making aurally delivered materials available to individuals with hearing limitations; (2) Qualified readers, taped texts, audio recordings, Brailled materials, large print materials, or other effective methods of making visually delivered materials available to individuals with visual impairments; (3) Acquisition or modification of equipment or devices; (4) Other similar services and actions; and (5) Providing and disseminating information, written materials, and notices in languages other than English, where appropriate.

context sensitive solutions (CSS) A collaborative, interdisciplinary approach used to develop a transportation project that fits its physical surroundings and is responsive to the community's scenic, aesthetic, social, economic, historic, and environmental values and resources, while maintaining safety and mobility. CSS is an approach that considers the total context within which a transportation improvement project will exist (see 210.02 and 210.04(2)).

court reporter A person with a license to write and issue official accounts of judicial or legislative proceedings.

Findings and Order A document containing the findings and conclusions of a limited access hearing approved by the Environmental and Engineering Programs Director (see 210.09(12) and (13)).

hearing An assembly to which the public is invited to attend and participate. Types of hearings include:

- ***administrative appeal hearing*** A formal process whereby a property owner may appeal WSDOT's implementation of access management legislation. The appeal is heard by an administrative law judge (ALJ), who renders a decision. (See Chapter 1435 for administrative appeal hearing procedures.)
- ***combined hearing*** A hearing that is held when there are public benefits to be gained by combining environmental, corridor, design, and/or limited access subjects.

- ***corridor hearing*** A formal or informal hearing that presents the corridor alternatives to the public for review and comment before a commitment is made to any one route or location. This type of hearing is beneficial on existing corridors with multiple improvement projects programmed over a long duration.
- ***design hearing*** A formal or informal hearing that presents the design alternatives to the public for review and comment before the selection of a preferred alternative.
- ***environmental hearing*** A formal or informal hearing documenting that social, economic, and environmental impacts have been considered and that public opinion has been solicited.
- ***limited access hearing*** A formal hearing that gives local public officials, owners of abutting properties, and other interested persons an opportunity to be heard about the limitation of access to the highway system.
- ***formal hearing format*** A hearing that is conducted by a moderator using a formal agenda, overseen by a hearing examiner, and recorded by a court reporter, as required by law. Limited access hearings require the use of the formal hearing format (see 210.05(3)).
- ***informal hearing format*** A hearing where oral comments are recorded by a court reporter, as required by law. An informal hearing often uses the "open house" format (see 210.04(1)(a)). A formal agenda and participation by a hearing examiner are optional.

hearing agenda Used with formal hearings; an outline of the actual public hearing elements. (See 210.05(9)(a) for contents.)

Hearing Coordinator The Access and Hearings Manager within the HQ Access and Hearings Unit, (360) 705-7251.

hearing examiner An administrative law judge from the Office of Administrative Hearings, or a WSDOT designee, appointed to moderate a hearing.

hearing script A written document of text to be presented orally by department representatives at the hearing.

hearing summary Documentation prepared by the Region and approved by Headquarters that summarizes environmental, corridor, and design hearings. (See 210.05(10) for content requirements.)

hearing transcript A document prepared by the court reporter that transcribes verbatim all oral statements made during the hearing, including public comments. This document becomes part of the official hearing record.

NEPA National Environmental Policy Act.

notice of appearance A form provided by WSDOT for anyone wanting to receive a copy of the Findings and Order and the adopted *Limited Access Plan* (see 210.09(3) and (8)).

notice of hearing (or ***hearing notice)*** A published advertisement that a public hearing will be held.

notice of opportunity for a hearing An advertised offer to hold a public hearing.

order of hearing An official establishment of the hearing date by the State Design Engineer.

prehearing packet A concise, organized collection of all necessary prehearing data, prepared by the Region and approved by the HQ Access and Hearings Engineer prior to the hearing (see 210.05(4) and Figure 210-3).

project management plan A formal, approved document that defines how the project is executed, monitored, and controlled. It may be in summary or detailed form and may be composed of one or more subsidiary management plans and other planning documents. For further information, see the Project Management Online Guide: www.wsdot.wa.gov/Projects/ProjectMgmt/Process.htm

public involvement plan A plan to collaboratively involve the public in decision making, tailored to the specific needs and conditions of the project, the people, and the communities it serves. It is often part of a broader communications plan.

relocation assistance program The purpose of the program, as defined in the *Right of Way Manual*, is to establish uniform procedures for relocation assistance that will assure legal entitlements and provide fair, equitable, and consistent treatment to persons displaced by WSDOT-administered projects.

résumé An official notification of action taken by WSDOT following adoption of a Findings and Order (see 210.09(14)).

SEPA State Environmental Policy Act.

study plan A term associated with environmental procedures, proposing an outline or "road map" of the environmental process to be followed during the development of a project that requires complex NEPA documentation. (See 210.06 and the *Environmental Procedures Manual*.)

210.04 Public Involvement

Developing and implementing an effective plan for collaboration with the public is critical to the success of WSDOT's project delivery effort. It provides an opportunity to understand and achieve diverse community and transportation goals. Transportation projects with high visibility or community issues or effects often attract the attention of a broad range of interested people. These types of projects will best benefit from early public involvement, which can influence the project's success and community acceptance.

Developing a profile (through demographic analysis) of the affected community is critical to achieving successful public involvement. This will enable the agency to tailor its outreach efforts toward the abilities/needs of the community. Individuals from minority and ethnic groups and low-income households, who are traditionally underserved by transportation, often find participation difficult. While these groups form a growing portion of the population, particularly in urban areas, historically they have experienced barriers to participation in the public decision-making process and are therefore underrepresented. These barriers arise from both the historical nature of the public involvement process and from cultural, linguistic, and economic differences. For example, a community made up of largely senior citizens (with limited mobility/automobile usage) may mean:

- Meetings/open houses are planned in locations easily accessible to them, such as senior centers and neighborhood community centers.
- Meetings are scheduled in the mornings or midday to accommodate individuals who prefer not to leave home after dark.

- Meetings are scheduled in the evenings to accommodate persons who work during the day.

A project's affected area might consist of a population that might be limited in speaking/understanding English. This may entail:

- Developing/disseminating materials in other languages, as appropriate.
- Having a certified translator on hand at the meetings.

Conducting a demographic profile should be the first order of business when developing a public involvement plan.

Effective public involvement must begin with clearly defined, project-related goals that focus on specific issues, specific kinds of input needed, and specific people or groups that need to be involved. The more detailed a public involvement plan, the greater its chances of obtaining information the agency can use in decision making. Extra effort may be needed to elicit involvement from people unaccustomed to participating, because they often have different needs and perspectives than those who traditionally participate in transportation decision making. They not only may have greater difficulty getting to jobs, schools, recreation, and shopping than the population at large, but also they are often unaware of transportation proposals that could dramatically change their lives. Many lack experience with public involvement, even though they may have important, unspoken issues that should be heard.

Current policies provide general guidelines that allow considerable flexibility. NEPA and SEPA environmental policies and procedures are intended to provide relevant environmental information to public officials, agencies, and citizens, and allow public input to be considered before decisions are made. There are also various other laws, regulations, and policies that emphasize this, including 23 CFR, Title VI of the Civil Rights Act, the Americans with Disabilities Act, and Executive Orders 12898 and 13166.

WSDOT's collaborative process with the public should be open, honest, strategic, consistent, inclusive, and continual. Initiating a project in an atmosphere of collaboration and partnership can go a long way toward providing equal opportunities for all parties (whether they are local, state, tribal, private, nonprofit, or federal) to participate in a project vision. This collaboration requires an intensive communications effort that is initiated during project visioning and extends through construction and eventual operation of the facility.

Department specialists in public communications, environmental procedures, traffic engineering, real estate services, and limited access control are routinely involved with public outreach efforts and project hearings. Depending on the scale and complexity of a project, the Region is encouraged to engage the participation of interdisciplinary experts when developing a public involvement plan and communicating project details. Agency representatives convey WSDOT's image to the public; therefore, they should be confident, well-informed, conscientious of their roles, and skillful communicators.

(1) Public Involvement Plan

The Region develops a public involvement plan for its own use and guidance. To engage the public, share the decision-making process, identify issues, and resolve concerns, the Region communicates with the affected community through group presentations, open house meetings, newspaper articles, fliers, and other methods. The public involvement plan includes methods that will elicit the best participation from the community, including traditionally underrepresented groups.

Developing an effective public involvement plan is a strategic effort. WSDOT must identify audiences, messages, strategies, and techniques that will meet the unique needs of a proposed transportation project, as well as the needs of the public.

The ultimate goal of the public involvement plan is to allow members of the public opportunities throughout the process to learn about the project, provide information and options, collaborate, and provide input intended to influence WSDOT decisions. The plan will outline ways to identify and involve the communities affected by the project; provide them with accessible information through reader-friendly documents, graphics, plans, and summaries; and involve them in decision making.

An effective public involvement plan:

- Is tailored to the project.
- Encourages interactive communication.
- Demonstrates to residents that their input is valued and utilized.
- Includes all affected communities.
- Identifies and resolves issues early in the project development process.
- Ensures public access to relevant and comprehensible information.
- Informs the public of the purpose, need for, and benefits of the proposed action.
- Informs the public about the process that will be used to make decisions.
- Gains public support.
- Provides equal opportunity, regardless of disability, race, national origin, color, gender, or income.

The Region Communications and Environmental offices can provide expertise in developing a public involvement plan tailored to a specific project. The HQ Access and Hearings Unit specializes in procedures for public hearings. The Real Estate Services Office can provide expertise regarding acquisition, relocation assistance, and other related programs. Enlisting the support of these groups is essential to the success of WSDOT projects.

WSDOT recognizes local, state, federal, and tribal staff and elected officials as active sponsors of proposed projects. Those officials might help develop and implement the public involvement plan. Early and continued contact with these resources is key to the success of a project.

The public involvement plan might include the following:

- Objectives
- Strategies
- Tactics (or a list of proposed activities)
- Proposed time schedule to accomplish each project

- Methods to track public comments
- Methods used to consider comments during the decision-making process, including follow-up procedures
- Personnel, time, and funds needed to carry out the plan
- Identification of the project partners and stakeholders

Early use of demographics can help identify the public to be involved. After identification, a variety of methods can be chosen to encourage the most effective public involvement. The public involved (affected directly or indirectly) might include any or all of the following:

- Adjacent property owners and tenants
- Indian tribes
- Low-income groups
- Minority groups
- Cooperating and participating agencies
- Local, state, and federal government staff and elected officials
- Community groups, such as clubs, civic groups, business groups, environmental groups, labor unions, disability advocacy groups, and churches
- Commuters and the traveling public
- Emergency and utility service providers
- Adjacent billboard owners and clients
- The general public and others known to be affected
- Others expressing interest

The following are examples of common outreach methods:

- Public meetings and open house meetings
- Drop-in information centers or booths
- Advisory committee meetings
- Design workshops
- Meetings with public officials
- Individual (one-on-one) meetings
- Meetings with community groups
- Project Internet pages
- WSDOT project e-mail alert lists
- Surveys
- Questionnaires
- Telephone hot lines
- Using established media relations and contacts
- Internet blogs
- Direct mail
- Individual e-mails and letters
- Advisory committees and groups
- Public hearings

(a) **Public Meetings and Open Houses**. Public meetings range from large informational workshops to small groups using one-on-one meetings with individuals. They are less formal than hearings. The Region evaluates the desired outcome from a meeting and how the input will be tracked, and then plans accordingly.

- Open house meetings can be effective for introducing a project to the public and stimulating an exchange of ideas.
- Small meetings are useful for gaining information from community groups, underrepresented groups, neighborhood groups, and advisory committees.
- Workshop formats, where large groups are organized into small discussion groups, serve to maximize the participation of all attendees while discouraging domination by a few groups or individuals.

(b) **Follow-Up Procedures**. Effective public involvement is an ongoing collaborative exchange, and it is necessary to provide follow-up information several times during a large project to maintain a continuing exchange of information.

At significant stages, the Region provides a wide range of general information about the project. Follow-up information conveys, as accurately as possible, how public input was considered during development of the project.

It may become necessary to revise the public involvement plan as the project evolves, conditions change, oppositional groups emerge, or new issues arise. Sometimes innovative methods must be used to ensure the inclusion of affected community members. This is especially important for underrepresented groups such as minority and low-income groups and in communities where a significant percentage of the affected population does not speak English. Consider the need for translators, interpreters, and providing written information in languages other than English. Reference to information on limited English proficiency is provided in 210.04(2)(d). A resident advisory committee can often help identify community issues and concerns as well as recommend effective methods for public involvement.

(2) Public Involvement References

There are a number of publications, references, and training courses available to assist the Region in developing public involvement plans for their projects. The following are recommended references:

(a) **WSDOT Project Management Online Guide**. A project's public involvement plan is an essential element of the overall project management plan. The *WSDOT Project Management Online Guide* is an Internet resource intended to support delivery of transportation projects through effective project management and task planning. The guide includes best practices, tools, templates, and examples to enhance the internal and external communication processes. The process, tools, and templates can be found at: www.wsdot.wa.gov/Projects/ProjectMgmt

(b) **WSDOT Communications Intranet Page**. The *WSDOT Communications Intranet Page* provides guidance for effective communications. This resource includes a "*Communications Manual*," key messaging, and WSDOT's communications philosophy, and is an excellent resource for developing a public involvement plan: wwwi.wsdot.wa.gov/communications/

(c) **Context Sensitive Solutions and Community Involvement**. A proposed transportation project must consider both its physical aspects as a facility serving specific transportation objectives and its effects on the aesthetic, social, economic, and environmental values within a larger community setting. Context Sensitive Solutions is a collaborative, interdisciplinary approach that involves the community in the development of a project. WSDOT's philosophy encourages collaboration and consensus-building as highly advantageous to all parties to help avoid delays and other costly obstacles to project implementation. WSDOT endorses the Context Sensitive Solutions approach for all projects, large and small, from early planning through construction and eventual operation of the facility. For further information, see WSDOT Executive Order E-1028.01 on Context Sensitive Solutions:
www.wsdot.wa.gov/biz/csd/ExecutiveOrder.htm
wwwi.wsdot.wa.gov/docs/

Additionally, the following WSDOT HQ Design, Highways and Local Programs, and Environment Internet pages offer an excellent array of publications, training, and resources for public involvement:
www.wsdot.wa.gov/eesc/design/Urban/Default.htm
www.wsdot.wa.gov/TA/Operations/LocalPlanning/contextsensitivesolutions.html
www.wsdot.wa.gov/TA/Operations/LocalPlanning/Research.html
www.wsdot.wa.gov/Environment/EJ/

(d) **Federal Highway Administration References**

Improving the Effectiveness of Public Meetings and Hearings, FHWA Guidebook. Provides a variety of techniques and processes based on the practical community involvement experience of its authors:
www.ntl.bts.gov/card_view.cfm?docid=4020

Public Involvement Techniques for Transportation Decision-Making, FHWA September 1996, provides tools and techniques for effective public involvement:
www.fhwa.dot.gov/reports/pittd/cover.htm

How to Engage Low-Literacy and Limited-English-Proficiency Populations in Transportation Decision Making, FHWA 2006, provides tools and techniques for identifying and including these populations:
www.fhwa.dot.gov/hep/lowlim/index.htm

23 CFR 630, Subpart J, Final Rule on Work Zone Safety and Mobility, Work Zone Public Information and Outreach Strategies. The following Internet guide is designed to help transportation agencies plan and implement effective public information and outreach campaigns to mitigate the effects of road construction work zones:
www.ops.fhwa.dot.gov/wz/info_and_outreach/index.htm

(3) Legal Compliance Statements

All public announcements shall include the required statements relative to the Americans with Disabilities Act (ADA) and Title VI legislation. The Region Communications Office and the WSDOT Communications Office Intranet page can provide the current version of both of these statements for legal compliance.

(a) **ADA Compliance**. The ADA and Section 504 of the Rehabilitation Act require WSDOT to inform the general public of its obligation to ensure that programs and activities are accessible to and usable by persons with disabilities. For publications, the notice must provide a way to obtain the materials in alternative formats (such as Braille or taped). For public meetings and hearings, the notice must inform the public that reasonable accommodations can be made for a variety of needs.

The public meeting/hearing facility must always meet minimum ADA accessibility standards (such as ramps for wheelchair access, wide corridors, and accessible rest rooms). Additionally, WSDOT must provide, upon request, reasonable accommodations to afford equal access to information, meetings, etc., to persons with disabilities. Reasonable accommodations can include services and auxiliary aids (such as qualified interpreters, transcription services, assistive listening devices for persons who are deaf or hard of hearing, or additional lighting for persons with visual impairments.) The WSDOT Office of Equal Opportunity can provide assistance for reasonable accommodation provisions.

(b) **Title VI**. Title VI of the Civil Rights Act of 1964 requires that WSDOT inform the general public of its obligation to ensure that no person shall, on the grounds of race, color, national origin and/or sex, be excluded from participation in, be denied the benefits of, or be otherwise discriminated against under any of its federally funded programs and activities.

210.05 Public Hearings

By state and federal law, certain capital transportation projects propose actions that require a public hearing. The remainder of this chapter provides guidance on public hearing procedures.

The common types of public hearings associated with WSDOT projects include environmental, design, corridor, and limited access hearings, which are discussed in subsequent sections. The guidance in this chapter discusses project actions that trigger a hearing and the procedures for effectively planning, conducting, and completing the hearing process.

While there are several different types of public hearings, they follow similar steps for planning and preparation of project materials and information. These steps facilitate efficient reviews and approvals required for the hearing to proceed as planned. Special attention to the scheduling of deliverables and notifications leading up to the hearing help the process progress smoothly.

Public hearing formats are either formal or informal. Limited access hearings are always conducted as formal hearings. An informal process can be used for most other hearings.

Hearings are often conducted in accordance with NEPA/SEPA procedures for public involvement during the environmental documentation phase of the project. The Region reviews the requirements for hearings during the early stages of project development and before completion of the draft environmental documents.

(1) General Information for Hearings

Preparing for and conducting a successful public hearing requires considerable coordination and effort. You can best do this by establishing a support team to identify and carry out the tasks and arrangements. It is crucial to identify and schedule tasks and deliverables well in advance of a public hearing. A project team might enlist the support of Region specialists from Communications, Environmental, Government Relations, Right of Way, Real Estate, and Traffic offices, as well as the HQ Hearing Coordinator, HQ NEPA Policy staff, Office of Equal Opportunity, and others involved with the project. The following figures and narrative help identify whether a public hearing is required and how to prepare.

(2) Selecting the Hearing Type

By law, certain project actions or proposed conditions require that specific types of public hearings are conducted. Figure 210-1 identifies project conditions and their associated hearing requirements. If one or more of the conditions in Figure 210-1 occurs, a notice of opportunity for a hearing is required by federal and state law (USC Title 23 §771.111 and RCW 47.52) and by WSDOT policy. Consult the Hearing Coordinator in the HQ Access and Hearings Unit, as well as project environmental specialists, for hearing requirements.

(3) Selecting the Hearing Format

The types of public hearing formats used by WSDOT are known as formal and informal. Hearing formats are different than hearing types. In some cases the hearing type will dictate the required format, such as with limited access hearings. The following text and Figure 210-2 provide guidance on formats.

(a) **Formal Hearings**. A formal hearing is conducted by a moderator using a formal agenda, overseen by a hearing examiner, and recorded by a court reporter, as required by law. Limited access hearings and administrative appeal hearings require the use of the formal hearing format. For projects that require a formal public hearing, it is common for WSDOT to hold a public open house preceding the hearing.

The following are required for all formal hearings:

- Hearing notice with a fixed time and date (see 210.05(5) and (6))
- Fixed agenda and script
- Hearing examiner
- Hearing moderator (may be the hearing examiner)
- Court reporter
- Specified comment period
- Hearing summary (see 210.05(10))

In addition to providing oral comments, people can write opinions on comment forms available at or after the hearing and submit them before the announced deadline.

(b) **Informal Hearings**. An informal hearing is also known as an open format hearing. Individual oral comments are recorded by a court reporter. The presence of a hearing examiner and a formal agenda are optional.

These events are usually scheduled for substantial portions of an afternoon or evening so people can drop by at their convenience and fully participate. Activities usually include attending a presentation, viewing exhibits, talking to project staff, and submitting written or oral comments.

The following items are features of an open format (or informal) hearing:

- Open format hearings can be scheduled to accommodate people's work schedules.
- Brief presentations about the project and hearing process are advertised at preset times in the hearing notice. Presentations can be live, videotaped, or computerized.
- Agency or technical staff is present to answer questions and provide details of the project.
- Information is presented buffet-style, allowing participants access to specific information.
- Graphics, maps, photos, models, videos, and related documents are frequently used.
- People have the opportunity to clarify their comments by reviewing materials and asking questions before commenting.
- People can comment formally before a court reporter, or they can write opinions on comment forms and submit them before the announced deadline.

(4) Hearing Preparation

When Region staff has determined that a formal or informal public hearing will be held, they should contact the HQ Hearing Coordinator to discuss preliminary details. The HQ Hearing Coordinator specializes in assisting with preparations for the hearing and will usually attend. Other WSDOT groups involved with the project and tasked with developing and implementing the public involvement plan can assist with hearing preparations and provide assistance at the hearing.

The figures in this chapter can be used as checklists to identify important milestones and work products needed. Important elements include setting an initial target date for the hearing and agreement on staff roles and responsibilities at the hearing.

(a) **Setting the Hearing Date and Other Arrangements**. The State Design Engineer sets the hearing date at the recommendation of the HQ Hearing Coordinator. This is known as the order of hearing. Final arrangements for the hearing date can be handled by telephone or brief check-in meetings between the HQ Hearing Coordinator and the Region.

The Region proposes a hearing date based on the following considerations:

- Convenient for community participation. Contact local community and government representatives to avoid possible conflict with local activities. Consider times and locations that are most appropriate for the community.
- For corridor and design hearings, at least 30 days after circulation of the draft environmental impact statement (DEIS) or the published notice of availability of any other environmental document.

- In most cases, more than 45 days after submittal of the prehearing packet.

The Region makes other arrangements as follows:

- Reviews the location of the hearing hall to ensure it is easily accessed by public transportation (whenever possible), convenient for community participation, and ADA accessible.
- Arranges for a court reporter.
- Requests that the HQ Hearing Coordinator provide a hearing examiner for all limited access hearings and for other hearings, if desired.
- Develops a hearing agenda for all limited access hearings and for other types of hearings, if desired.
- If requested in response to the hearing notice, provides communication auxiliary aids and other reasonable accommodations required for persons with disabilities. Examples include interpreters for persons who are deaf; audio equipment for persons who are hard of hearing; language interpreters; and the use of guide animals and Braille or taped information for persons with visual impairments.
- All public hearings and meetings require the development of procedures for the collection of statistical data (race, color, sex, and national origin) of participants in, and beneficiaries of, state highway programs such as relocatees, impacted citizens, and affected communities. Public Involvement Forms should be available for meeting attendees to complete. The Public Involvement Form requests attendees to provide information on their race, ethnicity, national origin, and gender. The form is available in English, Spanish, Korean, Russian, Vietnamese, Tagalog, and Traditional and Simplified Chinese at: www.wsdot.wa.gov/oeo/titlevi.htm
- If demographics indicate that 5% or 1000 persons or more in the affected project area speak a language other than English, vital documents, advertisements, notices, newspapers, mailing notices, and other written and verbal media and informational materials may need to be translated into other languages to ensure that social impacts to communities and people are recognized and considered throughout the transportation planning and decision-making process. In addition, language interpreters may need to be present during the hearings or public meetings to ensure that individuals and minority communities are included throughout the process.

(b) **Developing the Prehearing Packet**. The Region prepares a prehearing packet, which is an assemblage of organized project information containing public notices, prepared news releases, exhibits, and handouts to be used at the hearing. The project team members and specialists enlisted to support the public involvement and hearing processes typically coordinate to produce the prehearing packet elements. Much of the information needed in the prehearing packet will come from the project's public involvement plan.

You should prepare a prehearing packet at least 45 days in advance of the public hearing and send it to the HQ Access and Hearings Unit. The HQ Hearing Coordinator reviews and concurs with the Region's plans, and recommends the State Design Engineer's approval of the hearing date. Headquarters concurrence with the prehearing packet typically requires two weeks after receipt of the information.

The following information is included in the prehearing packet:

1. **Project Background Information and Exhibits**. A project vicinity map and pertinent plans and exhibits for the hearing. The prehearing packet also contains a brief written narrative of the project. Usually, this narrative is already prepared and available in Project File documents, public involvement plans, or on a project Internet page.
2. **Proposed Hearing Type, Format, and Logistics**. The prehearing packet identifies the type of hearing required. A hearing support team provides various planning details and helps with arrangements (date, time, place, and announcements). A public open house is often scheduled on the same day, preceding a formal hearing, to provide opportunity for involvement by the community.
3. **News Release**. The Region Communications Office can assist in preparing announcements for the hearing and other public events.
4. **Legal Hearing Notice**. Notices must contain certain legal statements provided by the HQ Access and Hearings Unit. (See 210.05(5) and (6) for guidance on notices.)
5. **List of Newspapers and Other Media Sources**. The media listing used to announce the hearing. The Region Communications Office has developed relations with reporters and media outlets, including minority publications and media, and is accustomed to working these issues. Enlist the office's support for hearing preparations.
6. **List of Legislators and Government Agencies Involved**. Special notice is sent to local officials and legislators announcing public hearings. At formal hearings, the moderator and agenda typically identify those officials so they can interact with the public. The HQ Government Relations Office can assist with identifying and notifying legislators and key legislative staff within the project area.
7. **The Hearing Agenda and Script**. These are required for formal hearings and are prepared by the Region. The HQ Access and Hearings Unit can provide sample agendas and scripts to support the Region in its hearing preparations.

   Figure 210-3 provides a checklist of prehearing packet contents, including additional items needed for limited access hearings.

(5) Public Hearing Notices – Purpose and Content

There are two types of public notices for hearings: notice of hearing and notice of opportunity for a hearing. Consult the HQ Hearing Coordinator for specific project hearing requirements and implementation strategies.

(a) **Notice of Hearing**. A notice of hearing is prepared and published when a hearing is required by law and cannot be waived.

(b) **Notice of Opportunity for a Hearing**. In select cases, a notice of opportunity for a hearing is prepared and published in order to gauge the public's interest in having a particular hearing. This kind of notice is only used if the requirements for a hearing can be legally waived. In these cases, documentation is required as set forth in 210.05(7).

(c) **Content Requirements**. The HQ Access and Hearings Unit provides sample notices to the Region upon request. Public notices include statements that are required by state and federal statutes. Some important elements of a notice include the following:

- A map or graphic identifying project location and limits.
- For a notice of opportunity for a hearing, include the procedures for requesting a hearing and the deadline, and note the existence of the relocation assistance program for persons or businesses displaced by the project.
- For an environmental, corridor, design, or combined corridor-design hearing, or for a notice of opportunity for a hearing, announce the availability of the environmental document and accessible locations.
- Project impacts to wetlands; flood plains; prime and unique farmlands; Section 4(f), 6(f), or 106 properties; endangered species or related habitats; or affected communities.
- Information on any associated prehearing presentation(s).
- Americans with Disabilities Act and Title VI legislation statements.

(6) Publishing Hearing Notices – Procedure

To advertise a legal notice of hearing or a notice of opportunity for a hearing, use the following procedure for appropriate media coverage and timing requirements:

1. **Headquarters Concurrence**. As part of the prehearing packet, the Region transmits the proposed notice and a list of the newspapers in which the notice will appear to the HQ Hearing Coordinator for concurrence prior to advertisement.
2. **Region Distribution of Hearing Notice**. Upon receiving Headquarters concurrence, the Region distributes copies of the hearing notice and news release as follows:
   - Send a copy of the hearing notice and a summary project description to appropriate legislators and local officials one week before the first publication of a hearing notice. Provide the HQ Government Relations Office with a copy of all materials that will be distributed to legislators, along with a list of legislative recipients.
   - Advertise the hearing notice in the appropriate newspapers within one week following the mailing to legislators. The advertisement must be published in a newspaper with general circulation in the vicinity of the proposed project or with a substantial circulation in the area concerned, such as foreign language and local newspapers. If affected limited-English-proficient populations have been identified, other foreign language newspapers may be appropriate as well. The legal notices section may be used or, preferably, a paid display advertisement in a prominent section of the newspaper, such as the local news section. With either type of advertisement, request that the newspaper provide an affidavit of publication.
   - Distribute the project news release to all appropriate news media about three days before the first publication of a hearing notice, using newspapers publishing the formal advertisement of the notice.
   - Additional methods may also be used to better reach interested or affected groups or individuals, including notifications distributed via project e-mail lists, ads in local community news media, direct mail, fliers, posters, and telephone calls.

- For corridor and design hearings, the first notice publication must occur at least 30 days before the date of the hearing. The second publication must be 5 to 12 days before the date of the hearing (see Figure 210-4). The first notice for a corridor or design hearing shall not be advertised prior to public availability of the draft environmental document.
- For limited access and environmental hearings, the notice must be published at least 15 days prior to the hearing. The timing of additional publications is optional (see Figure 210-5).
- For a notice of opportunity for a hearing, the notice must be published once each week for two consecutive weeks. The deadline for requesting a hearing must be at least 21 days after the first date of publication and at least 14 days after the second date of publication.
- A copy of the published hearing notice is sent to the HQ Hearing Coordinator at the time of publication.

3. **Headquarters Distribution of Hearing Notice**. The HQ Hearing Coordinator sends a copy of the notice of hearing to the Transportation Commission, Attorney General's Office, HQ Communications Office, and FHWA (if applicable).

   For a summary of the procedure and timing requirements, see Figure 210-4 (for environmental, corridor, and design hearings) or Figure 210-5 (for limited access hearings).

(7) No Hearing Interest – Procedure and Documentation

As described in 210.05(5), in select cases the Region can satisfy certain project hearing requirements by advertising a notice of opportunity for a hearing. This procedure can be beneficial, particularly with limited access hearings in cases where very few abutting property owners are affected. If no hearing requests are received after issuing the notice of opportunity, the following procedures and documentation are required to waive a hearing:

(a) **Corridor or Design Hearing**. If no requests are received for a corridor or design hearing, the Region transmits a package (the notice of opportunity for a hearing, the affidavit of publication of the notice, and a letter stating that there were no requests for a hearing) to the HQ Access and Hearings Unit.

(b) **Limited Access Hearing**. When a notice of opportunity for a hearing is used to fulfill the requirements for a limited access hearing and there are no requests for a hearing, the following steps are taken:

- The Region must secure signed hearing waivers from every abutting property owner whose access rights will be affected by the project, as well as the affected local agency. The HQ Access and Hearings Unit can supply a sample waiver to the Region.
- The Project Engineer must contact every affected property owner of record (not tenant) and the local agency to explain the proposed project. This explanation must include information on access features, right of way acquisition (if any), and the right to a hearing. Property owners must also be advised that signing the waiver will not affect their right to fair compensation for their property, or their access rights or relocation benefits.

- The Region transmits the original signed waivers to the HQ Access and Hearings Unit, along with the affidavit of publication of the notice of opportunity for a limited access hearing and a recommendation for approval of the Right of Way Plan. Once the completed package is received by the HQ Access and Hearings Unit, it is submitted to the State Design Engineer for review and approval.

(c) **Environmental Hearing**. Environmental hearings cannot use the process of waivers to satisfy project hearing requirements.

(8) Prehearing Briefs and Readiness

After publication of a hearing notice, the Region should expect to receive public requests for information and project briefings, including requests for information in languages other than English.

(a) **Presentation of Material for Inspection and Copying**. The information outlined in the hearing notice and other engineering and environmental studies, as well as information intended to be presented at the hearing, must be made available for public review and copying throughout the period between the first advertisement and the approval of the hearing summary or Findings and Order. The information may also need to be available in languages other than English if demographics indicate. The information need not be in final form, but must include every item currently included in the hearing presentation. The environmental documents must also be available for public review.

These materials are made available in the general locality of the project. The Region reviews the variables (the locations of the Project Office and project site; the interested individuals; and the probability of requests for review) and selects a mutually convenient site for the presentation of the information. In accordance with RCW 42.56, Public Records, a record should be kept for future evidence, stating who came in, when, and what data they reviewed and copied.

(b) **Hearing Briefing**. On controversial projects, the HQ Hearing Coordinator arranges for a briefing (held before the hearing) for those interested in the project. Attendants typically include appropriate Headquarters, Region, and FHWA personnel, with special notice to the Secretary of Transportation. Region personnel present the briefing.

(c) **Prehearing Presentation**. The Region is encouraged to give an informal presentation to the public for discussion of the project prior to the hearing. A prehearing presentation is informal, with ample opportunity for exchange of information between WSDOT and the public. Providing community members with opportunities to talk about their concerns in advance of the hearing promotes positive public relationships, and can make the actual hearing proceed more smoothly. Prehearing presentations can be open house meetings, drop-in centers, workshops, or other formats identified in the public involvement plan.

The prehearing presentation is usually held about one week before the hearing for more controversial projects; modified as needed.

Include the date, time, and place in the hearing notice and ensure it is mailed in time to give adequate notice of the prehearing presentation.

(9) Conducting the Hearing

The hearing is facilitated by the Regional Administrator or a designee. Normally, a hearing examiner is used when significant controversy or considerable public involvement is anticipated. A hearing examiner is required for limited access hearings.

A verbatim transcript of the proceedings is made by a court reporter.

Hearings are generally more informative and gain more public participation when an informal format is used, where people's views and opinions are openly sought in a casual and personal way. The informal hearing format may be used for all hearings except limited access hearings. At least one court reporter is required to take individual testimony. Use displays, exhibits, maps, and tables, and have knowledgeable staff available to answer specific questions about the proposed project.

It is the responsibility of the hearing moderator and other department representatives to be responsive to all reasonable and appropriate questions. If a question or proposal is presented at the limited access hearing that can only be answered at a later date, the Region shall reserve an exhibit to respond to the comment in the Findings and Order. The hearing moderator must not allow any person to be harassed or subjected to unreasonable cross-examination.

(a) **Hearing Agenda Items**. For all limited access hearings, and for other formal hearings, the Region prepares a hearing agenda to ensure all significant items are addressed. A hearing agenda includes:

1. **Opening Statement:**
    - Highway and project name
    - Purpose of hearing
    - Description of how the hearing will be conducted
    - Introduction of elected officials
    - Federal/State/County/City relationship
    - Statutory requirements being fulfilled by the hearing
    - Status of the project with regard to NEPA/SEPA documents
    - Description of information available for review and copying
    - For environmental, corridor, or design hearings, notice that written statements and other exhibits can be submitted during the open record period following the hearing
    - Statement that all who want to receive written notification of WSDOT's action as a result of the hearing may add their names to the interest list or file a notice of appearance for limited access hearings
2. **Project History**. Present a brief project history, including purpose and need for the project, public involvement program, future hearing opportunities, and hearings held.
3. **Presentation of Plans**. Develop alternatives that include comparable levels of detail, and present them equally. Include the no-action alternative. Refer to any supporting studies that are publicly available.

Identify a preliminary preferred alternative, if selected by WSDOT, for more detailed development. When a preliminary preferred alternative has been identified, stress that it is subject to revision and reevaluation based on public comments, additional studies, and other information that may become available.

4. **Environmental, Social, and Economic Discussion**. Discuss all positive and negative environmental, social, and economic effects (or summarize the major effects), and refer to the environmental documentation.
5. **Statements, Plans, or Counterproposals From the Public**. Accept public views or statements regarding the proposal presented, the alternatives, and the social, economic, and environmental effects identified. Avoid evaluating the views presented while conducting the hearing.
6. **Relocation Assistance Program**. Explain the relocation assistance program and relocation assistance payments available. At all hearings, the relocation assistance brochure must be available for free distribution, including (if appropriate) brochures in languages other than English. Real Estate Services personnel should be available.

   If the project does not require any relocations, the relocation assistance discussion may be omitted. Make a simple statement to the effect that relocation assistance is provided, but currently no relocations have been identified for the project. The relocation brochure and personnel should still be available to the public at the hearing.
7. **Acquisition**. Discuss right of way acquisition, estimated cost, and currently proposed construction schedules and critical activities that may involve or affect the public.
8. **Closing**. Summarize the hearing and announce proposed future actions.
9. **Adjournment**. Adjourn the hearing with sincere gratitude for the public's valuable participation.

(10) Hearing Summary and Adoption

Upon completion of a public hearing, a documentation and approval procedure leads to official adoption of the hearing proceedings. After the hearing, a summary is prepared by the Region. There are two types of summary documents used, depending on the type of hearing. For environmental, corridor, and design hearings, a hearing summary is produced. Following a limited access hearing, a Findings and Order document is prepared. Each of these packages is comprised of documentation assembled by the Region and approved by Headquarters.

(a) **Hearing Summary Contents**. The hearing summary includes the following elements:

1. Hearing transcript.
2. Copy of the affidavit of publication of the hearing notice.
3. Hearing material:
   - Copies of the letters received before and after the hearing
   - Copies or photographs of, or references to, every exhibit used in the hearing

4. Summary and analyses of all oral and written comments. Include consideration of the positive and negative social, economic, and environmental aspects of these comments.

(b) **Limited Access Hearing Findings and Order**. Following a limited access hearing, the "summary" document is labeled the Findings and Order. Refer to 210.09(12) for the process description and required documentation for Findings and Order documents.

(c) **Adoption and Approval**. For specific hearing types, see subsequent sections in this chapter related to adoption procedures.

Figure 210-6 identifies the Headquarters approval authority for hearing summary and Findings and Order documents.

210.06 Environmental Hearing

Early coordination with appropriate agencies and the public may help to determine the appropriate level of environmental documentation, the scope of the document, the level of analysis, and related environmental disciplines to be analyzed.

Environmental documents address the positive and negative social, economic, and environmental project effects, as described in Chapter 220 and the *Environmental Procedures Manual*. The project environmental documentation is the first step in the environmental hearing procedure. Each step of the hearing procedure is dovetailed into the environmental process and is important in achieving the appropriate project documentation. Corridor and design hearings are not normally required for Environmental Assessments, SEPA Checklists, and categorically excluded projects, but the opportunity for an environmental hearing might be required or advisable for controversial proposals. When an environmental hearing is not required, an informational meeting may serve as a useful forum for public involvement in the environmental process. Consult with Region environmental staff and the HQ Hearing Coordinator for specific project requirements.

Projects requiring an Environmental Impact Statement (EIS) must use an evaluation process called *scoping* in the NEPA and SEPA requirements. This process helps the project proponents identify the significant issues and possible alternatives analyzed and documented in the Draft EIS, and must follow the public involvement plan included in the environmental study plan for the project.

After the project has been thoroughly analyzed through the environmental evaluation process and discussed within the community using informal public involvement methods, a hearing is held to present and gather testimony. The hearing is timed to fall within the comment period for the Draft EIS.

For an environmental hearing, the hearing notice must be published at least 15 days prior to the hearing. The timing of additional publications is optional (see Figure 210-4).

Responses to comments on the Draft EIS must be addressed in the Final EIS.

(1) Environmental Hearing Summary

The environmental hearing summary includes the items outlined in 210.05(10).

(2) Adoption of Environmental Hearing

Chapter 220 and the *Environmental Procedures Manual* provide guidance on NEPA and SEPA procedures, documentation requirements, and approvals.

210.07 Corridor Hearing

A corridor hearing is a public hearing that:

- Is held before WSDOT is committed to a preferred alternative establishing the final route corridor.
- Is held to ensure that opportunity is afforded for effective participation by interested persons in the process of determining the need for and location of a state highway.
- Provides the public an opportunity to present views on the social, economic, and environmental effects of the proposed alternative highway corridors.

A corridor hearing is required if any of the following project actions would occur:

- Proposed route on new location
- Substantial social, economic, or environmental impacts
- Significant change in layout or function of connecting roads or streets

When a corridor hearing is held, the Region must provide enough design detail on the proposed alignment(s) within the corridor(s) that an informed presentation can be made at the hearing. Justification to abandon an existing corridor must also be presented.

For general procedures and notification requirements, see 210.05 and Figure 210-4.

(1) Corridor Hearing Summary

After the hearing, the Region:

- Reviews the hearing transcript.
- Responds to all questions or proposals submitted at or subsequent to the hearing.
- Compiles a corridor hearing summary.
- Transmits three copies (four copies for Interstate projects) to the HQ Access and Hearings Unit.

When appropriate, the hearing summary may be included in the FEIS. If not included, submit the complete corridor hearing summary to the HQ Access and Hearings Unit within approximately two months following the hearing.

The corridor hearing summary includes the items outlined in 210.05(10).

(2) Adoption of Corridor Hearing Summary

The HQ Access and Hearings Unit prepares a package that contains the corridor hearing summary and a formal description of the project, and forwards it to the Director of Environmental and Engineering Programs for adoption. The HQ Hearing Coordinator notifies the Region when adoption has occurred and returns an approved copy to the Region.

210.08 Design Hearing

A design hearing is a public hearing that:

- Is held after a route corridor is established and approved but before final design of a highway is engineered.
- Is held to ensure that an opportunity is afforded for the public to present their views on each proposed design alternative, including the social, economic, and environmental effects of those designs.

A design hearing is required if any of the following project actions will occur:

- Substantial social, economic, or environmental impacts
- Significant change in layout or function of connecting roads or streets
- Acquisition of a significant amount of right of way results in relocation of individuals, groups, or institutions

For general procedures and notification requirements, see 210.05 and Figure 210-4.

(1) Design Hearing Summary

The design hearing summary includes the elements outlined in 210.05(10).

Submit the complete hearing summary to the HQ Access and Hearings Unit within approximately two months following the hearing.

If new studies or additional data are required subsequent to the hearing, the Region compiles the information in coordination with the HQ Design Office.

(2) Adoption of Design Hearing Summary

After the hearing, the Region reviews the hearing transcript, responds to all questions or proposals submitted at or subsequent to the hearing, compiles a hearing summary, and transmits three copies (four copies for Interstate projects) to the HQ Access and Hearings Unit. When appropriate, the design hearing summary may be included in the final environmental document. The HQ Access and Hearings Unit prepares a formal document that identifies and describes the project and submits it to the State Design Engineer for approval. One approved copy is returned to the Region. The HQ Hearing Coordinator notifies the Region that adoption has occurred.

On Interstate projects, the State Design Engineer (or designee) submits the approved design hearing summary to the FHWA for federal approval. If possible, this submittal is timed to coincide with the submittal of the Design Decision Summary to the FHWA.

(3) Public Notification of Action Taken

The Region prepares a formal response to individuals who had unresolved questions at the hearing. The Region keeps the public advised regarding the result of the hearing process, such as project adoption or revision to the plan. A project newsletter sent to those on the interest list is an effective method of notification. Project news items can be sent via e-mail, as well as by more traditional methods.

210.09 Limited Access Hearing

Limited access hearings are required by law (per RCW 47.52) whenever limited access is established or revised on new or existing highways. Decisions concerning limited access hearings are made on a project-by-project basis by the State Design Engineer based on information that includes the recommendations submitted by the Region (see Chapters 1410, 1420, 1430, and 1435).

Limited access hearing procedures generally follow those identified in 210.05; however, several unique products and notifications are also prepared. These include Limited Access Hearing Plans and notifications sent to abutting property owners and local jurisdictions. (See 210.09(4) and Figure 210-3 for a listing of these products.) Figure 210-5 presents a summary of the limited access hearing procedures.

Prior to the limited access hearing (RCW 47.52.131), discussions with the local jurisdictions shall be held on the merits of the Limited Access Report and the Limited Access Hearing Plan(s). These are required exhibits for the limited access hearing. (See Chapter 1430 for guidance on Limited Access Reports.)

The following information applies only to limited access hearings and procedures for approval of the Findings and Order.

(1) Hearing Examiner

The HQ Access and Hearings Unit hires an administrative law judge from the Office of Administrative Hearings to conduct the limited access hearing.

(2) Order of Hearing

The order of hearing officially establishes the hearing date. The State Design Engineer approves the order of hearing. The HQ Hearing Coordinator then notifies the Region, the Attorney General's Office, and the hearing examiner of the official hearing date.

(3) Limited Access Hearing Plan

The Region prepares a Limited Access Hearing Plan to be used as an exhibit at the formal hearing and forwards it to the HQ Plans Engineer for review and approval approximately 45 days before the hearing. This is a Phase 2 Plan (see Chapter 1410). The HQ Plans Engineer schedules the approval of the Limited Access Hearing Plan on the State Design Engineer's calendar.

(4) Limited Access Hearing Information to Abutters

The Region prepares an information packet that must be mailed to abutters, and other entities as specified below, at least 15 days prior to the hearing (concurrent with advertisement of the hearing notice). These items are elements of the prehearing packet as described in 210.05(4)(b) and in Figure 210-3. If some of the limited access hearing packets are returned as undeliverable, the Region must make every effort to communicate with the property owners.

The limited access hearing packet for abutters contains the following:

- Limited Access Hearing Plan
- Limited access hearing notice
- Notice of appearance

The Region also sends the limited access hearing packet to the following:

- The county and/or city
- The owners of property listed on the county tax rolls as abutting the section of highway, road, or street being considered at the hearing as a limited access facility
- Local agencies and public officials who have requested a notice of hearing or who, by the nature of their functions, objectives, or responsibilities, are interested in or affected by the proposal
- Every agency, organization, official, or individual on the interest list

The limited access hearing packet is also sent, when applicable, to the following:

- State resource, recreation, and planning agencies
- Tribal governments
- Appropriate representatives of the Department of the Interior and the Department of Housing and Urban Development
- Other federal agencies
- Public advisory groups

(5) Affidavit of Service by Mailing

The Region prepares an affidavit of service by mailing. This affidavit states that the limited access hearing packet was mailed at least 15 days prior to the hearing and that it will be entered into the record at the hearing.

(6) Limited Access Hearing Plan Revisions

The Limited Access Hearing Plan cannot be revised after the State Design Engineer (or designee) approves the plan without rescheduling the hearing. If significant revisions to the plan become necessary during the period between the approval and the hearing, the revisions can be made and must be entered into the record as a revised (red and green) plan at the hearing.

(7) Limited Access Hearing Notice

The limited access hearing notice must be published at least 15 calendar days before the hearing. This is a legal requirement and the hearing must be rescheduled if the advertising deadline is not met. Publication and notice requirements are the same as those required in 210.05, except that the statutory abutter mailing must be mailed after notification to the appropriate legislators.

(8) Notice of Appearance

The HQ Hearing Coordinator transmits the notice of appearance form to the Region. Anyone wanting to receive a copy of the Findings and Order and the adopted Right of Way and Limited Access Plan must complete a notice of appearance form and return it to WSDOT either at the hearing or by mail.

(9) Reproduction of Plans

The HQ Hearing Coordinator submits the hearing plans for reproduction at least 24 days prior to the hearing. The reproduced plans are sent to the Region at least 17 days before the hearing, for mailing to the abutters at least 15 days before the hearing.

(10) Limited Access Hearing Exhibits

The Region retains the limited access hearing exhibits until preparation of the draft Findings and Order is complete. The Region then submits all the original hearing exhibits and three copies to the HQ Access and Hearings Unit as part of the Findings and Order package. Any exhibits submitted directly to Headquarters are sent to the Region for inclusion with the Region's submittal.

(11) Limited Access Hearing Transcript

The court reporter furnishes the original limited access hearing transcript to the Region. The Region forwards the transcript to the hearing examiner, or presiding authority, for signature certifying that the transcript is complete. The signed original and three copies are returned to the Region for inclusion in the Findings and Order package.

(12) Findings and Order

The Findings and Order is a document containing the findings and conclusions of a limited access hearing, based entirely on the evidence in the hearing record. The Region reviews a copy of the transcript from the court reporter and prepares a Findings and Order package. The package is sent to the HQ Access and Hearings Unit.

The Findings and Order package contains the following:

- The draft Findings and Order
- Draft responses to comments (reserved exhibits)
- A draft Findings and Order Plan (as modified from the Hearing Plan)
- All limited access hearing exhibits (originals and three copies)
- The limited access hearing transcript (original and three copies)
- The notice of appearance forms
- Estimate of the number of copies of the final Findings and Order Plan and text the Region will need for the mailing

(13) Adoption of Findings and Order

The Environmental and Engineering Programs Director adopts the Findings and Order based on the evidence introduced at the hearing and any supplemental exhibits.

Following adoption of the Findings and Order, the HQ Plans Branch makes the necessary revisions to the Limited Access Hearing Plan, which then becomes the Findings and Order Plan.

The HQ Access and Hearings Unit arranges for reproduction of the Findings and Order Plan and the Findings and Order text and transmits them to the Region.

The Region mails a copy of the Findings and Order Plan and the Findings and Order text to all parties filing a notice of appearance and to all local governmental agencies involved. Subsequent to this mailing, the Region prepares an affidavit of service by mailing and transmits it to the HQ Access and Hearings Unit.

At the time of mailing, but before publication of the résumé, the Region notifies the appropriate legislators of WSDOT's action.

(14) Résumé

The résumé is an official notification of action taken by WSDOT following adoption of a Findings and Order. The HQ Access and Hearings Unit provides the résumé to the Region. The Region must publish the résumé once each week for two consecutive weeks, not to begin until at least ten days after the mailing of the Findings and Order.

(15) Final Establishment of Access Control

When the Findings and Order is adopted, the Findings and Order Plan becomes a Phase 4 Plan (see Chapter 1410). The establishment of access control becomes final 30 days from the date the Findings and Order is mailed by the Region, as documented by the affidavit of service by mailing.

(16) Appeal Process

An appeal from the county or city must be in the form of a written disapproval, submitted to the Secretary of Transportation, requesting a hearing before a board of review.

An appeal from abutting property owners must be filed in the Superior Court of the state of Washington, in the county where the limited access facility is to be located, and shall affect only those specific ownerships. The plan is final for all other ownerships.

210.10 Combined Hearings

A combined hearing often alleviates the need to schedule separate hearings to discuss similar information. A combined hearing is desirable when the timing for circulation of the draft environmental document is simultaneous with the timing for corridor and design hearings and when all alternative designs are available for each alternative corridor.

When deciding whether to combine hearings, consider:

- Whether there is controversy.
- Whether alternative corridors are proposed.
- The nature of the environmental concerns.
- The benefits to the public of a combined hearing.

210.11 Administrative Appeal Hearing

Administrative appeal hearings apply only to managed access highways, are conducted as formal hearings, and are initiated by a property owner seeking to appeal a decision made to restrict or remove an access connection. This is also known as an adjudicative proceeding, and the procedure is presented in Chapter 1435.

210.12 Follow-Up Hearing

A new hearing or the opportunity for a hearing is required for any previously held hearing when any one of the following occurs (USC 23, §771.111):

- Major actions (such as adoption of Findings and Order and approval of hearing summaries) did not occur within three years following the date the last hearing was held or the opportunity for a hearing was afforded
- A substantial change occurs in the area affected by the proposal (due to unanticipated development, for example)
- A substantial change occurs in a proposal for which an opportunity for a hearing was previously advertised or a hearing was held
- A significant social, economic, or environmental effect is identified that was not considered at earlier hearings

210.13 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

Proposed Project Actions or Conditions	Types of Hearings[1]					
	Environmental	Design	Corridor	Limited Access	Combined	Follow-Up
Proposed route on new location			X	X		
Substantial social, economic, or environmental impacts	X	X	X	X		
Significant change in layout or function of connecting roads or streets		X	X	X		
Acquisition of significant amount of right of way results in relocation of individuals, groups, or institutions	X	X				
Significant adverse impact on abutting real property	X					
An EIS is required or a hearing is requested for an EA	X					
Significant public interest or controversy	X					
Regulatory agencies have hearing requirements that could be consolidated into one hearing process	X					
Limited access control is established or revised				X		
If several hearings are required, consider efficiency of combining					X	
Major actions not taken within 3 years after date last hearing was held						X[2]
An unusually long time has elapsed since the last hearing or the opportunity for a hearing						X
Substantial change in proposal since prior hearing						X
Significant social, economic, or environmental effect is identified and was not considered at prior hearing						X

Notes:

[1] This table presents a list of project actions that correspond to required public hearings. The list is intended as a guide and is not all-inclusive. In cases where several types of hearings are anticipated for a project, a combined hearing may be an effective method. Consult with Region and Headquarters environmental staff, the designated Assistant State Design Engineer, and the HQ Access and Hearings Unit to identify specific hearing requirements and strategies.

[2] Posthearing major actions include: FHWA approvals (for Interstate projects); adoption of hearing summaries and Findings and Order; and public notification of action taken, such as publishing a résumé.

Types of Public Hearings

Figure 210-1

Hearing Type	Hearing Format	
	Formal	**Informal**
Limited Access	Required	Not allowed
Environmental	Either format acceptable	
Design	Either format acceptable	
Corridor	Either format acceptable	
Combined	Format depends on type*	
Follow-up	Format depends on type*	

Notes:

Check with the HQ Hearing Coordinator to identify specific hearing type and appropriate hearing format.

* If a combined or follow-up hearing includes a limited access hearing, then that portion of the hearing must adhere to the formal format.

Public Hearing Formats
Figure 210-2

Prehearing Packet Items	All Hearings	Additional Items for Limited Access Hearings
Brief project description; purpose and public benefit; history; known public perceptions; and support or opposition	X	
Proposed hearing type	X	
Hearing arrangements: proposed date, time, and place	X	
Proposed hearing format: formal or informal	X	[1]
Notice of whether an open house event will precede the hearing	X	
Vicinity map	X	
Plans for corridor and design alternatives with descriptions	X	
News release	X	
Legal notice of hearing	X	X[2]
List of newspapers and other media sources that will cover the news release and hearing notice	X	
List of legislators and government agencies involved	X	
Hearing agenda	[3]	X[3]
Hearing script	[3]	X[3]
Limited Access Report (Chapter 1430)		X
Limited Access Hearing Plan(s) (Chapter 1430)		X
List of abutting property owners		X
Notice of appearance form		X

Notes:

The prehearing packet is prepared by the Region and transmitted to the HQ Access and Hearings Unit for review, concurrence, and processing. This information is assembled in advance of the hearing to facilitate timely announcements and a smooth-flowing event. The HQ Hearing Coordinator requires the prehearing packet 45 days (or sooner) in advance of the proposed hearing date.

[1] Limited access hearings are required by law to be formal.

[2] For a limited access hearing, each abutting property owner affected by the project must receive the hearing notice, along with the notice of appearance form and specific Limited Access Hearing Plan(s) showing their parcel(s). Indicate in the prehearing packet the number of affected property owners to whom the packets will be mailed.

[3] A hearing agenda and hearing script are required for a limited access hearing. Any formal hearing requires a fixed agenda and a script. It is recognized that the script may be in draft format at the time of submittal of the prehearing packet. The HQ Hearing Coordinator can assist in its completion and can provide sample scripts and agendas.

Prehearing Packet Checklist
Figure 210-3

Sequence for Corridor, Design, and Environmental Hearings	
Preparatory Work	
Consult with HQ Hearing Coordinator and environmental specialists to determine specific requirements for a hearing or a notice of opportunity for a hearing.	[see 210.05 & Figure 210-1]
Assemble support team; identify and schedule tasks and deliverables.	[see 210.05(4)]
Prepare prehearing packet (news releases, legal notices, exhibits).	[see 210.05(4)(b) & Fig. 210-3]
♦ **Minimum 45 Days Prior to Hearing – Transmit Prehearing Packet to HQ** HQ Hearing Coordinator reviews and concurs; schedules hearing.	[see 210.05(4)(b)]
Public Notifications and News Releases	[see 210.05(5) & (6)]
♦ **35–40 Days Prior to Hearing** (1 week prior to first public ad) Send notice to legislators and local officials.	
♦ **33–35 Days Prior to Hearing** (about 3 days before advertisement) Send letter with news release to media.	
♦ **30 Days Prior to Hearing** Draft EIS becomes available and its open comment period begins.	
Corridor and Design Hearings ♦ **30 Days Prior to Hearing – Publish First Notice** Advertise at least 30 days in advance, but not prior to public availability of draft environmental document. ♦ **5–12 Days Prior to Hearing – Publish Second Notice**	
Environmental Hearings ♦ **15 Days Prior to Hearing – Publish First Notice** Advertise at least 15 days in advance; timing of additional notices optional. (If done in combination with design or corridor hearing, use 30-day advance notice.)	
Prehearing Briefings	[see 210.05(8)]
♦ **5–12 Days Prior to Hearing** Region confers with local jurisdictions; conducts hearing briefings and presentations; and makes hearing materials and information available for public inspection and copying.	
Conduct the Hearing	[see 210.05(9)]
Conduct environmental, corridor, or design hearing.	
Posthearing Actions	
Court reporter provides hearing transcript to Region (usually within 2 weeks).	
♦ **2 Months After Hearing – Prepare Hearing Summary and send to HQ** Region addresses public comments from hearing and throughout comment; period prepares hearing summary and transmits to HQ Hearing Coordinator for processing.	[see 210.05(10)]
HQ Hearing Coordinator transmits hearing summary package to HQ approval authority for approval.	[see Figure 210-6]
HQ Hearing Coordinator notifies Region of adoption and returns a copy of approved hearing summary to Region.	

Notes:

Important timing requirements are marked ♦

* If the advertisement is a notice of opportunity for a hearing, requests must be received within 21 days after the first advertisement. If there are no requests, see 210.05(7).

Sequence for Corridor, Design, and Environmental Hearings
Figure 210-4

Sequence for Limited Access Hearing	
Preparatory Work	
Consult with HQ Access and Hearings Unit. Determine requirements for a limited access hearing or a notice of opportunity for a hearing.	[see 210.05 & Fig. 210-1]
Assemble support team; identify and schedule tasks and deliverables.	[see 210.05(4)]
Prepare Limited Access Report and Limited Access Hearing Plan(s).	[see Chapters 1410 & 1430]
Prepare prehearing packet (legal notice, exhibits, information packets for abutting property owners).	[see 210.05(4)(b) & Fig. 210-3]
♦ **Minimum 45 Days Prior to Hearing – Transmit Prehearing Packet to HQ – Transmit Limited Access Report and Hearing Plans for Approval** HQ Hearing Coordinator reviews and concurs; schedules hearing. Transmits Limited Access Report and Limited Access Hearing Plan.	[see 210.05(4)(b) & 210.09]
♦ **45 Days Prior to Hearing** HQ actions: Calendar order of hearing & Limited Access Hearing Plan approved	[see 210.09(2)&(3)]
♦ **24 Days Prior to Hearing – HQ Reproduction of Plans** HQ action: Approved Limited Access Hearing Plan(s) are reproduced in number sufficient for mailing to abutters and other handout needs; one set to be used as hearing exhibit.	[see 210.09(9)]
Notifications, News Releases, Confer With Local Agencies	
♦ **35–40 Days Prior to Hearing** Send notice to legislators and local officials (1 week prior to first public ad).	[see 210.05(6)]
♦ **33–35 Days Prior to Hearing** Send letter with news release to media (about 3 days before advertisement).	[see 210.05(6)]
♦ **15 Days Prior to Hearing – Publish First Notice*** Advertise at least 15 days in advance; timing of additional notices optional.	[see 210.05(6)]
♦ **15 Days Prior to Hearing – Send Hearing Packets to Abutters** (Hearing notice, *Limited Access Plan*, and notice of appearance form).	[see 210.05(4)]
♦ **15 Days Prior to Hearing – Confer With Local Jurisdictions**	[see 210.05(8)]
Conduct the Hearing	[see 210.05(6)]
Using agenda and script, conduct formal limited access hearing.	
Posthearing Actions	
Court reporter provides limited access hearing transcript to Region.	[see 210.09(11)]
Region prepares Findings and Order document and transmits to HQ Hearing Coordinator.	[see 210.09(12)]
Environmental and Engineering Programs Director adopts Findings and Order.	[see 210.09(13)]
Limited Access Hearing Plan becomes Findings and Order Plan.	[see 210.09(15)]
Findings and Order reproduced and mailed to abutters and local jurisdictions.	[see 210.09(13)]
HQ provides résumé to Region and Region publishes.	[see 210.09(14)]

Notes:

Important timing requirements are marked ♦

* If the advertisement is a notice of opportunity for a hearing, requests must be received within 21 days after the first advertisement. If there are no requests, see 210.05(7).

Sequence for Limited Access Hearing
Figure 210-5

Hearing Summary Document	WSDOT HQ Approval Authority
Limited access hearing Findings and Order	Director, Environmental and Engineering Programs
Corridor hearing summary	Director, Environmental and Engineering Programs
Environmental hearing summary	Director, HQ Environmental Services Office[1]
Design hearing summary	State Design Engineer

Note:

[1] If the environmental hearing summary is included in the Final Environmental Document (FEIS, EA), the HQ Environmental Services Office Director approves the summary. If the summary is separate from the Final Environmental Document, the State Design Engineer approves.

Hearing Summary Approvals
Figure 210-6

Chapter 220 Project Environmental Documentation

220.01 Introduction

The term "environmental documentation" refers to the documents produced for a project to satisfy the requirements contained in the National Environmental Policy Act (NEPA) and the State Environmental Policy Act (SEPA). The *Environmental Procedures Manual* provides detailed instructions on how to determine what level of documentation is required and how to prepare the documents. This section provides a summary of the relevant provisions in the *Environmental Procedures Manual*.

The purpose of the environmental document is to provide decision-makers, agencies, and the public with information on a project's environmental impacts, alternatives to the proposed action, and mitigation measures to reduce unavoidable impacts. Final environmental documents identify and evaluate the project to be constructed. Because projects vary in their level of environmental impacts, the rules on environmental documentation allow for different levels of documentation. As a project's impacts increase, so does the level of documentation.

The Region Environmental Office and the Environmental Documentation Section of the Headquarters (HQ) Environmental Services Office routinely provide environmental documentation assistance to designers and Project Engineers.

220.02 References

(1) Federal/State Laws and Codes

42 USC Chapter 55, National Environmental Policy Act of 1969 (NEPA)

23 CFR 771, Environmental Impact and Related Procedures

23 CFR 771.135 Section 4(f) (49 USC 303), Policy on Lands, Wildlife and Waterfowl Refuges, and Historic Sites

36 CFR 800, Protection of Historic and Cultural Properties

40 CFR Parts 1500-1508, Council for Environmental Quality Regulations for Implementing NEPA

RCW 43.21C, State Environmental Policy Act (SEPA)

WAC 197-11, SEPA Rules

WAC 468-12, WSDOT SEPA Rules

(2) Design Guidance

Environmental Procedures Manual, M 31-11, WSDOT

220.03 Definitions/Acronyms

Categorical Exclusion (CE) (NEPA) or ***Categorical Exemption (CE)*** (SEPA) Actions that do not individually or cumulatively have a significant effect on the environment.

DCE Documented Categorical Exclusion (NEPA)

Determination of Nonsignificance (DNS) (SEPA) The written decision by the Region Administrator that a proposal will not have a significant impact and no EIS is required.

Determination of Significance (DS) (SEPA) A written decision by the Region Administrator that a proposal could have a significant adverse impact and that an EIS is required.

Environmental Assessment (EA) (NEPA) A document prepared for federally funded, permitted, or licensed projects that are not categorical exclusions (CE) but do not appear to be of sufficient magnitude to require an EIS. The EA provides enough analysis to determine whether an EIS or a FONSI should be prepared.

Environmental Classification Summary (ECS) A form used to evaluate and classify projects for the construction program. The ECS supports a decision of a documented CE.

Environmental Impact Statement (EIS) A detailed written statement of a proposed course of action, project alternatives, and the possible impacts of the proposal.

Environmental Review Summary (ERS) Part of the Project Summary document, it identifies environmental permits and approvals. The ERS is prepared in the Region and is required for Design Approval.

Finding of No Significant Impact (FONSI) (NEPA) A federal document indicating that a proposal will not significantly affect the environment and that an EIS is not required.

NEPA National Environmental Policy Act

ROD Record of Decision

SEPA State Environmental Policy Act

220.04 Determining the Environmental Documentation

The Environmental Review Summary (ERS) provides the first indication of what form the environmental documentation will take. The ERS is prepared as part of the Project Summary, which is prepared during the scoping phase of all projects in the construction program. The Project Summary includes three components:

- Project Definition
- Design Decisions Summary
- Environmental Review Summary

The ERS form is found in the Project Summary database in each Region. The *Environmental Procedures Manual* has detailed instructions on how to prepare the ERS. The process for classifying projects and determining the environmental document is similar for NEPA and SEPA and generally is as follows:

- Once the project has been sufficiently developed to assess any environmental impacts, the Region completes the ERS based on the best information available at the scoping phase of development.
- The Region Environmental Manager then concurs with the classification by signing the ERS and returning the completed form to the Region Design Office for inclusion in the Project Summary package.
- For NEPA, if a project has been determined to be a Categorical Exclusion (CE), the NEPA environmental review process is considered complete. If it is determined that a Documented Categorical Exclusion (DCE), Environmental Assessment (EA), or Environmental Impact Statement (EIS) is required, the Region evaluates the project schedule and arranges for preparation of the appropriate document.
- For SEPA, the signing and submittal of the ERS completes the environmental classification process. On projects that are categorized as exempt from SEPA, the environmental process is complete, unless the project requires consultation under the Endangered Species Act. On projects that do not meet the criteria for a SEPA Categorical Exemption (WAC 197-11-800 and WAC 468-12) and require a SEPA checklist (WAC 197-11-960) or an EIS, those documents are prepared as necessary prior to Project Development Approval.

The ERS allows environmental staff to consider at this early stage potential impacts and mitigations and required permits. For many projects, the WSDOT Environmental GIS Workbench coupled with a site visit provides sufficient information to fill out the ERS (see the *Environmental Procedures Manual*).

For most WSDOT projects, the Federal Highway Administration (FHWA) is the lead agency for NEPA. Other federal lead agencies on WSDOT projects are the Federal Aviation Administration, Federal Railroad Administration, and the Federal Transit Administration (FTA).

220.05 Identifying the Project Classification

Based on the environmental considerations identified during preparation of the ERS, WSDOT projects are classified for NEPA/SEPA purposes to determine the type of environmental documentation that will be required. Projects with a federal nexus (using federal funds, involving federal lands, or requiring federal approvals or permits) are subject to NEPA and SEPA. Projects that are state funded only, with no federal nexus including federal permits, follow SEPA guidelines. Since many WSDOT projects are prepared with the intent of obtaining federal funding, NEPA guidelines are usually followed. The *Environmental Procedures Manual* provides detailed definitions of the classes of projects and lists the types of work typically found in each class; FHWA/federal agency concurrence requirements; and procedures for classifying and, if necessary, reclassifying the type of environmental documentation for projects.

Projects subject to NEPA are classified as Class I, II, or III. Class I projects require preparation of an EIS because the action is likely to have significant adverse environmental impacts. Class II projects are Categorical Exclusions or Documented Categorical Exclusions that meet the definitions contained in 40 CFR 1508.4 and 23 CFR 771.117. These are actions that are not likely to cause significant adverse environmental impacts. Class III projects require an Environmental Assessment (EA) because the significance of the impact on the environment is not clearly established.

SEPA has a similar, but not identical, system. SEPA recognizes projects that are categorically exempt, projects that require an EIS, and projects that do not require an EIS. WSDOT projects that are CEs under NEPA (Class II) may not be categorically exempt under SEPA.

If the project is not exempt under SEPA, WSDOT must issue a threshold determination and then prepare a SEPA Checklist or EIS. The threshold determination may be a determination of nonsignificance (DNS) or a determination of significance (DS) requiring an EIS. WSDOT may adopt a NEPA EA FONSI to satisfy the requirements for a DNS.

220.06 Environmental Impact Statements – Class I Projects

Class I projects are actions that are likely to have significant impact on the environment because of their effects on land use, planned growth, development patterns, traffic volumes, travel patterns, transportation services and natural resources, or because they are apt to create substantial public controversy. An EIS may follow an EA if significant impacts are discovered during preparation of an EA. The *Environmental Procedures Manual* has details on EIS documents and procedures. WSDOT typically prepares a joint NEPA/SEPA EIS to satisfy both statutes.

Examples of projects that usually require an EIS, as referenced in 23 CFR 771.115, are as follows:

- New controlled-access freeway
- Highway projects of four or more lanes in a new location
- New construction or extension of fixed rail transit facilities (for example, rapid rail, light rail, commuter rail, automated guideway transit)
- New construction or extension of a separate roadway for buses or high-occupancy vehicles not located within an existing highway facility
- Construction of a new ferry terminal or large-scale changes to existing terminal facilities

Although examples are given, it is important to remember that it is the size and significance of the potential impacts that determine the need for an EIS, not the size of the project. "Significance" is not always clearly defined but is generally determined by the impact's "context" and "intensity." Having a significant impact in just one area is sufficient to warrant preparation of an EIS.

Only about 3% of WSDOT's projects go through the EIS process. Typically these are the larger, more complicated projects often in urban areas or involving new right of way and important natural or cultural resources. The process takes from two to five years or longer depending on the issues and stakeholders. EISs are expensive because of the amount of information produced, the level of design required, the frequency of redesign to address issues that are discovered, and the higher level of agency and public involvement. WSDOT has prepared an EIS "Reader-Friendly Tool Kit" to simplify the content of EISs and to improve them as a communication tool to inform the public and decision-makers. Both federal and state initiatives exist to streamline the EIS process and reduce the costs.

220.07 Categorical Exclusions – Class II Projects

The FHWA NEPA Regulations identify project types that qualify as CEs (23 CFR 771.117). In general, CEs are actions that, based on past experience with similar projects, do not have significant environmental impacts. CEs are subject to reevaluation by FHWA where there are unusual circumstances, such as new environmental impacts; controversy on environmental grounds; unforeseen impacts to cultural, historic, or recreational resources (Section 4(f) or Section 106); or inconsistencies with federal, state, or local laws.

CEs are defined further by two subcategories: CEs not requiring FHWA concurrence and Documented Categorical Exclusions (DCEs). Projects defined as CEs not requiring FHWA concurrence must meet the requirements of the *Memorandum of Understanding Between WSDOT and FHWA on Programmatic Categorical Exclusion Approvals*, signed May 25, 1999 (see the *Environmental Procedures Manual*). This may include preparation of a Biological Assessment (BA) to document effects to endangered and threatened species. If a "no effects" determination is the outcome of the BA, then the only NEPA documentation required is a signed ERS that is included in the Project Summary package sent to HQ Systems Analysis and Program Development. No other NEPA documentation or approval by FHWA is required.

For DCEs, additional environmental documentation is required and FHWA approval must be obtained before the Project File can be approved. All environmental documentation must be completed before finalizing the PS&E package and going to ad. The ERS is then renamed the Environmental Classification Summary (ECS), signed by the Region Environmental Manager, and sent with federal permits and/or documentation to FHWA for approval.

After obligation of project design funds, detailed environmental studies for CE documentation may be required for DCE projects to determine the environmental, economic, and social impacts. WSDOT then finalizes the ECS and submits it to FHWA for final approval.

220.08 Environmental Assessments – Class III Projects

Under NEPA, when the significance of the impact of a proposed project on the environment is not clearly established, an Environmental Assessment (EA) is prepared to determine the extent of environmental impact and to determine whether an EIS is needed. WSDOT may adopt the EA to satisfy requirements for a SEPA DNS, but the EA will not satisfy the EIS requirement under SEPA. No EIS is required when the EA supports a NEPA Finding of No Significant Impact (FONSI). Issuance of a FONSI (normally by the FHWA) is the final step in the EA process. (See Section 411.04 of the *Environmental Procedures Manual* for details on EA documentation and procedures.)

220.09 Reevaluations

Both NEPA and SEPA allow for reevaluating the project classification or environmental document. In general, reevaluations are required when there are substantial changes to the scope of a project, such that the project is likely to have significant adverse environmental impacts, or there is new information that increases the likelihood that a project will have significant adverse environmental impacts. Reevaluations are also required if project construction has not begun within five years of completing the NEPA process.

Because FHWA must concur with the NEPA classification, any major change in a project classification for a project involving federal funds requires the processing of a revised ECS form. Minor changes may be handled informally, if FHWA concurs.

For SEPA, when the scope of a project is changed, a revised ERS is normally required, with some exceptions. As part of that revision process, the environmental classification needs to be reassessed. The decision on whether or not to revise the ERS is made by the Region Environmental Office in coordination with the Region Program Management Office. For many minor scope changes, a new ERS is not required. A note to the file or a follow-up memo is then prepared to document the revision.

In some cases, new circumstances may cause a change in the environmental classification but not a change in scope. Document any changes in classification with a note to the file or a follow-up memo.

220.10 Commitment File

As an initial part of project development, the Region establishes a project commitment file. Establishment of this file generally coincides with preparation of the environmental document or might be at later stages as required. The file consists of proposed mitigating measures, commitments made to resource or other agencies with permitting authority, and other documented commitments made on the project. Also included in the file are design and environmental commitments. Other commitment types (ROW, Maintenance, etc.) may be added at the Region's discretion.

The Region continues to maintain the commitment file as a project progresses through its development process. Whenever commitments are made, they are incorporated into project documents and transferred from one phase of the project to the next. Commitments are normally included or identified in the following documents or actions:

- Environmental documents and consultations
- Design Documentation Package (DDP)
- Environmental permits
- MOUs/Letters to stakeholders
- Right of way plans
- Access plans
- Findings and Order from access hearings
- Contract document

- Preconstruction conference
- Change orders
- End of project report
- Maintenance

To organize and track commitments made during the development and implementation of a project, WSDOT has established a Commitment Tracking System (CTS). This system provides easy access and retrieval of commitment information. Reports from the system establish the commitment record for the Project File. When a commitment is made, log it in the CTS. The entry requires sufficient detail necessary to document the commitment, including references to correspondence, agreement numbers, etc. A commitment may be revised when WSDOT and the organization or individual involved agree to the revision.

When commitments are completed, the CTS is updated with the date the commitment was finished and appropriate comments. Commitments requiring ongoing maintenance need to be formally passed off to Maintenance and Operations for incorporation into the Maintenance Program.

220.11 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

Chapter 240 Environmental Permits and Approvals

240.01 Introduction

WSDOT projects are subject to a variety of federal, state, and local environmental permits and approvals. The *Environmental Procedures Manual* provides detailed guidance on the applicability of each permit and approval. Because the facts of each project vary and the environmental regulations are complex, reliance on either the *Design Manual* or the *Environmental Procedures Manual* is insufficient. Consult the Region and Headquarters (HQ) Environmental offices.

240.02 Permits and Approvals

The Environmental Review Summary (ERS) prepared as part of the Project Summary identifies some of the most common environmental permits that might be required based on the information known at that stage. As the project design develops, additional permits and approvals can be identified. Conducting project site visits for engineering and environmental features may reduce project delays due to late discoveries. Coordinate with the Region and HQ Environmental offices.

Figures 240-1a through 1e provide a comprehensive list of the environmental permits and approvals required by WSDOT projects. For each permit or approval, the responsible agency is identified, the conditions that trigger the permit are listed, the relevant sections of the *Environmental Procedures Manual* are provided, and the statutory authority is cited.

The conditions that trigger a permit or approval are discussed in detail in the *Environmental Procedures Manual*. The permit triggers are subject to interpretation and change as new regulations are developed or court decisions are rendered that alter their applicability. Determining which permits and approvals apply and how they apply is dependent on the facts of each project. Consult the Environmental Office at each stage of the project design to review the permits and approvals that might be required based on the project design.

Permit or Approval	Responsible Agency	Conditions Requiring	Environmental Procedures	Statutory Authority
National Environmental Policy Act (NEPA)	FHWA and WSDOT	Activities that require federal permits, approvals, or funding trigger NEPA procedural and documentation requirements.	320, 410-480	42 USC 4321 23 CFR 771 40 CFR 1500-1508
State Environmental Policy Act (SEPA)	Ecology	Any activity not categorically exempt triggers SEPA procedural and documentation requirements.	410-480	RCW 43.21C WAC 197-11, WAC 468-12
Corps of Engineers Section 404 Individual Permits (Uses Joint Aquatic Resource Permits Application [JARPA])	COE	Any discharging, dredging, or placing of fill material in waters of the U.S. and adjacent wetlands	431, 432, 437, 452, 510	Section 404 of the Clean Water Act (CWA); 33 USC 1344, 33 CFR 330.5 and 330.6
Corps of Engineers Section 404 Nationwide Permits (NWP) (Uses JARPA)	COE	NWP information is presented in a 2002 special public notice issued by the COE. A total of 44 NWPs for a range of activities in waters of the US are described in the public notice.	431, 432, 437, 452, 510	Section 404 of the CWA; 33 USC 1344, 33 CFR 330.5 and 330.6
Water Quality 401 Certification (Uses JARPA)	Ecology Headquarters, Shorelands and Environmental Assistance Program, Coordination Section; U.S. EPA on Tribal and Federal land	Any activity requiring a federal permit for discharging into waters must receive certification from the state that the discharge complies with that state's water quality standards.	431, 432, 437, 452, 453	33 USC 1341, 33 CFR 320.4; RCW 90.48, WAC 173-225
Coastal Zone Management (CZM) Certification (Uses JARPA)	Ecology Headquarters, Shorelands and Environmental Assistance Program	Any activity requiring a federal permit/license must certify that the activity will comply with the State's Coastal Zone Management Program (Shoreline Management Act).	431, 432, 437, 452, 520	16 USC 1456, 33 CFR 320.3, RCW 90.58
Coast Guard Section 9 Bridge Permit (Uses JARPA)	U.S. Coast Guard	Any work on bridges and causeways in navigable waters or waters that are susceptible to improvement for transporting interstate or foreign commerce, or waters that are used by boats 21 feet or more in length.	431, 432, 452, 453	Section 9 of the Rivers and Harbors Act; 33 USC 401; 33 CFR 114 and 115; Federal Aid Highway Act of 1987. Section 123(b)
Corps of Engineers Section 10 Permit (Uses JARPA)	COE	Any obstruction, alteration, or improvement of any navigable water, including rechanneling, piers, wharfs, dolphins, bulkheads, and buoys.	431, 432, 452	Section 10 of the Rivers and Harbors Act; 33 USC 401; 33 CFR 330.5 and 330.6
Threatened and Endangered Species	USFWS and NMFS	Projects affecting critical habitat of species listed under the ESA may be subject to water quality and wetland permits listed in Section 431.06 and Section 437.06.	436, 447, 510, 520	16 USC 1531-1543

Permits and Approvals
Figure 240-1a

Permit or Approval	Responsible Agency	Conditions Requiring	Environmental Procedures	Statutory Authority
Historic Preservations Act - Section 106	OAHP SHPO	Potential impacts to historic or archaeological properties trigger Section 106 procedural and documentation requirements.	411, 456	16 USC 470 Sec.106 36 CFR 800 RCW 43.51.750
Land and Water Conservations Act - Section 6(f)	FHWA and Affected Agency (WSDOT)	Use of lands purchased with LWCA funds triggers Section 6(f) procedural and documentation requirements.	411, 455	LWCA, 16 USC
U.S. Dept of Transportation Act - Section 4(f)	FHWA and Affected Agency (WSDOT)	Use of park and recreation lands, wildlife and waterfowl refuges, and historic sites of national, state, or local significance triggers Section 4(f) procedural and documentation requirements.	411, 455	49 USC 1651 Sec. 4 (f) 23 CFR 138
Wild and Scenic Rivers	FHWA and Affected Agency	No specific permits are required for projects in wild and/or scenic river corridors, but water quality permits may apply.	453	16 USC 1271
Farmland Conversion	NRCS Counties/Cities	NRCS Form AD1006 approval may be required if project entails conversion of farmlands. Local grading permits may also be required.	454	7 USC 4201 7 CFR 650
Airport/Highway Clearance	FAA (Federal)	Airspace intrusion by a highway facility (i.e. proposed construction in the vicinity of public use or military airports) may require FAA notification.	460	FHPM 6-1-1-2 FAA Regs. Part .77
(NPDES Municipal Stormwater Discharge General Permit	Ecology	WSDOT projects that discharge stormwater. There are four geographical areas covered by separate general permits that are based on watershed boundaries: Island, Snohomish, South Puget Sound, and Cedar/Green.	431, 433	33 USC 1342, RCW 90.48, WAC 173-226
NPDES Stormwater Construction Permit	Ecology	WSDOT construction activities disturbing more than 5 acres.	431, 433	33 USC 1342, RCW 90.48, WAC 173-226
NPDES Sand and Gravel General Permit	Ecology	Discharges of process water and stormwater associated with sand and gravel operations and rock quarries.	431, 433	33 USC 1342, RCW 90.48; WAC 173-226
NPDES Stormwater Industrial Permit	Ecology	Ferry-related activities that discharge stormwater to waters of the state.	431, 433	33 USC 1342, RCW 90.48; WAC 173-226
Underground Injection Control	Ecology	Injection well that may contaminate drinking water.	433	40 CFR 144 RCW 43-21A.44 , WAC 173-218

Permits and Approvals
Figure 240-1b

Permit or Approval	Responsible Agency	Conditions Requiring	Environmental Procedures	Statutory Authority
Hazardous Waste Tracking Form	Ecology	A WAD tracking number from Ecology is required for transport, storage, or disposal of dangerous waste.	447	WAC 173-303
Water Quality Permit. Use of Herbicides to Control Noxious Weeds on WSDOT Properties and Projects within the State of Washington	Ecology, Environmental Coordination Section, Federal Permit Manager for WSDOT	Application of herbicides to waters of the state at WSDOT-owned or –managed sites to control noxious weeds.	431	RCW 90.48.445, and WAC 173-201A-110
Administrative Order # DE99WQ-003. WSDOT Use of Herbicides to Control Non-noxious Weeds on WSDOT Properties and Projects within the State of Washington	Ecology, Environmental Coordination Section, Federal Permit Manager for WSDOT	Approved methods of application must be followed and careful record keeping must be documented. WDFW must be consulted for identification of salmonid bearing waters and special seasonal timing restrictions. Restrictions and public notice requirements are placed on herbicide application within 0.5 mile of areas of potential public use.	431	RCW 90.48, and WAC 173-201A-110
Water Right Permit	Ecology, Water Resources Program	Any withdrawal of surface or groundwater for a WSDOT activity or project.	431, 433	RCW 90.03; 90.44; 90.54
State Waste Discharge (SWD) Permit	Ecology	Any activity that will discharge or dispose of municipal and industrial wastewater into groundwaters of the state, or discharge industrial wastewater to a NPDES-permitted wastewater treatment plant. SWD permits are different from NPDES permits because NPDES permits regulate discharges directly to water or stormwater systems.	433	RCW 90.48; WAC 173-226
Water System Project Approvals	Washington State Department of Health or County/City Department of Health	Any project in which there are two or more water service connections for human consumption and domestic use.	431, 433	RCW 43.20A; WAC 246-290 through 293
Hydraulic Project Approval (HPA)	WDFW	Any project that will use, cross, divert, obstruct, or change the natural flow or bed of any of the salt or fresh waters of the state. Regulated activities include culvert work, stream realignment, and bridge replacement.	431, 432, 436, 447, 452, 453, 510, 520	RCW 75.20.100; WAC 220-110;

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Figure 240-1c

Permit or Approval	Responsible Agency	Conditions Requiring	Environmental Procedures	Statutory Authority
Fish Habitat Enhancement Project Application	WDFW	Streamlined process for projects designed to enhance fish habitat. Application is in addition to JARPA.	436	
Aquatic Resource Use Authorization (Uses JARPA)	DNR	Included in JARPA.	436, 437, 520	RCW 79.90 WAC 332-30
Easements	DNR	Any activity that fills, crosses over, bridges, or is on the beds of navigable waters of the state.	436, 437, 520	RCW 47.12
Monument Removal	DNR	Removal or destruction of a monument.	451	
Operating Permit for Surface Mining	DNR, USFS, BLM	Surface mining (pit and quarry sites); more than 3 acres disturbed at one time or pit walls more than 30 feet high and steeper than 1:1; pit site reclamation (WDNR). Borrow pits on federal land may require a permit or easement from the land-management agency.	420, 510	RCW 78.44
Forest Practices Application	DNR	Road construction, pits, pesticide use, and other specified activities on public or private forest land (i.e., land capable of supporting merchantable timber).	455	RCW 76.09 WAC 222
Shoreline Substantial Development Permit (Uses JARPA)	Counties or Cities	Qualified activities within shoreline jurisdiction – lakes/reservoirs 20 acres or greater, streams with 20 cfs annual flow, marine water, and all areas landward for 200 feet of OHWM.	431, 432, 437, 452, 520	RCW 90.48, WAC 173-10 through 173-28
Flood Plain Development Permit (Uses JARPA)	Counties or Cities	Any structure or activity that may adversely affect the flood regime of a stream within the flood zone.	432	RCW 86.16; WAC 173-158
Critical Areas Ordinance (Uses JARPA)	Counties and Cities	Any activity involving critical areas as regulated by the local jurisdiction. Critical areas include wetlands, critical recharge areas to aquifers, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas.	420, 431, 436, 437, 451, 520	RCW 36.70A

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Figure 240-1d

Permit or Approval	Responsible Agency	Conditions Requiring	Environmental Procedures	Statutory Authority
Clearing, Grading, and Building Permits	Counties / Cities	Clearing and grading of land for development with impacts outside WSDOT right of way (includes connecting streets, frontage roads, etc.). Construction of any building for human habitation.	420, 451, 454, 460, 520	RCW 36.21.080
Temporary Air Pollution	Ecology, Local Clean Air Agencies, Fire Protection Agencies	Pollutants above allowed levels for temporary periods; includes building demolition and brush burning. Regulations may limit the type, size, or timing of brush burning.	425	RCW 70.94
New Source Construction	Ecology, Local Clean Air Agencies	Air pollution from a point source (e.g., asphalt plants, rock crushers).	425	RCW 70.94.152
Noise Variance	Counties / Cities	Construction and maintenance activities during nighttime hours may require a variance from local noise ordinances. Daytime noise from construction is usually exempt.	446	WAC 173-60
Archaeological Resources Protection Permit	Tribes Federal Landowners, (e.g. BLM, COE, NPS)	Excavation or removal of archaeological resources from tribal or federal land.	456	43 CFR 7.6 – 7.11

BLM – Bureau of Land Management
CFR – Code of Federal Regulations
COE – Corps of Engineers
CWA – Clean Water Act
CZMA – Coastal Zone Management Act
DNR – Department of Natural Resources
DOE – Department of Ecology
EPA – Environmental Protection Agency
ESA – Endangered Species Act
FERC – Federal Energy Regulatory Commission
LWCA – Land and Water Conservation Act
NMFS – National Marine Fisheries Service
NPDES – National Pollution Discharge Elimination System
NPS – National Park Service
NRCS – Natural Resources Conservation Service
OAHP – Office of Archaeology and Historic Preservation
OHWM – Ordinary High Water Mark
RCW – Revised Code of Washington
SHPO – State Historic Preservation Officer
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
WAC – Washington Administrative Code
WAD – EPA, Washington State waste ID tracking number
WDFW – Washington State Department of Fish and Wildlife

Permits and Approvals
Figure 240-1e

240.03 Project Types and Permits

Understanding and anticipating what permits and approvals may be required for a particular project type will assist the designer in project delivery. This section provides information on what project types are likely to trigger which permits. The purpose of this section is to inform designers of the potential for permits and does not substitute for the information developed in the Environmental Review Summary prepared during the Project Summary or more specific permit information developed during design. The intent is to provide a familiar and reasonably quick method for gauging the relative complexity of the permit process. Designers are encouraged to use the expertise in the Region Environmental Office and the HQ Environmental Services Office.

To make the evaluation familiar, this chapter uses the design matrices developed in Chapter 325 as a template. The project types and definitions are found in Chapter 325, with the exception of some additional project types for bridge work. These additional bridge projects are defined below. Rather than identify levels of design for each project type, the matrices identify permits and approvals. While every project is unique to some degree, there are common facts associated with project types that allow for a level of predictability. As the project type gets more complex, the predictability of which environmental permits and approvals may be triggered decreases.

Figures 240-2 through 240-7 present certain project types combined with assumptions on environmental conditions to generate probabilities about required permits and approvals. The probabilities cannot be substituted for a fact-based analysis of the project and the applicability of any particular environmental permit or approval. Contact the Region or HQ Environmental Office before decisions are made about whether a permit or approval applies. Coordination with the HQ Bridge and Structures Office and the HQ Environmental Services Office is recommended for bridge projects.

The probabilities for needing a permit are divided into low, medium, and high. A low probability generally means that the thresholds for triggering an environmental permit or approval may not be reached under the assumptions behind the project type. A medium probability means that there is the potential to trigger the application of the permit or approval. A high probability means that there is a likelihood of triggering the permit or approval.

The assumptions underlying the project types and probabilities are shown as endnotes following the matrices (Figure 240-7). Some general assumptions were made regarding the project types; for main line projects on the Interstate, National Highway System main line (except Interstate), or non-National Highway System, all bridgework is assumed to be over water. For interchange projects on the Interstate and non-Interstate, all bridgework is assumed to be over roads (see Chapter 325).

The environmental permits and approvals selected for inclusion in the matrices represent the ones that are most frequently triggered. The other permits and approvals listed in Figures 240-1a through 1e are more limited in their application and often require very specific fact situations. They are discussed in more detail in the *Environmental Procedures Manual.*

The additional bridge projects are as follows:

- **Bridge Replacement (Obsolete, Structural)**. Projects to replace or rehabilitate state-owned bridges when continued maintenance and preservation strategies can no longer accommodate safe, continuous movement of people and goods. Includes new or replacement bridge (on or over, main line, interchange ramp, or water body), and repair or replacement of reinforced concrete, steel, and/or timber bridges. Obsolete replacement typically includes bridges that have a narrow width or low vertical clearance or a restrictive waterway opening. Structural replacement is a replacement of a bridge that has a structural deficiency in a superstructure or substructure element.
- **Existing Bridge Widening**. Widening an existing bridge for an existing highway.
- **Bridge Deck Rehabilitation**. Structures preservation projects that repair delaminated concrete bridge deck and add a protective overlay that will provide a sound, smooth surface; prevent further corrosion of the reinforcing steel; and preserve operational and structural capacity. The goal is to ensure safe, long-lasting riding surfaces on all reinforced concrete bridges.
- **Bridge Scour Countermeasures**. Measures undertaken to reduce the risk of bridge foundation scour damage and stream bank erosive forces that increase the potential of bridge collapse due to flooding and long-term waterway changes. The goal is to maintain the structural integrity of the roadway prism and highway structures. Bridge scour repair can include repair to the streambed around a bridge column or repairs to stream banks near a bridge. This category typically involves an in-depth engineering and environmental review for site and/or reach processes. Extensive documentation and permitting are typically needed. Early and close coordination with the permit agency representatives through the Region Environmental Office is essential. Close coordination with the HQ Bridge Preservation Office, Hydraulics Branch, and Environmental Services Office (watershed, permit program) are useful to ensure that a one-WSDOT project approach is established early in the design phase.
- **Steel Bridge Painting**. Measures undertaken to preserve the load-carrying capacity of steel bridges by maintaining properly functioning paint systems to provide protection against corrosion. These measures include high-pressure washing and spot abrasive blasting to prepare steel surfaces for painting. This category typically involves discharge of wastewater into waters of the state and the decisions surrounding the need for full or partial containment of the wash water and blast media used for preparing the steel surfaces. Early and close coordination with the Bridge Management Engineer is necessary. A thorough review of the *Standard Specifications'* current Water Quality Implementing Agreement (WQIA) and available Programmatic Permits, such as the General Hydraulic Project Approval (GHPA) and National Pollution Discharge Elimination System (NPDES) permits, is also recommended. Early project scoping for determination of wildlife usage is another factor for early coordination with all departments.

- **Bridge Seismic Retrofit**. Seismic retrofit of a bridge element (typically bridge columns). Measures undertaken to reduce the vulnerability of existing Washington State-owned bridges in the high to moderate seismic risk areas to earthquake damage that could cause collapse, excessive repair costs, or lengthy closures to traffic. This includes Phase 1 repairs (prevent span separation), Phase 2 repairs (retrofit single-column supports), and Final Phase (retrofit multiple-column supports).
- **Special Bridge Repair (Electrical/Mechanical Retrofit)**. Rehabilitating a major portion of an existing bridge to include electrical and mechanical repairs, such as for a movable bridge, a bridge over navigable water, or sign support structures.
- **Other Bridge Structures**. Major repair or replacement of Sign Bridges, Cantilever Sign Supports, Bridge-Mounted Sign Supports, Tunnels, and High Mast Light Standard.
- **New Special Structures**. Measures taken to build a new floating, movable, suspension, or cable stayed bridge for new or existing roadway.

⇩ Project Type Permit or Approval(***) ⇨	Section 404 Individual Permits	Section 404 Nationwide Permits (NWP)	Water Quality 401 Certification[1]	Coastal Zone Management (CZM) Certification[2]	Threatened and Endangered Species	Hydraulic Project Approval (HPA)	Shoreline Substantial Development Permit	Flood Plain Development Permit	Aquatic Resource Use Authorization	NPDES Municipal Stormwater Permit[3]	NPDES Stormwater Construction Permit	NPDES Industrial Discharge Permit	State Waste Discharge (SWD) Permit[4]	Section 9 Bridge Permit[5]	Section 10 Permit[6]	Section 106	Section 4(f) 6(f)	Critical/Sensitive Areas Ordinances[7]	Noise Variance
(1-1) Preventive Maintenance																			
Pavement Restoration																			
(1-2) Diamond Grinding	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(1-3) Milling with HMA Inlays	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(1-4) Nonstructural Overlay	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
Pavement Rehab./Resurf.																			
(1-5) HMA Structural Overlays	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(1-6) PCCP Overlays	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(1-7) Dowel Bar Retrofit	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
Bridge Rehabilitation																			
(1-8) Bridge Widening	M	M	M	M	M	H	H	M	L	L	L	L	L	M	M	M	L	M	L**
(1-8a) Existing Bridge Replacement	M/H	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	H	M	M	M
(1-8b) Bridge Deck Rehabilitation	M	L	L	H	M	M	H	L	L	H	L	L	L	M	L	M	L	L	M
(1-8c) Bridge Scour Countermeasures	M	H	H	H	H	H	H	L	M	L	L	L	L	M	M	M	L	H	L
(1-8d) Steel Bridge Painting	L	L	H	H	M	H	L	L	L	L	L	L*	L	M	L	L	L	L	M**
(1-8e) Bridge Seismic Retrofit	L	M	M	M	M	H	L	L	L	L	L	L	L	M	L	L	L	L	L
(1-8f) Special Bridge Repair	L	M	M	M	M	M	L	L	L	L	L	L	L	M	L	L	L	L	M
Safety																			
(1-9) Median Barrier	L	M	M	L	L	L	L	L	L	H	M	L	L	L	L	L	L	L	L
(1-10) Guardrail Upgrades	L	M	M	L	L	L	M	L	L	H	M	L	L	L	L	L	L	L	L
(1-11) Bridge Rail Upgrades	L	L	L	H	L	L	H	L	L	H	L	L	L	L	L	M	L	L	L
Reconstruction																			
(1-12) New/Reconstruction	M/H	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	H	M	M	M

Note: For explanation of matrices, see Figure 240-7.

Project Environmental Matrix 1:
Permit Probabilities for Interstate Routes (Main Line)
Figure 240-2

⇩ Project Type / Permit or Approval ⇨	Section 404 Individual Permits	Section 404 Nationwide Permits (NWP)	Water Quality 401 Certification[1]	Coastal Zone Management (CZM) Certification[2]	Threatened and Endangered Species	Hydraulic Project Approval (HPA)	Shoreline Substantial Development Permit	Flood Plain Development Permit	Aquatic Resource Use Authorization	NPDES Municipal Stormwater Permit[3]	NPDES Stormwater Construction Permit	NPDES Industrial Discharge Permit	State Waste Discharge (SWD) Permit[4]	Section 9 Bridge Permit[5]	Section 10 Permit[6]	Section 106	Section 4(f) 6(f)	Critical/Sensitive Areas Ordinances[7]	Noise Permit
(2-1) Preventive Maintenance																			
Pavement Restoration																			
(2-2) Diamond Grinding	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
(2-3) Milling with HMA Inlays	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
(2-4) Nonstructural Overlay	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
Pavement Rehab./Resurf.																			
(2-5) HMA Structural Overlays	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
(2-6) PCCP Overlays	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
(2-7) Dowel Bar Retrofit	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
Bridge Rehabilitation																			
(2-8) Bridge Deck Rehabilitation	M	L	L	H	M	M	H	L	L	H	L	L	L	M	L	M	L	L	M**
(2-8a) Steel Bridge Painting	L	L	H	H	M	H	L	L	L	L	L	H	L	M	L	L	L	L	L
(2-8b) Bridge Seismic Retrofit	L	M	M	M	M	H	L	L	L	L	L	L	L	M	L	L	L	L	L
Safety																			
(2-9) Guard Rail Upgrades	L	M	M	L	L	L	M	L	L	H	M	L	L	L	L	M	L	L	L
(2-10) Bridge Rail Upgrades	L	L	L	M	L	L	M	L	L	H	M	L	L	L	L	M	L	L	L
Reconstruction																			
(2-11) New/Reconstruction	M/H	H	H	H	H	H	H	M	L	H	H	L	L	L	L	H	M	M	M

Note: For explanation of matrices, see Figure 240-7.

Project Environmental Matrix 2:
Permit Probabilities for Interstate Interchange Areas
Figure 240-3

⇩ Project Type / Permit or Approval ⇨	Section 404 Individual Permits	Section 404 Nationwide Permits (NWP)	Water Quality 401 Certification[1]	Coastal Zone Management (CZM) Certification[2]	Threatened and Endangered Species	Hydraulic Project Approval (HPA)	Shoreline Substantial Development Permit	Flood Plain Development Permit	Aquatic Resource Use Authorization	NPDES Municipal Stormwater Permit[3]	NPDES Stormwater Construction Permit	NPDES Industrial Discharge Permit	State Waste Discharge (SWD) Permit[4]	Section 9 Bridge Permit[5]	Section 10 Permit[6]	Section 106	Section 4(f) 6(F)	Critical/Sensitive Areas Ordinances[7]	Noise Permit
Preservation																			
Roadway																			
(3-1) Non-Interstate Freeway	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(3-2) HMA/PCCP/BST Overlays	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(3-3) Replace HMA w/ PCCP at I/S	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
Structures																			
(3-4) Bridge Replacement	H	H	H	H	H	H	H	H	M	H	H	L	L	M	M	M	M	M	L
(3-5) Bridge Deck Rehab.	M	L	L	H	M	M	H	L	L	H	L	L	L	M	L	M	L	L	M
(3-5a) Bridge Scour	M	H	H	H	H	H	H	L	M	L	L	L	L	M	M	M	L	H	L
(3-5b) Steel Bridge Painting	L	L	H	H	M	H	L	L	L	L	L	H	L	M	L	L	L	L	L
(3-5c) Bridge Seismic Retrofit	L	M	M	M	M	H	L	L	L	L	L	L	L	M	L	L	L	L	L
(3-5d) Special Bridge Repair	L	M	M	M	M	M	L	L	L	L	L	L	L	M	L	L	L	L	M
Improvements																			
Mobility																			
(3-6) Non-Interstate Freeway	M/H	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	M	M	M	M**
(3-7) Urban	M/H	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	M	M	M	M**
(3-8) Rural	M	H	H	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(3-9) HOV	M	M	M	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	M
(3-10) Bike/Ped. Connectivity	M	H	H	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	L
Safety																			
(3-11) Non-Interstate Freeway	L	L	L	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(3-12) Intersection	L	L	L	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(3-13) Corridor	L	L	L	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(3-14) Median Barrier	L	M	M	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(3-15) Guardrail Upgrades	L	M	M	L	L	L	M	L	L	H	M	L	L	L	L	M	L	L	L
(3-16) Bridge Rail Upgrades	L	L	L	M	L	L	M	L	L	H	M	L	L	L	L	M	L	L	L
(3-17) Risk: Roadside	L	H	H	L	L	L	M	M	L	H	M	L	L	L	L	M	L	L	L
(3-18) Risk: Sight Distance	L	L	L	L	L	L	M	M	L	H	M	L	L	L	L	M	L	L	L
(3-19) Risk: Roadway Width	L	H	H	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(3-20) Risk: Realignment	M	H	H	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	L
Economic Development																			
(3-21) Freight and Goods (Frost Free)	M	H	H	M	M	M	M	M	L	H	H	L	L	L	L	M	M	M	M
(3-22) Four-Lane Trunk System	M	H	H	M	M	M	M	M	M	H	H	L	L	L	L	H	H	H	M
(3-23) Rest Areas (New)	M	H	H	L	M	M	M	L	L	H	H	L	M	L	L	H	H	H	L
(3-24) Bridge Restrictions	M	H	H	H	M	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(3-25) Bike Routes (Shldrs)	L	M	M	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L

Note: For explanation of matrices, see Figure 240-7.

Project Environmental Matrix 3:
Permit Probabilities for NHS Routes, Non-Interstate (Main Line)
Figure 240-4

⇩ Project Type / Permit or Approval ⇨	Section 404 Individual Permits	Section 404 Nationwide Permits (NWP)	Water Quality 401 Certification[1]	Coastal Zone Management (CZM) Certification[2]	Threatened and Endangered Species	Hydraulic Project Approval (HPA)	Shoreline Substantial Development Permit	Flood Plain Development Permit	Aquatic Resource Use Authorization	NPDES Municipal Stormwater Permit[3]	NPDES Stormwater Construction Permit	NPDES Industrial Discharge Permit	State Waste Discharge (SWD) Permit[4]	Section 9 Bridge Permit[5]	Section 10 Permit[6]	Section 106	Section 4(f) 6(F)	Critical/Sensitive Areas Ordinances[7]	Noise Permit
Preservation																			
Roadway																			
(4-1) Non-Interstate Freeway	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
(4-2) HMA/PCCP/BST	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
Overlays Ramps	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
Structures																			
(4-3) Bridge Replacement	M	H	H	M	L	L	M	M	L	H	H	L	L	L	L	M	L	L	M
(4-4) Bridge Deck Rehab.	M	L	L	H	M	M	H	L	L	H	L	L	L	M	L	M	L	L	L
(4-5) Steel Bridge Painting	L	L	H	H	M	H	L	L	L	L	L	H	L	M	L	L	L	L	L
(4-6) Bridge Seismic Retrofit	L	M	M	M	M	H	L	L	L	L	L	L	L	M	L	L	L	L	L
Improvements																			
Mobility																			
(4-6) Non-Interstate Freeway	M/H	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	M	M	M	M**
(4-7) Urban	M/H	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	M	M	M	M**
(4-7) Rural	M	H	H	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
(4-8) HOV By Pass	M	H	H	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	M
(4-9) Bike/Ped. Connectivity	M	H	H	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
Safety																			
(4-10) Non-Interstate Freeway	L	L	L	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
(4-11) At Grade	L	L	L	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(4-12) Intersection	L	L	L	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(4-13) Guardrail Upgrades	L	M	M	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(4-14) Bridge Rail Upgrades	L	L	L	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(4-15) Risk: Roadside	L	H	H	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
(4-16) Risk: Sight Distance	L	L	L	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
(4-17) Risk: Roadway Width	L	H	H	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
(4-18) Risk: Realignment	M	H	H	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
Economic Development																			
(4-19) Four-Lane Trunk System	M	H	H	M	M	M	M	M	M	H	H	L	L	L	L	H	H	H	M

Note: For explanation of matrices, see Figure 240-7.

Project Environmental Matrix 4:
Permit Probabilities for Interchange Areas, NHS (Except Interstate) and Non-NHS
Figure 240-5

⇩ Project Type / Permit or Approval ⇨	Section 404 Individual Permits	Section 404 Nationwide Permits (NWP)	Water Quality 401 Certification[1]	Coastal Zone Management (CZM) Certification[2]	Threatened and Endangered Species	Hydraulic Project Approval (HPA)	Shoreline Substantial Development Permit	Flood Plain Development Permit	Aquatic Resource Use Authorization	NPDES Municipal Stormwater Permit[3]	NPDES Stormwater Construction Permit	NPDES Industrial Discharge Permit	State Waste Discharge (SWD) Permit[4]	Section 9 Bridge Permit[5]	Section 10 Permit[6]	Section 106	Section 4(f) 6(F)	Critical/Sensitive Areas Ordinances[7]	Noise Permit
Preservation																			
Roadway																			
(5-1) HMA/PCCP	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(5-2) BST	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(5-3) BST Routes/Basic Safety	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(5-4) Replace HMA with PCCP at I/S	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	
Structures																			
(5-5) Bridge Replacement	H	H	H	H	H	H	H	H	M	H	H	L	L	M	M	M	M	M	M
(5-6) Bridge Repl. (Multilane)	H	H	H	H	H	H	H	H	M	H	H	L	L	M	M	M	M	M	M
(5-7) Bridge Deck Rehab	M	L	L	H	M	M	H	L	L	H	L	L	L	M	L	M	L	L	M
(5-7a) Bridge Scour Countermeasures	M	H	H	H	H	H	H	L	M	L	L	L	L	M	M	M	L	H	L
(5-7b) Steel Bridge Painting	L	L	H	H	M	H	L	L	L	L	L	H	L	M	L	L	L	L	L
(5-7c) Bridge Seismic Retrofit	L	M	M	M	M	H	L	L	L	L	L	L	L	M	L	L	L	L	L
(5-7d) Special Bridge Repair	L	M	M	M	M	M	L	L	L	L	L	L	L	M	L	L	L	L	M
Improvements																			
Mobility																			
(5-8) Non-Interstate Freeway	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	M	M	M	M	M**
(5-9) Urban	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	M	M	M	M	M**
(5-10) Rural	M	H	H	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(5-11) HOV	M	M	M	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	M
(5-12) Bike/Ped. Connectivity	M	M	H	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	L
Safety																			
(5-13) Non-Interstate Freeway	L	L	L	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(5-14) Intersection	L	L	L	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(5-15) Corridor	L	L	L	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(5-16) Median Barrier	L	M	M	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(5-17) Guardrail Upgrades	L	M	M	L	L	L	M	L	L	H	M	L	L	L	L	M	L	L	L
(5-18) Bridge Rail Upgrades	L	L	L	M	L	L	M	L	L	H	M	L	L	L	L	M	L	L	L
(5-19) Risk: Roadside	L	H	H	L	L	L	M	M	L	H	M	L	L	L	L	M	L	L	L
(5-20) Risk: Sight Distance	L	L	L	L	L	L	M	M	L	H	M	L	L	L	L	M	L	L	L
(5-21) Risk: Roadway Width	L	H	H	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(5-22) Risk: Realignment	M	H	H	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	L
Economic Development																			
(5-23) Freight and Goods (Frost Free)	M	H	H	M	M	M	M	M	L	H	H	L	L	L	L	M	M	M	M
(5-24) Rest Areas (New)	M	H	H	M	M	M	M	L	L	H	H	L	M	L	L	H	H	H	L
(5-25) Bridge Restrictions	M	H	H	H	M	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(5-26) Bike Routes (Shldrs)	L	M	M	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L

Note: For explanation of matrices, see Figure 240-7.

Project Environmental Matrix 5: Non-NHS Routes (Main Line)
Figure 240-6

NOTES

For Figures 240-2 through 240-6
For main line projects on the Interstate, National Highway System main line (except Interstate), or non-National Highway System, all bridgework is assumed to be over water. For interchange projects on the Interstate and non-Interstate, all bridgework is assumed to be over roads (see Chapter 325).

NEPA/SEPA Endnotes
(*) Programmatic permits may apply
(**) Night work may require variance
(***) NEPA/SEPA compliance is required on all projects. The level of documentation will correspond to the complexity of the project and the potential environmental impacts anticipated (see Region or HQ environmental staff).

Section 404 IP Endnotes
L = Low probability assumes the work is covered by an NWP.
M = Medium probability assumes the potential for impacts beyond the thresholds for an NWP.
H = High probability assumes a likelihood for impacts beyond the thresholds for an NWP.

Section 404 NWP Endnotes
L = Low probability assumes no work and/or fill below the OHWM or wetlands in waters of the U.S.
M = Medium probability assumes potential for work and/or fill below the OHWM in waters of the U.S. and/or minimal wetland fill.
H = High probability assumes likelihood for work and/or fill in waters of the U.S. below the OHWM or wetland fills below ⅓ acre (tidal) or ½ acre (nontidal).

Section 401 Endnotes
(1) Parallels probability of Section 404 IP/NWP. Includes reference to Corps/Ecology/Tribes Regional General Conditions.

CZM Endnotes
(2) Parallels probability of Section 401 within 15 coastal counties only and involving waters of the state subject to Shoreline Management Act.

ESA Endnotes
L = Low probability assumes either applicable programmatic BA or individual BA and No Effect Determination.
M = Medium probability assumes either applicable programmatic or individual BA and Not Likely to Adversely Affect Determination.
H = High probability assumes either applicable programmatic or individual BA and Adverse Effect Determination (Biological Opinion).

HPA Endnotes
L = Low probability assumes no work within or over waters of the state subject to HPA.
M = Medium probability assumes potential for limited work within or over waters of the state.
H = High probability assumes likelihood for work within or over waters of the state.

Shoreline Endnotes
L = Low probability assumes no work within shorelines of the state.
M = Medium probability assumes potential for work within shorelines of the state.
H = High probability assumes likelihood for work within shorelines of the state.

Endnotes for Project Environmental Matrices
Figure 240-7

Floodplain Endnotes

L = Low probability assumes no fill in the 100-year floodplain.
M = Medium probability assumes potential for fill in the 100-year floodplain.
H = High probability assumes likelihood for fill in the 100-year floodplain.

Aquatic Resource Use Authorization Endnotes (DNR)

L = Low probability assumes no new structures or use of aquatic lands. ("Use" is subject to interpretation by DNR.)
M = Medium probability assumes potential for new structures or use of aquatic lands.
H = High probability assumes likelihood for new structures or use of aquatic lands. May need to define USE and include Easement Over Navigable Water.

Section 402 NPDES Municipal Stormwater General Permit Endnotes

(3) Applies to construction, operation, and maintenance activities in four watersheds: Island/Snohomish, Cedar/Green, South Puget Sound, and Columbia Gorge.
L = Low probability assumes project exempt from NPDES Municipal Stormwater Permit.
H = High probability assumes project subject to NPDES Municipal Stormwater Permit.

Section 402 NPDES Stormwater Construction General Permit Endnotes

L = Low probability assumes ground disturbance of less that one acre.
M = Medium probability assumes ground disturbance of one acre or more.
H = High probability assumes likelihood of ground disturbance of one acre or more.

Section 402 NPDES Industrial Discharge General Permit Endnotes

L = Low probability assumes no bridge or ferry terminal washing over waters of the state.
M = Medium probability assumes potential for bridge or ferry terminal washing over waters of the state.
H = High probability assumes likelihood for bridge or ferry terminal washing over waters of the state.

State Waste Discharge Permit Endnotes

(4) Applies to discharges of commercial or industrial wastewater into waters of the state; does not cover stormwater discharges under NPDES program.
L = Low probability assumes SWD permit does not apply.
M = Medium probability assumes potential for SWD permit.

Section 9 Bridge Permit Endnotes

(5) Applies to work on bridges across navigable waters of the U.S.
L = Low probability assumes no bridgework.
M = Medium probability assumes potential for work on a bridge across navigable water.
H = High probability assumes likelihood for work on a bridge across navigable water.

Section 10 Permit Endnotes

(6) Applies to obstruction, alteration, or improvement of navigable waters of the U.S.
L = Low probability assumes no obstructions, alterations, or improvements to navigable waters.
M = Medium probability assumes potential for obstructions, alterations, or improvements to navigable waters.
H = High probability assumes likelihood for obstructions, alterations, or improvements to navigable waters.

Endnotes for Project Environmental Matrices
Figure 240-7 (continued)

Section 106 Endnotes

L = Low probability assumes no federal nexus and/or activities exempted per the statewide Programmatic Agreement on Section 106 signed by FHWA, WSDOT, OAHP and ACHP.

M = Medium probability assumes a federal nexus; therefore, Section 106 federal regulations apply.

H = High probability assumes a federal nexus and/or the likelihood for discovery of historic or culturally significant artifacts. (See 36 CFR Part 800, *Environmental Procedures Manual*, current DOT Policy, and the Section 106 Programmatic Agreement.)

Section 4(f)/6(f) Endnotes

L = Low probability assumes no use of or acquisition of new right of way.

M = Medium probability assumes potential use of or acquiring of new right of way.

H = High probability assumes likelihood for use of or acquiring of new right of way. Review triggers: www.wsdot.wa.gov/Environment/Compliance/Section4Fguidance.htm

Critical/Sensitive Areas Endnotes

(7) The mechanism for critical/sensitive areas review varies by jurisdiction.

L = Low probability assumes no work inside or outside of right of way in critical/sensitive areas.

M = Medium probability assumes potential for work inside or outside of right of way in critical/sensitive areas.

H = High probability assumes likelihood for work inside or outside of right of way in critical/sensitive areas.

Noise Variance Endnotes

L = Low probability assumes no night work.

M = Medium probability assumes potential for night work.

H = High probability assumes likelihood for night work.

Endnotes for Project Environmental Matrices

Figure 240-7 (continued)

240.04 Design Process and Permit Interaction

Environmental permits require information prepared during the design phase to demonstrate compliance with environmental rules, regulations, and policies. To avoid delays in project delivery, it is necessary for the designer to understand and anticipate this exchange of information. The timing of this exchange often affects design schedules, while the permit requirements can affect the design itself. In complex cases, the negotiations over permit conditions can result in iterative designs as issues are raised and resolved.

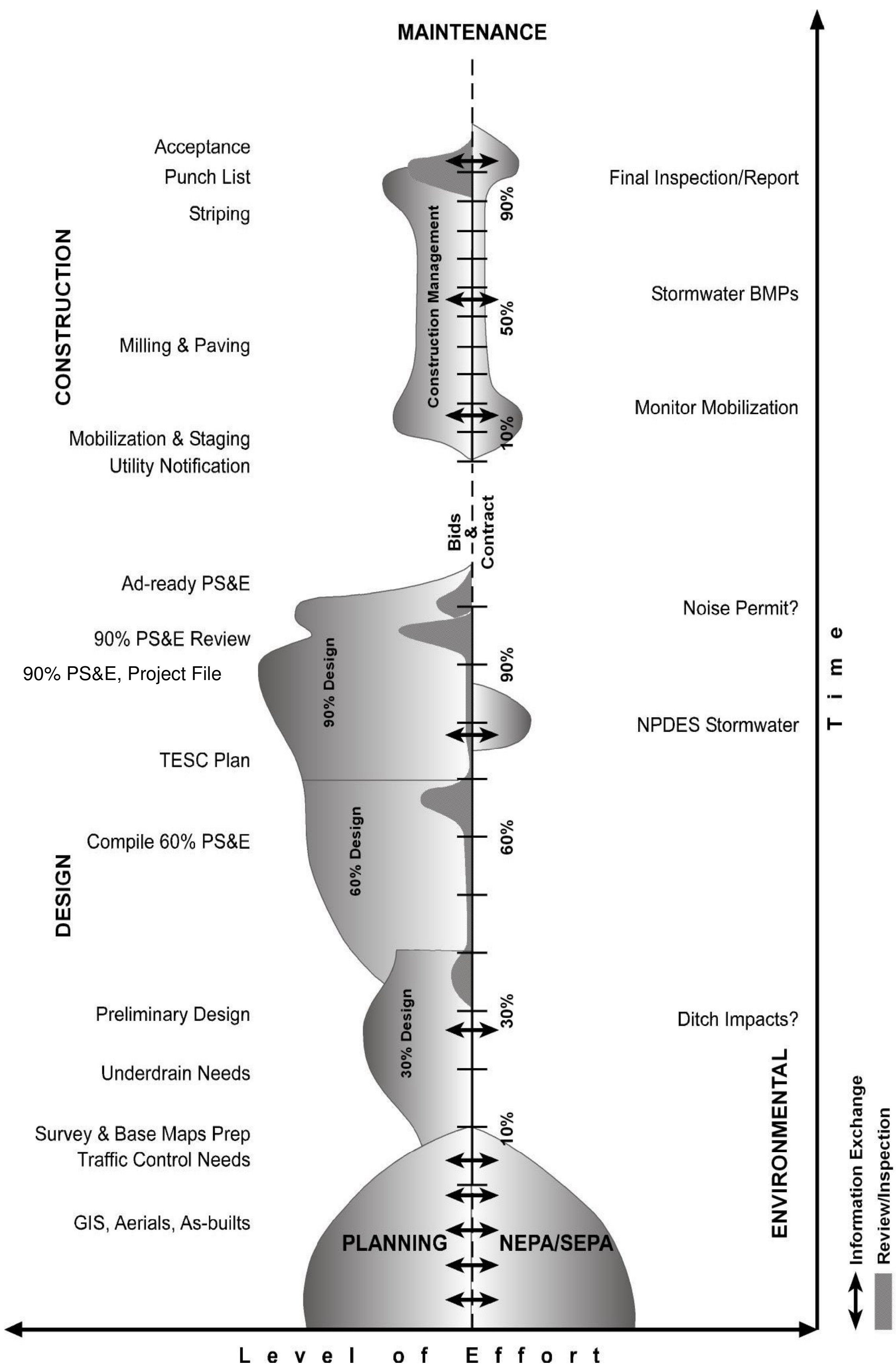
The permit process begins well in advance of the actual permit application. For some permits, WSDOT has already negotiated permit conditions through the use of programmatic and general permits. These permits typically apply to repetitive, relatively simple projects, and the permit conditions apply regardless of the actual facts of the project type. For complex projects, the negotiations with permit agencies often begin during the environmental documentation phase for compliance with NEPA and SEPA. The mitigation measures developed for the NEPA/SEPA documents are captured as permit conditions on the subsequent permits.

For many other project types, the permit process begins during the design phase. This section illustrates the interaction between design and permitting for two relatively uncomplicated projects. Figures 240-8 and 240-9 illustrate project timelines for two project types and the interaction of typical permits for those project types. The project types are an overlay project and a channelization project. The figures illustrate the level of effort over time for both design components and environmental permits.

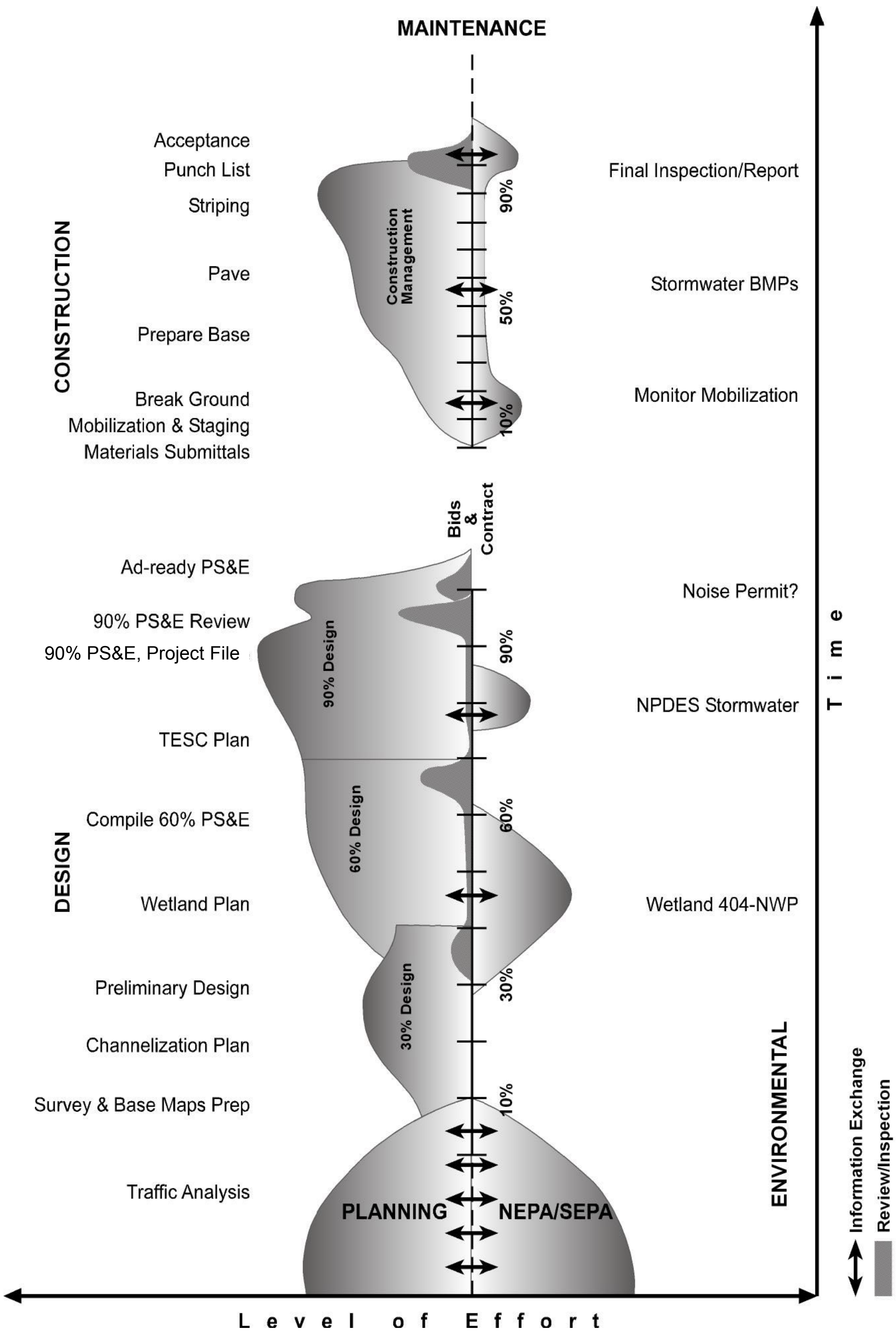
The overlay project assumes that only an NPDES Municipal Stormwater General Permit is required. Compliance with this permit is through application of the *Highway Runoff Manual* and the implementation of WSDOT’s 1997 *Stormwater Management Plan*. The possibility for a noise variance exists because of the potential for night work.

The channelization project assumes minor amounts of new right of way are required. Because roadside ditches are often at the edge of the right of way, it was assumed that the potential for impacting wetlands exists. Usually the amount of fill is minor and the project may qualify for a Corps of Engineers Section 404 Nationwide Permit. A wetland mitigation plan is required to meet permit requirements, and the plan’s elements have the potential to affect design, including stormwater facilities.

The interaction of design and permitting increases in complexity as the project type becomes more complex. More detailed analysis of environmental permits and their requirements is available in the *Environmental Procedures Manual* and through consultation with Region and HQ Environmental Office.



Environmental Interrelationship: HMA/PCCP/BST Main Line Overlay
Figure 240-8



Environmental Interrelationship: Safety Corridor Channelization Main Line
Figure 240-9

Chapter 315 Value Engineering

315.01 General

Value Engineering is a systematic process designed to focus on the major issues of a complex project or process. The process incorporates, to the extent possible, the values of the design engineer, construction engineer, maintenance engineer, contractor, state and federal approval agencies, local agencies, other stakeholders, and the public.

A Value Engineering study uses a multidisciplined team to develop recommendations for important design decisions.

The primary objective of a Value Engineering study is *value improvement*. The value improvements might relate to scope definition, functional design, constructibility, coordination (both internal and external), or the schedule for project development. Other possible value improvements are reduced environmental impacts, reduced public (traffic) inconvenience, or reduced project cost.

315.02 References

(1) Federal/State Laws and Codes

23 CFR Part 627, Value Engineering

(2) Supporting Information

Value Engineering for Highways, Study Workbook, U.S. Department of Transportation, FHWA

Value Standard and Body of Knowledge, SAVE International, The Value Society
www.value-eng.org/about_vmstandard.php

WSDOT Value Engineering web site: www.wsdot.wa.gov/eesc/design/VE/

315.03 Definitions

Value Engineering (VE) A systematic application of recognized techniques by a multidisciplined team to identify the function of a product or service, establish a worth for that function, generate alternatives through the use of creative thinking, and provide the needed functions to accomplish the original purpose; thus assuring the lowest life cycle cost without sacrificing safety, necessary quality, or environmental attributes. Value Engineering is sometimes referred to as Value Analysis (VA) or Value Management (VM).

project The portion of a transportation facility that WSDOT proposes to construct, reconstruct, or improve, as described in the *State Highway System Plan* or applicable environmental documents. A project may consist of several contracts or phases over several years that are studied together as *one project*.

315.04 Procedure

The VE process uses the Eight-Phase Job Plan shown in Figure 315-1. Only Phases 1 and 7 are discussed in this chapter. A detailed discussion of Phases 2 through 6 can be found in the document *Value Standard and Body of Knowledge,* developed by SAVE International, The Value Society: www.value-eng.org/about_vmstandard.php

(1) Selection Phase

(a) **Project Selection**

Projects for VE studies may be selected from any of the categories identified in the Highway Construction Program, including *Preservation* or *Improvement* projects, depending on the size and/or complexity of the project. In addition to the cost, other issues adding to the complexity of the project design are considered in the selection process. These include critical constraints, difficult technical issues, expensive solutions, external influences, and complicated functional requirements.

A VE study is required for any NHS project with an estimated cost of $25 million or more (CFR 23 Part 627). This cost includes design, construction, right of way, and utilities. Other projects that should be considered for Value Engineering have a preliminary estimate exceeding $5 million and include one or more of the following:

- Projects with alternative solutions that vary the scope and cost
- New alignment or bypass sections
- Capacity improvements that widen an existing highway
- Major structures
- Interchanges on multilane facilities
- Projects with extensive or expensive environmental or geotechnical requirements
- Materials that are difficult to acquire or that require special efforts
- Inferior materials sources
- Major reconstruction
- Projects requiring major traffic control
- Projects with multiple stages

(b) **Statewide VE Study Plan**

On a biennial basis, the state VE Manager coordinates with the Region VE coordinators to prepare the Two-Year VE Study Plan, with specific projects scheduled quarterly. The VE Study Plan is the basis for determining the projected VE program needs, including team members, team leaders, and training. The Statewide VE Study Plan is a working document and close coordination is necessary between Headquarters (HQ) and the Regions to keep it updated.

The Region VE coordinator:

- Identifies potential projects for VE studies from the Project Summaries and the available planning documents for future work.
- Makes recommendations for the VE study timing.
- Presents a list of the identified projects to Region management to prioritize into a regional Two-Year VE Study Plan.

The State Design Engineer:

- Reviews the regional Two-Year VE Study Plan regarding the content and schedule of the plan.

The state VE Manager:

- Incorporates the regional Two-Year VE Study plans and the HQ Study plans to create the Statewide VE Study Plan.

(c) **VE Study Timing**

Selecting the project at the appropriate stage of development (the timing of the study) is very important to the success of the VE program. Value can be added by performing a VE study at any time during project development; however, the WSDOT VE program identifies three windows of opportunity for performing a VE study.

1. **Project Definition Stage**

   As soon as preliminary engineering information is available and the specific deficiencies or “drivers” are identified, the project scope and preliminary cost are under consideration. This is the best time to consider the various alternatives or design solutions, and there is the highest potential that the related recommendations of the VE team can be implemented. At the conclusion of the VE study, the project scope, preliminary cost, and major design decisions can be based on the recommendations.

   When conducting a study in the project definition stage, the VE study focuses on issues affecting project drivers. This stage often provides an opportunity for building consensus with stakeholders.

2. **Conceptual Design Stage**

   At the conceptual design stage, the project scope and preliminary cost have already been established and the major design decisions have been made. Some Plans, Specifications, and Estimates (PS&E) activities might have begun and coordination has been initiated with the various service units that will be involved with the design. At this stage, the established project scope, preliminary cost, and schedule will define the limits of the VE study, and there is still opportunity for the study to focus on the technical issues of the specific design elements.

3. **30% Development Stage**

   At the 30% development stage, most of the important project decisions have been made and the opportunity to affect the project design is limited. The VE study focuses on constructibility, construction sequencing, staging, traffic control, and any significant design issues that have been identified during design development.

(d) **Study Preparation**

To initiate a VE study, the project manager submits a Request for Value Engineering Study form (shown in Figure 315-2) to the Region VE coordinator at least one month before the proposed study date.

The Region VE coordinator then works with the state VE Manager to determine the team leader and team members.

The design team prepares a study package of project information for each of the team members. A list of potential items is shown in Figure 315-3.

The Region provides a facility and the equipment (see Figure 315-3) for the study.

(e) **Team Leader**

The quality of the VE study is dependent on the skills of the VE team leader. This individual guides the team's efforts and is responsible for its actions during the study. The best VE team leader is knowledgeable and proficient in transportation design and construction and in the VE study process for transportation projects.

For best results, the team leader should be certified by the Society of American Value Engineers (SAVE) as a Certified Value Specialist (CVS) or as a Value Methodology Practitioner (VMP).

The state VE Manager coordinates with the Region VE coordinator to select the team leader. Team leadership can be supplied from within the Region (or from other Regions), Headquarters, consultants, or other qualified leaders outside the department. A statewide pool of qualified team leaders is maintained by the state VE Manager.

(f) **Team Members**

The VE team is usually composed of five to ten persons with diverse expertise relevant to the specific study. The team members may be selected from the Regions, Headquarters, other state and federal agencies, local agencies, or the private sector.

Team members are selected on the basis of the kinds of expertise needed to address the major functional areas and critical high-cost issues of the study. All team members must be committed to the time required for the study. For best results, the team members should have VE training before participating in a VE study.

(g) **VE Study Requirements**

The time required to conduct a VE study varies with the complexity and size of the project, but typically ranges from three to five days.

The VE study Final Report includes a narrative description of project information; the background, history, list of constraints, drivers, and VE team focus areas; a discussion of the team speculation and evaluation processes; and the team's final recommendations. All of the team's evaluation documentation (including sketches, calculations, analyses, and rationale for recommendations) is included in the Final Report. Include a copy of the Final Report in the Project File. The number of copies of the Final Report is specified by the project manager.

(2) Implementation Phase

The VE team's recommendations are included in the Final Report. The project manager reviews and evaluates the recommendations and prepares a VE Decision Document. This document has a specific response for each of the VE team's recommendations and a summary statement containing the managers' decisions and schedule for implementation regarding further project development.

The VE Decision Document also includes the estimated additional costs or cost savings of the recommendations, as well as the estimated costs to implement the recommendations. A copy of this document is sent to the state VE Manager so the results can be included in the annual VE report to FHWA.

The VE Decision Document is submitted to the State Design Engineer and a copy becomes a vital element in the Project File. Project development then continues based on the decisions developed from the preliminary engineering and VE study recommendations (barring participation agreements funded by other agencies, utilities, developers, and so forth).

315.05 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

1.	**Selection Phase 315.04(1)**	Select the right projects, timing, team, and project processes and elements.
2.	**Investigation Phase**	Investigate the background information, technical input reports, field data, function analysis, and team focus and objectives.
3.	**Speculation Phase**	Be creative and brainstorm alternative proposals and solutions.
4.	**Evaluation Phase**	Analyze design alternatives, technical processes, life cycle costs, documentation of logic, and rationale.
5.	**Development Phase**	Develop technical and economic supporting data to prove the feasibility of the desirable concepts. Develop team recommendations. Recommend long-term as well as interim solutions.
6.	**Presentation Phase**	Present the recommendations of the VE team in an oral presentation and in a written report.
7.	**Implementation Phase 315.04(2)**	Evaluate the recommendations. Prepare an implementation plan (VE Decision Document), including the response of the managers and a schedule for accomplishing the decisions based on the recommendations.
8.	**Audit Phase**	Maintain a records system to track the results and accomplishments of the VE program on a statewide basis. Compile appropriate statistical analyses, as requested.

Note:

Phases 2–6 are performed during the study; see *Value Standard and Body of Knowledge* for procedures during these steps.

Eight-Phase Job Plan for VE Studies

Figure 315-1

Project Title:					
SR No.	**MP**	**To**	**MP**	**Length**	**Subprogram**
PIN			**WIN**		
Assigned Project Engineer					
Proposed Advertising Date					
Estimated Right of Way Costs			**Estimated Construction Costs**		
Design Speed			**Projected ADT**		
Route Conditions/Geometry: **Adjacent Segments** **Overall Route**					
Major Project Elements					
Environmental Issues					
Construction Issues					
Suggested Value Team Composition: ☐ Architecture ☐ Landscape Architecture ☐ Bridge ☐ Maintenance ☐ Construction ☐ Planning/Programming ☐ Design ☐ Real Estate Services ☐ Environmental ☐ Traffic ☐ Hydraulics ☐ Other _____________					
Region Contact Person			**Dates requested for VE study**		

Request for Value Engineering Study
Figure 315-2

Project-Related Input* (Study Package)	Study-Related Facilities and Equipment
Design File	Room With Large Table
Quantities	Phone
Estimates	Photo/Video Log Access/SRView
R/W Plans	Van for Field Trip**
Geotechnical Reports	Easel(s)
Plan Sheets	Large Tablet Paper (2x2 Squares)
Environmental Documents	Colored Marking Pens
X-Sections and Profiles	Masking and Clear Adhesive Tape
Land Use Maps	Workbook(s)
Contour Maps	Digital Camera
Quadrant Maps	*Design Manual*
Accident Data	"*Green Book*"
Traffic Data	*Standard Plans*
Up-to-Date Large-Scale Aerial Photographs	*Standard Specifications*
Vicinity Map	M.P. Log
Hydraulics Report	Bridge List
Aerial Photos	WSDOT Phone Book
Existing As-Built Plans	Scales and Straight Edge
	Red Book – Field Tables
	Unit Bid Prices
	Calculators
	Scissors

* Not all information listed may be available to the team, depending on the stage of the project.

** If a field trip is not possible, provide video of the project.

VE Study Team Tools
Figure 315-3

Chapter 325 Design Matrix Procedures

325.01 General

The *Design Manual* provides guidance for three levels of design for highway projects: the basic, modified, and full design levels. The design matrices in this chapter are used to identify the design level(s) for a project and the associated processes for allowing design variances. The matrices address the majority of Preservation and Improvement projects and focus on those design elements that are of greatest concern in project development.

The design matrices are five tables that are identified by route type. Two of the matrices apply to Interstate highways; the other three apply to non-Interstate highways and address Preservation and Improvement projects.

A design matrix is used to determine the design level for the design elements of a project. Apply the appropriate design levels and document the design decisions as required by this chapter and Chapter 330.

325.02 Selecting a Design Matrix

Selection of a design matrix (see Figure 325-1) is based on highway system (Interstate, NHS excluding Interstate, and non-NHS) and location (main line and interchange).

Highway System	Location	
	Main Line	Interchange Area
Interstate	Matrix 1	Matrix 2
NHS*	Matrix 3	Matrix 4
Non-NHS	Matrix 5	Matrix 4

* Except Interstate.

Design Matrix Selection Guide
Figure 325-1

The **Interstate System** (Matrices 1 and 2) is a network of routes selected by the state and the FHWA under terms of the federal-aid acts. These routes are the principal arterials that are the most important to the economic welfare and defense of the United States. They connect, as directly as practicable:

- Principal metropolitan areas and cities.
- Industrial centers.
- International border crossings.

The Interstate System includes important routes into, through, and around urban areas; serves the national defense; and (where possible) connects with routes of continental importance. It also serves international and interstate travel and military movements.

The Interstate System is represented on the list of NHS highways (see Figure 325-2) with the letter "I" before the route number.

The **National Highway System (NHS)** (Matrices 3 and 4) is an interconnected system of principal arterial routes and highways (including toll facilities) that serves the following:

- Major population centers
- International border crossings
- Industrial centers
- Ports
- Airports
- Public transportation facilities
- Other intermodal transportation facilities
- Other major travel destinations

The NHS includes the Interstate System and the Strategic Highway Corridor Network (STRAHNET) and its highway connectors to major military installations (Interstate and non-Interstate).

The NHS meets national defense requirements and serves international, interstate, and interregional travel (see Figure 325-2).

The **Non-NHS** highways (Matrices 4 and 5) are state routes that form a highway network that supplements the NHS system by providing for freight mobility and regional and interregional travel. Non-NHS highways are not shown on Figure 325-2. They are shown on WSDOT's (free) Official State Highway Map of Washington.

325.03 Using a Design Matrix

The design matrices are shown in Figures 325-3 through 325-7. Follow *Design Manual* guidance for all projects except as noted in the design matrices (and elsewhere as applicable). The definitions presented in this chapter are meant to provide clarification of terminology used in the *Design Manual*. There is no assurance that these terms are used consistently in references outside the *Design Manual*.

(1) Project Type

For project types not listed in the design matrices (such as unstable slopes), consult the Headquarters (HQ) Design Office for guidance.

In the design matrices, row selection is based on Project Type. The Project Summary (see Chapter 330) defines and describes the project. For NHS and non-NHS routes (Matrices 3, 4, and 5), the project's program/subprogram might provide sufficient information to identify the Project Type. (See the *Programming Manual* for details about funding programs and subprograms.)

The various sources of funds for these subprograms carry eligibility requirements that the designers and project development must identify and monitor throughout project development. This is especially important to ensure accuracy when writing agreements and to avoid delaying advertisement for bids if the Project Type changes.

Some projects involve work from several subprograms. In such cases, identify the various limits of the project that apply to each subprogram. Where the project limits overlap, apply the higher design level to the overlapping portion.

Project Types (in alphabetical order) are:

At Grade. Safety improvement projects on NHS highways (45 mph or greater) to build grade-separation facilities that replace the existing intersections.

Bike Routes (Shldrs). Main line economic development improvement projects to provide a statewide network of rural bicycle touring routes with shoulders a minimum of 4 feet wide.

Bike/Ped. **Connectivity**. Mobility improvement projects to provide bicycle/pedestrian connections, along or across state highways within urban growth areas, to complete local networks.

Bridge Deck Rehab. Structures preservation projects that repair delaminated bridge decks and add protective overlays to provide a sound, smooth surface, prevent further corrosion of the reinforcing steel, and preserve operational and structural integrity.

Bridge Rail Upgrades. Safety improvement projects to update older bridge rails to improve strength and redirectional capabilities.

Bridge Repl. (Multilane). Non-NHS main line structures preservation projects that replace bridges on multilane highways to improve operational and structural capacity.

Bridge Replacement. NHS and two-lane non-NHS (main line and interchange) structures preservation projects that replace bridges to improve operational and structural capacity.

Bridge Restrictions. Main line economic development improvement projects that remove vertical or load capacity restrictions to benefit the movement of commerce.

BST. Non-NHS roadway preservation projects to do bituminus surface treatment (BST) work only, to protect the public investment.

BST Routes/Basic Safety. Non-NHS roadway preservation projects that resurface highways at regular intervals and restore existing safety features, to protect the public investment.

Corridor. Main line improvement projects to reduce and prevent vehicular, nonmotorized, and pedestrian collisions (within available resources).

Diamond Grinding. Grinding a concrete pavement, using gang-mounted diamond saw blades, to remove surface wear or joint faulting.

Dowel Bar Retrofit. Reestablishing the load transfer efficiencies of the existing concrete joints and transverse cracks by cutting slots, placing epoxy-coated dowel bars, and placing high-early strength, nonshrink concrete.

Four-Lane Trunk System. NHS economic development improvement projects to complete contiguous four-lane limited access facilities on a trunk system consisting of all Freight and Goods Transportation Routes (FGTS) with a classification of 10,000,000 tons/year.

Freight & Goods (Frost Free). Main line economic development improvement projects to reduce delay from weather-related closures on high-priority freight and goods highways.

Guardrail Upgrades. Safety improvement projects limited to the specified roadside design elements. These projects focus on W beam with 12-foot-6-inch spacing and on guardrail systems with concrete posts. The length of need is examined and minor adjustments are made. Removal is an option if guardrail is no longer needed. For Interstate main line, address length of need as specified in Chapter 710. For non-interstate routes, additional length of more than 5% of the existing length is beyond the intent of this program. In these instances, consider funding in accordance with priority programming instructions and, if the length of need is not met, document to the Design Documentation Package (DDP) that the length of need is not addressed because it is beyond the intent of this program.

HMA/PCCP. Non-NHS roadway preservation projects to resurface highways at regular intervals and restore existing safety features to protect the public investment.

HMA/PCCP/BST Overlays. NHS main line roadway preservation projects that resurface the existing surfaces at regular intervals to protect the public investment.

HMA/PCCP/BST Overlays Ramps. NHS and non-NHS ramp roadway preservation projects that resurface the existing surfaces at regular intervals and restore existing safety features to protect the public investment.

HMA Structural Overlays. Hot mix asphalt overlays that are placed to increase the load-carrying ability of the pavement structure. Structural overlay thickness is greater than 0.15 foot.

HOV Bypass. NHS and non-NHS ramp mobility improvement projects to improve mobility within congested highway corridors by providing HOV bypass lanes on freeway ramps. Congested highway corridors have high congestion index values as described in the *Highway System Plan* (footnote in text for Improvement/Mobility).

HOV. Main line mobility improvement projects completing the freeway Core HOV lane system in the Puget Sound region and providing level of service C on HOV lanes (including business access transit lanes) within congested highway corridors.

Intersection. Safety improvement projects to reduce and prevent collisions, to increase the safety of highways, and to improve pedestrian safety (within available resources).

Median Barrier. Limited safety improvement projects; mainly new median barrier, with a focus on cable barrier, to reduce median crossover accidents.

Milling with HMA Inlays. Removing a specified thickness of the existing HMA pavement, typically from the traveled lanes, and then overlaying with HMA at the same specified thickness.

New/Reconstruction projects include the following types of work:

- Capacity changes: add a through lane, convert a general purpose (GP) lane to a special purpose lane (such as an HOV lane), or convert a high occupancy vehicle (HOV) lane to GP
- Other lane changes: add or eliminate a collector-distributor or auxiliary lane (a rural truck-climbing lane that, for its entire length, meets the warrants in Chapter 1010 is not considered new/reconstruction)

- Pavement reconstruction: full depth PCCP or HMA replacement
- New interchange
- Changes in interchange type such as diamond to directional or adding a ramp
- New or replacement bridge (on or over, main line or interchange ramp)

Non-Interstate Freeway (mobility). On non-NHS and NHS interchanges and on NHS main line, these are mobility improvement projects on multilane divided highways with limited access control, within congested highway corridors.

Non-Interstate Freeway (roadway preservation). Roadway preservation projects on non-NHS and NHS interchanges and on NHS main line, to overlay or inlay with HMA/PCCP/BST on multilane divided highways with limited access control to minimize long-term costs and restore existing safety features.

Non-Interstate Freeway (safety). NHS and non-NHS (main line and interchanges) safety improvement projects on multilane divided highways with limited access control to increase the safety within available resources.

Nonstructural Overlay. An HMA pavement overlay that is placed to minimize the aging effects and minor surface irregularities of the existing HMA pavement structure. The existing HMA pavement structure is not showing extensive signs of fatigue (longitudinal or alligator cracking in the wheel paths). Nonstructural overlays are less than or equal to 0.15-foot thick and frequently less than 0.12-foot thick.

PCCP Overlays. Portland cement concrete pavement overlays of existing PCCP or HMA surfaces.

Preventive Maintenance. Includes roadway work such as pavement patching; restoration of drainage system; panel replacement; joint and shoulder repair; and bridge work such as crack sealing, joint repair, slope stabilization, seismic retrofit, scour countermeasures, and painting. Preventive maintenance projects must not degrade any existing safety or geometric aspects of the facility. Any elements that will be reconstructed as part of a preventive maintenance project are to be addressed in accordance with full design level.

Replace HMA w/ PCCP at I/S (intersections). NHS and non-NHS main line roadway preservation projects that restore existing safety features and replace existing HMA intersection pavement that has reached the point of lowest life cycle cost (11–15 years old) with PCCP that has about a 40-year life cycle.

Rest Areas (New). NHS and non-NHS main line economic development and safety improvement projects to provide rest areas every 60 miles and some RV dump stations.

Risk: Realignment. Improvement projects intended to improve alignment at specific locations where the Risk program has identified a high probability of collisions/accidents.

Risk: Roadside. Improvement projects intended to mitigate roadside conditions at specific locations where the Risk program has identified a high probability of vehicular encroachment.

Risk: Roadway Width. Improvement projects intended to adjust the roadway width at specific locations where the Risk program has identified a high probability of a vehicle leaving its lane of travel.

Risk: Sight Distance. Improvement projects intended to improve sight distance at specific locations where the Risk program has identified a high probability of collisions/accidents.

Rural. Mobility improvement projects providing uncongested level of service on rural highways within congested highway corridors. (See HOV Bypass for cross reference regarding “congested.”)

Urban. NHS and two-lane non-NHS (main line and interchange) mobility improvement projects within congested urban highway corridors. (See HOV Bypass for cross reference regarding “congested.”)

Urban (Multilane). Non-NHS mobility improvement projects within congested urban multilane highway corridors. (See HOV Bypass for cross reference regarding “congested.”)

(2) Design Elements

The column headings on a design matrix are **Design Elements**. Not all potential design elements have been included in the matrices.

The design elements that are included are based on the following thirteen FHWA controlling design criteria: design speed, lane width, shoulder width, bridge width, structural capacity, horizontal alignment, vertical alignment, grade, stopping sight distance, cross slope, superelevation, vertical clearance, and horizontal clearance. For the column headings, some of these controlling criteria have been combined (for example, design speed is part of horizontal and vertical alignment).

If using a design element that is not on the assigned matrix, use full design level as found elsewhere in this manual.

If using a design element that is not covered in this manual, use an approved manual or guidance on the subject and document the decision and the basis for the decision.

The following elements are shown on the design matrices. If the full design level applies, see the chapters listed below. If basic design level applies, see Chapter 410. If the modified design level applies, see Chapter 430.

Horizontal Alignment. The horizontal attributes of the roadway, including horizontal curvature, superelevation, and stopping sight distance; all based on design speed. (See Chapter 620 for horizontal alignment, Chapter 642 for superelevation, Chapter 650 for stopping sight distance, and Chapters 440 or 940 for design speed.)

Vertical Alignment. The vertical attributes of the roadway including vertical curvature, profile grades, and stopping sight distance; all based on design speed. (See Chapter 630 for vertical alignment, Chapters 430, 440, 630, and 940 for grades, Chapters 430 and 650 for stopping sight distance, and Chapters 430, 440, or 940 for design speed.)

Lane Width. Defined in Chapter 440 (also see Chapters 430, 640, 641, and 940).

Shoulder Width. Defined in Chapter 440 (also see Chapters 430, 640, and 940). For shy distance requirements when barrier is present, see Chapter 710.

Lane Transitions (pavement transitions). The rate and length of transition of changes in width of lanes (see Chapter 620).

On/Off Connection. The widened portion of pavement at the end of a ramp connecting to a main lane of a freeway (see Chapter 940).

Median Width. The distance between inside edge lines (see Chapters 440 and 640).

Cross Slope: Lane. The rate of elevation change across a lane. This element includes the algebraic difference in cross slope between adjacent lanes (see Chapters 430 and 640).

Cross Slope: Shoulder. The rate of elevation change across a shoulder (see Chapters 430 and 640).

Fill/Ditch Slopes. The downward slope from edge of shoulder to bottom of ditch or catch (see Chapters 430 and 640).

Access. The means of entering or leaving a public road, street, or highway with respect to abutting private property or another public road, street, or highway (see Chapter 1420).

Clear Zone. The total roadside border area, starting at the edge of the traveled way, available for use by errant vehicles. This area may consist of a shoulder, a recoverable slope, a nonrecoverable slope, and/or a clear run-out area. The median is part of a clear zone (see Chapter 700).

Signing, Delineation, Illumination. Signs, guideposts, pavement markings, and lighting. (See Chapter 820 for signing and 1120 for bridge signs, Chapter 830 for delineation, and Chapter 840 for illumination.)

Vertical Clearance. Defined in Chapter 1120.

Basic Safety. The list of safety items is in Chapter 410.

Bicycle and Pedestrian. Defined in Chapter 1020, Bicycle Facilities, and Chapter 1025, Pedestrian Design Considerations.

Bridges: Lane Width. The width of a lane on a structure (see Chapters 430, 440, 640, 641, 940, and 1120).

Bridges: Shoulder Width. The distance between the edge of traveled way and the face of curb or barrier, whichever is less (see Chapters 430, 440, 640, 940, and 1120; also see Chapter 710 for shy distance requirements).

Bridges/Roadway: Vertical Clearance. The minimum height between the roadway, including shoulder, and an overhead obstruction (see Chapter 1120).

Bridges: Structural Capacity. The load-bearing ability of a structure (see Chapter 1120).

Intersections/Ramp Terminals: Turn Radii. Defined in Chapter 910.

Intersections/Ramp Terminals: Angle. Defined in Chapter 910.

Intersections/Ramp Terminals: Intersection Sight Distance. Definitions are in Chapters 910 and 940.

Barriers: Terminals and Transition Sections. Terminals: Crashworthy end treatments for longitudinal barriers that are designed to reduce the potential for spearing, vaulting, rolling, or excessive deceleration of impacting vehicles from either direction of travel. Impact attenuators are considered terminals. Beam guardrail terminals include anchorage. Transition Sections: Sections of barriers used to produce a gradual stiffening of a flexible or semirigid barrier as it connects to a more rigid barrier or fixed object (see Chapters 700, 710, and 720).

Barriers: Standard Run. Guardrail and other barriers as found in the *Standard Plans for Road Bridge and Municipal Construction* excluding terminals, transitions, attenuators, and bridge rails (see Chapter 710).

Barriers: Bridge Rail. Barrier on a bridge, excluding transitions (see Chapter 710).

(3) Design Level

In the non-Interstate matrices, design levels are noted in the cells by B, M, F, and sometimes with a number corresponding to a footnote on the matrix. For Improvement projects, full design level applies to all design elements, except as noted in the design matrices and in other chapters as applicable. In the Interstate matrices, only full design level applies.

The design levels of basic, modified, and full (B, M, and F) were used to develop the design matrices. Each design level is based on the investment intended for the highway system and Project Type. (For example, the investment is higher for an Interstate overlay than for an overlay on a non-NHS route.)

A **blank cell** in a design matrix row signifies that the design element will not be addressed because it is beyond the scope of the typical project. In rare instances, a design element with a blank cell may be included if that element is linked to the original need that generated the project and is identified in the Project Summary or a Project Change Request Form.

Basic design level (B) preserves pavement structures, extends pavement service life, and maintains safe operations of the highway. (See Chapter 410 for design guidance.)

Modified design level (M) preserves and improves existing roadway geometrics, safety, and operational elements. (See Chapter 430 for design guidance.) Use full design level for design elements or portions of design elements that are not covered in Chapter 430.

Full design level (F) improves roadway geometrics, safety, and operational elements. (See Chapter 440 and other applicable *Design Manual* chapters for design guidance.)

(4) Design Variances

Types of design variances are design exceptions, evaluate upgrades, and deviations. (See Chapter 330 concerning the Design Variance Inventory System (DVIS).)

A **design exception (DE)** in a matrix cell indicates that WSDOT has determined that the design element is usually outside the scope of the Project Type. Therefore, an existing condition that does not meet or exceed the design level specified in the matrix may remain in place unless a need has been identified in the *Highway System Plan* and prioritized in accordance with the programming process. (See Chapter 330 regarding documentation.)

An **evaluate upgrade (EU)** in a matrix cell indicates that WSDOT has determined that the design element is an item of work that is to be considered for inclusion in the project. For an existing element that does not meet or exceed the specified design level, an analysis is required to determine the impacts and cost-effectiveness of including the element in the project. The EU analysis must support the decision regarding whether or not to upgrade that element. (See Chapter 330 regarding documentation.)

A **deviation** is required when an existing or proposed design element differs from the specified design level for the project and neither DE nor EU processing is indicated. (See Chapter 330 regarding documentation.)

DE or EU with /F or /M in a cell means that the design element is to be analyzed with respect to the specified design level. For instance, a DE/F is analyzed with respect to full design level and might be recorded as having an existing design element that does not meet or exceed current full design level. An EU/M is analyzed to decide whether or not to upgrade any existing design element that does not meet or exceed the current modified design level.

(5) Terminology in Notes

F/M Full for freeways/Modified for nonfreeway uses the word **freeway** to mean a divided highway facility that has a minimum of two lanes in each direction, for the exclusive use of traffic and with full control of access. For matrix cells with an F/M designation, analyze freeway routes at full design level and nonfreeway routes at modified design level.

The **HAL, HAC, and PAL** mentioned in note (1) in Design Matrices 3, 4, and 5 are high accident locations (HAL), high accident corridors (HAC), and pedestrian accident locations (PAL).

The **Access Control Tracking System** mentioned in note (3) in Design Matrices 3, 4, and 5 is a database list related to highway route numbers and mileposts, available under the RELATED SITES heading at: www.wsdot.wa.gov/eesc/design/access/. (See Chapter 1420 for access control basics and 1430 and 1435 for limited and managed access, respectively.)

The **corridor or project analysis** mentioned in notes (2) and (4) on Design Matrices 3, 4, and 5 is the justification needed to support a change in design level from the indicated design level. The first step is to check for recommendations for future improvements in an approved *Route Development Plan*. If none are available, an analysis can be based on route continuity and other existing features. (See Chapter 330 regarding documentation.)

Note **(21) Analyses required** appears only on Design Elements for Risk projects on Design Matrices 3, 4, and 5. These design elements are to be evaluated using benefit/cost (B/C) to compare and rank each occurrence of the design element. The B/C evaluation supports engineering decisions regarding which proposed solutions are included in a Risk project.

Most components of a Risk project will have a B/C of 1.0 or greater. Proposed solutions with a B/C ratio less than 1.0 may be included in the project based on engineering judgment of their significant contribution to corridor continuity. Risk program size, purpose and need, or project prioritization may lead to instances where design elements with a ratio greater than 1.0 are excluded from a project. The analysis, design decisions, and program funding decisions are to be documented in the Design Documentation Package. Decisions regarding which design elements to include in a project are authorized at the WSDOT Region level.

State Route	NHS Route Description	Begin SR MP	Begin ARM	End SR MP	End ARM
US 2	I-5 to Idaho State Line	0.00B	0.00	334.51	326.64
US 2 Couplet	Brown Street Couplet	287.45	0.00	288.08	0.63
US 2 Couplet	Division Street Couplet	289.19	0.00	290.72	1.53
SR 3	US 101 to SR 104	0.00	0.00	60.02	59.81
SR 4	US 101 to I-5	0.00	0.00	62.28	62.27
I-5	Oregon State Line to Canadian Border	0.00	0.00	276.56	276.62
SR 8	US 12 to US 101	0.00	0.00	20.67	20.67
SR 9	SR 546 to Canadian Border	93.61	93.52	98.17	98.08
SR 9 Spur	Sumas Spur	98.00	0.00	98.25	0.24
SR 11	I-5 to Alaskan Ferry Terminal	19.93	19.93	21.28	21.28
US 12	US 101 to Idaho State Line	0.00	0.00	434.19	430.76
US 12 Couplet	Aberdeen Couplet	0.33	0.00	0.68	0.35
SR 14	I-5 to US 97	0.00	0.00	101.02	100.93
SR 14 Spur	Maryhill Spur	100.66	0.00	101.05	0.39
SR 16	I-5 to SR 3	0.00	0.00	29.19	27.01
SR 16 Spur	SR 16 to SR 3	28.74	0.00	29.13	0.39
SR 17	US 395 to I-90	7.43	0.00	50.89	43.40
SR 18	SR 99 to I-5	2.20B	0.00	0.00	0.53
SR 18	I-5 to I-90	0.00	0.53	27.91	28.41
SR 20	US 101 to I-5	0.00	0.00	59.54	59.49
SR 20 Spur	SR 20 to San Juan Ferry	47.89	0.00	55.67	7.78
SR 22	US 97 to I-82	0.70	0.00	4.00	3.31
SR 26	I-90 to US 195	0.00	0.00	133.53	133.61
SR 26 Spur	SR 26 to US 195	133.44	0.00	133.51	0.07
SR 28	US 2 to SR 281	0.00B	0.00	29.77	33.91
I-82	I-90 to Oregon State Line	0.00	0.00	132.60	132.57
I-90	I-5 to Idaho State Line	1.94	0.00	299.82	297.52
I-90 Reverse Lane	Reversible lane	1.99	0.00	9.44	7.45
SR 96	I-5 to McCollum Park and Ride	0.00	0.00	0.52	0.52
US 97	Oregon State Line to SR 22	0.00B	0.00	61.44	61.30
US 97	I-90 to Canadian Border	133.90	118.80	336.48	321.62
US 97 Couplet	Maryhill Couplet	2.59	0.00	2.68	0.09
US 97 Spur	US 97 to US 2 (Orondo)	213.36	0.00	213.62	0.26
SR 99	188th to SeaTac Airport	18.35	14.70	18.77	15.12
SR 99	SR 509 to SR 104	26.04	22.40	43.60	39.84
US 101	Oregon State Line to SR 401	0.00	0.00	0.46	0.46
US 101	SR 4 to I-5	28.89	28.89	367.41	365.78
US 101 Couplet	Aberdeen Couplet	87.49	0.00	91.66	4.17
US 101 Couplet	Port Angeles Couplet	249.65	0.00	251.32	1.67
SR 104	US 101 to I-5	0.20	0.00	29.67	29.14
SR 109	Pacific Beach Access	0.00	0.00	30.25	30.29
SR 125	Oregon State Line to SR 125 Spur	0.00	0.00	6.09	6.08
SR 125 Spur	SR 125 to US 12	6.09	0.00	6.76	0.67
SR 127	US 12 to SR 26	0.03	0.00	27.05	27.05
SR 128	US 12 to Idaho State Line	0.00	0.00	2.30	2.30

NHS Highways in Washington
Figure 325-2

State Route	NHS Route Description	Begin SR MP	Begin ARM	End SR MP	End ARM
SR 166	SR 16 to Bay St	0.02	0.00	3.40	3.38
SR 167	I-5 to SR 900 / S 2nd St	0.00	0.00	27.28	28.60
I-182	I-82 to US 395	0.00	0.00	15.19	15.19
US 195	Idaho State Line to I-90	0.00B	0.00	95.99	93.37
US 195 Spur	US 195 to Idaho State Line	0.06	0.00	0.60	0.54
I-205	Oregon State Line to I-5	26.59	0.00	37.16	10.57
SR 240	I-182 to Coast St / Bypass Hwy – Hanford Access	30.63	28.86	34.87	33.10
SR 270	US 195 to Idaho State Line	0.00	0.00	9.89	9.89
SR 270	Pullman Couplet	2.67	0.00	2.90	0.23
SR 281	I-90 to SR 28	0.00	0.00	10.55	10.55
SR 281 Spur	SR 281 to I-90	2.65	0.00	4.34	1.69
SR 303	SR 304 to SR 3	0.00B	0.00	9.16	9.32
SR 304	SR 3 to Bremerton Ferry	0.00	0.00	3.51	3.24
SR 305	Winslow Ferry to SR 3	0.02	0.00	13.52	13.50
SR 307	SR 305 to SR 104	0.00	0.00	5.25	5.25
SR 310	SR 3 to SR 304	0.00	0.00	1.84	1.84
US 395	Congressional High-Priority Route/I-82 to Canadian Border	13.05	19.81	270.26	275.09
SR 401	US 101 to SR 4	0.00	0.00	12.13	12.13
I-405	I-5 to I-5	0.00	0.00	30.32	30.30
SR 432	SR 4 to I-5	0.00	0.00	10.33	10.32
SR 433	Oregon State Line to SR 432	0.00	0.00	0.94	0.94
SR 500	I-5 to SR 503	0.00	0.00	5.96	5.96
SR 501	I-5 to Port of Vancouver	0.00	0.00	3.83	3.42
SR 502	I-5 to SR 503	0.00B	0.00	7.56	7.58
SR 503	SR 500 to SR 502	0.00	0.00	8.09	8.09
SR 509	12th Place S to SR 99	24.35B	26.13	29.83	33.11
SR 509	Pacific Ave. to Marine View Drive	0.22	1.44	3.20	4.42
SR 512	I-5 to SR 167	0.00	0.00	12.06	12.06
SR 513	Sandpoint Naval Air Station	0.00	0.00	3.35	3.35
SR 516	I-5 to SR 167	2.03	2.02	4.72	4.99
SR 518	I-5 to SR 509	0.00	0.00	3.81	3.42
SR 519	I-90 to Seattle Ferry Terminal	0.00	0.00	1.14	1.14
SR 520	I-5 to SR 202	0.00	0.00	12.83	12.82
SR 522	I-5 to US 2	0.00	0.00	24.68	24.68
SR 524	Cedar Way Spur to I-5	4.64	4.76	5.32	5.44
SR 524 Spur	Cedar Way Spur – Lynnwood Park and Ride to SR 524	4.64	0.00	5.14	0.50
SR 525	I-5 to SR 20	0.00	0.00	30.49	30.72
SR 526	SR 525 to I-5	0.00	0.00	4.52	4.52
SR 529	I-5 to Everett Homeport	0.00	0.00	2.72	2.72
SR 539	I-5 to Canadian Border	0.00	0.00	15.16	15.16
SR 543	I-5 to Canadian Border	0.00	0.00	1.09	1.09
SR 546	SR 539 to SR 9	0.00	0.00	8.02	8.02
I-705	I-5 to Schuster Parkway	0.00	0.00	1.50	1.50
SR 970	I-90 to US 97	0.00	0.00	10.31	10.31

NHS Highways in Washington
Figure 325-2 (continued)

⇩ Project Type																Bridges			Barriers		
Design Elements ⇨	Horiz. Align.	Vert. Align.	Lane Width	Shldr Width (13)	On/Off Conn.	Median Width	Cross Slope Lane	Cross Slope Shldr	Fill/Ditch Slopes	Clear Zone	Sign. (10)	Delini. (9)	Illumin.	Vert. Clear. (11)	Bike & Ped.	Lane Width	Shldr Width	Structural Capacity	Term. & Trans. Section (12)	Std Run	Bridge Rail (14)(19)
(1-1) Preventive Maintenance																					
Pavement Restoration																					
(1-2) Diamond Grinding										EU	EU	F		DE					F	EU	F
(1-3) Milling with HMA Inlays									EU	F	EU	F		DE					F	EU	F
(1-4) Nonstructural Overlay				DE			EU	EU	EU	F	EU	F		F					F	F	F
Pavement Rehab./Resurf.																					
(1-5) HMA Structural Overlays	EU	DE	F	F	F(17)	DE	F	EU	F	F	EU	F	F	F		F	DE		F	F	F
(1-6) PCCP Overlays	EU	DE	F	F	F(17)	DE	F	EU	F	F	EU	F	F	F		F	DE		F	F	F
(1-7) Dowel Bar Retrofit	EU	DE	F	F	F(17)	DE	DE		F	F	EU	F	F	DE			DE		F	F	F
Bridge Rehabilitation																					
(1-8) Bridge Deck Rehabilitation												F		F		F	DE	(11)	F(6)	F(22)	F
Safety																					
(1-9) Median Barrier				DE															F(20)	F(20)	
(1-10) Guardrail Upgrades				DE						F									F	F(23)	
(1-11) Bridge Rail Upgrades																			F	F(22)	F
Reconstruction (16)																					
(1-12) New/Reconstruction	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F

☐ Not Applicable
F Full design level. See Chapter 440.
DE Design Exception to full design level.
EU Evaluate Upgrade to full design level.

(6) Applies only to bridge end terminals and transition sections.
(9) Continuous shoulder rumble strips required in rural areas. See Chapter 700.
(10) See Chapter 820.
(11) See Chapter 1120.
(12) Impact attenuators are considered as terminals.
(13) See Chapters 440 and 640.
(14) Includes crossroad bridge rail. See Chapter 710.
(16) For design elements not in the matrix headings, apply full design level as found in the applicable chapters and see 325.03(2).
(17) DE for existing acceleration/deceleration lanes when length meets posted freeway speed and no significant accidents. See Chapter 940.
(19) The funding sources for bridge rail are a function of the length of the bridge. Consult programming personnel.
(20) Applies to median elements only.
(22) Upgrade barrier, if necessary, within 200 ft of the end of the bridge.
(23) See description of Guardrail Upgrades Project Type, 325.03(1) regarding length of need.

Design Matrix 1:
Interstate Routes (Main Line)
Figure 325-3

Ramps and Collector Distributors

⇩ Project Type / Design Elements ⇨	Horiz. Align.	Vert. Align.	Lane Width	Shldr Width	Lane Tran-sition	On/Off Conn.	Cross Slope Lane	Cross Slope Shldr	Fill/ Ditch Slopes	Limited Access	Clear Zone	Sign., Del., Illumin. (9)(10)	Vertical Clear. (11)	Bike & Ped.	Ramp Terminals: Turn Radii	Ramp Terminals: Angle	Ramp Terminals: I/S Sight Dist.	Barriers: Term. & Trans. Section (12)	Barriers: Std Run	Barriers: Bridge Rail (14)(19)
(2-1) Preventive Maintenance																				
Pavement Restoration																				
(2-2) Diamond Grinding											EU	F(15)						F	EU	F
(2-3) Milling with HMA Inlays									EU		F	F(15)	F	M				F	F	F
(2-4) Nonstructural Overlay							EU	EU	EU		F	F(15)	F	M				F	F	F
Pavement Rehab./Resurf.																				
(2-5) HMA Structural Overlays	EU	DE	F	F	F	F(17)	F	EU	F	F	F	F(15)	F	M	F	F	F	F	F	F
(2-6) PCCP Overlays	EU	DE	F	F	F	F(17)	F	EU	F	F	F	F(15)	F	M	F	F	F	F	F	F
(2-7) Dowel Bar Retrofit	DE		DE	DE	F	F(17)	DE		F	F	F	F(15)	DE		F	F	F	F	F	F
Bridge Rehabilitation																				
(2-8) Bridge Deck Rehabilitation													F	M				F(6)	F(22)	F
Safety																				
(2-9) Intersection			F	F	F				F	F	F	F		M	F	F	F	F	F	F
(2-10) Guardrail Upgrades				DE							F							F	F(23)	
(2-11) Bridge Rail Upgrades																		F	F(22)	F
Reconstruction (16)																				
(2-12) New/Reconstruction	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F

Cross Road

⇩ Project Type / Design Elements ⇨	Lane Width	Shldr Width	Fill/ Ditch Slopes	Limited Access	Clear Zone	Sign., Del., Illumin. (10)	Vert. Clear. (11)	Ped. & Bike	Barriers: Term. & Trans. Section (12)	Barriers: Std Run	Barriers: Bridge Rail (14)(19)
(2-1) Preventive Maintenance											
Pavement Restoration											
(2-2) Diamond Grinding					EU	F(15)			F	EU	F
(2-3) Milling with HMA Inlays			EU		F	F(15)		M	F	F	F
(2-4) Nonstructural Overlay			EU		F	F(15)		M	F	F	F
Pavement Rehab./Resurf.											
(2-5) HMA Structural Overlays	DE	DE	DE	F	F	F(15)	F	M	F	F	F
(2-6) PCCP Overlays	DE	DE	DE	F	F	F(15)	F	M	F	F	F
(2-7) Dowel Bar Retrofit				F		F(15)			F	F	F
Bridge Rehabilitation											
(2-8) Bridge Deck Rehabilitation							F	M	F(6)	F(22)	F
Safety											
(2-9) Intersection			F	F	F	F	F	M	F	F	F
(2-10) Guardrail Upgrades									F	F(23)	
(2-11) Bridge Rail Upgrades									F	F(22)	F
Reconstruction (16)											
(2-12) New/Reconstruction	F	F	F	F	F	F	F	F	F	F	F

☐ Not Applicable
F Full design level. See Chapter 440.
M Modified design level. See Chapter 430.
DE Design Exception to full design level.
EU Evaluate Upgrade to full design level.

(6) Applies only to bridge end terminals and transition sections.
(9) Continuous shoulder rumble strips required in rural areas. See Chapter 700.
(10) See Chapter 820.
(11) See Chapter 1120.
(12) Impact attenuators are considered as terminals.
(14) Includes crossroad bridge rail. See Chapter 710.
(15) EU for signing and illumination.
(16) For design elements not in the matrix headings, apply full design level as found in the applicable chapters and see 325.03(2).
(17) DE for existing acceleration/deceleration lanes when length meets posted freeway speed and no significant accidents. See Chapter 940.
(19) The funding sources for bridge rail are a function of the length of the bridge. Consult programming personnel.
(22) Upgrade barrier, if necessary, within 200 ft of the end of the bridge.
(23) See description of Guardrail Upgrades Project Type, 325.03(1) regarding length of need.

Design Matrix 2:
Interstate Interchange Areas
Figure 325-4

⇩ Project Type																Bridges (11)				Intersections			Barriers		
Design Elements ⇨	Horiz. Align.	Vert. Align.	Lane Width	Shldr Width	Lane Tran-sition	On/Off Conn.	Median Width	Cross Slope Lane	Cross Slope Shldr	Fill/ Ditch Slopes	Access (3)	Clear Zone (18)	Sign., Del., Illumin.	Basic Safety	Bike & Ped.	Lane Width	Shldr Width	Vertical Clear-ance	Structural Capacity	Turn Radii	Angle	I/S Sight Dist.	Term. & Trans. Section (12)	Std Run	Bridge Rail (14)(19)
Preservation																									
Roadway																									
(3-1) Non-Interstate Freeway	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F		B	B		DE/F	DE/F	F					F	B	F
(3-2) HMA/PCCP/BST Overlays	DE/M	DE/M	DE/M	DE/M	DE/F	DE/F	DE/M	DE/M	DE/M	DE/M			B	B	M	DE/M	DE/M	F				B	F	B	F
(3-3) Replace HMA w/ PCCP at I/S	DE/M	DE/M	EU/M	EU/M	DE/F		DE/M	EU/M	DE/M	DE/M			B	B	M	DE/M	DE/M	F				B	F	B	F
Structures																									
(3-4) Bridge Replacement	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F(2)		F	F		F	F(2)	F(2)	F	F	F(2)	F(2)	F	F	F	F
(3-5) Bridge Deck Rehab.													B	B	M			F					F(6)	F(22)	F
Improvements (16)																									
Mobility																									
(3-6) Non-Interstate Freeway	F	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F	F	F	F	F	F	F	F
(3-7) Urban	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F (2)	F	F	F (2)	F (2)	F	F	F	F
(3-8) Rural	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F (2)	F	F	F (2)	F (2)	F	F	F	F
(3-9) HOV	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F (2)	F	F	F (2)	F (2)	F	F	F	F
(3-10) Bike/Ped. Connectivity	(5)	(5)	(5)	(5)	(5)			(5)	(5)	(5)	(5)	(5)	(5)		F	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
Safety																									
(3-11) Non-Interstate Freeway	F	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F		F	F	F	F	F	F
(3-12) Intersection (1)			F(2)	F(2)	F					F (2)	F	F	F		M					F	F	F	F	F	F
(3-13) Corridor (1)(24)	M(4)	M(4)	M(4)	M(4)	F	F(17)	M(4)	M(4)	M(4)	M(4)	F	F	F		F	M(4)	M(4)	F		M(4)	M(4)	F	F	F	F
(3-14) Median Barrier				DE/F																			F(20)	F(20)	
(3-15) Guardrail Upgrades				DE/F																			F	F(23)	
(3-16) Bridge Rail Upgrades																							F	F(22)	F
(3-17) Risk: Roadside										F	EU/F	F	F										F	F	F
(3-18) Risk: Sight Distance	F/M(21)	F/M(21)	F/M(21)	F/M(21)						F/M(21)	F(21)	F(21)	F		F	F(21)	F(21)	F(21)		F/M(21)	F/M(21)	F(21)	F	F	F
(3-19) Risk: Roadway Width			F/M(21)	F/M(21)	F(21)	F(21)	F/M(21)	F/M(21)	F/M(21)	F/M(21)	F	F	F		F	F(21)	F(21)	F(21)		F/M(21)	F/M(21)	F(21)	F	F	F
(3-20) Risk: Realignment	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F		F(2)	F(2)	F(2)	F	F	F
Economic Development																									
(3-21) Freight & Goods (Frost Free)(8)	F(2)	F(2)	F(2)	F(2)	F	F (2)	F(2)	F(2)	F(2)	F(2)	EU/F	F	B		EU/F(26)	DE/F	DE/F	F	F	EU/F	EU/F	EU/F	F	F	F
(3-22) Four-Lane Trunk System	F	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F	F	F	F	F	F	F	F
(3-23) Rest Areas (New)	F	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F		F	F	F	F	F	F
(3-24) Bridge Restrictions	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F(2)		F	F		EU/F(26)	F(2)	F(2)	F	F	F(2)	F(2)	F	F	F	F
(3-25) Bike Routes (Shldrs)			EU/M	(7)	EU/F				EU/M	EU/M			B	B	F	EU/M	EU/M	F				B	F	B	EU/F

☐ Not Applicable
F Full design level. See Chapter 440.
M Modified design level. See Chapter 430.
B Basic design level. See Chapter 410.
F/M Full for freeways/Modified for nonfreeway
DE Design Exception
EU Evaluate Upgrade

(1) Collision Reduction (HAL, HAC, PAL), or Collision Prevention (At-Grade Removal, Signalization & Channelization). Specific deficiencies that created the project must be upgraded to design level as stated in the matrix.
(2) Modified design level may apply based on a corridor or project analysis. See 325.03(5).
(3) If designated as L/A acquired in the Access Control Tracking System, limited access requirements apply. If not, managed access applies. See 325.03(5).
(4) Full design level may apply based on a corridor or project analysis. See 325.03(5).
(5) For bike/pedestrian design see Chapters 1020 and 1025.
(6) Applies only to bridge end terminals and transition sections.
(7) 4 ft minimum shoulders.
(8) If all weather structure can be achieved with spot digouts and overlay, modified design level applies to NHS highways and basic design level applies to non-NHS highways.
(11) See Chapter 1120.
(12) Impact attenuators are considered as terminals.
(14) Includes crossroad bridge rail. See Chapter 710.
(16) For design elements not in the matrix headings, apply full design level as found in the applicable chapters and see 325.03(2).
(17) DE for existing acceleration/deceleration lanes when length meets posted freeway speed and no significant accidents. See Chapter 940.
(18) On managed access highways within the limits of incorporated cities and towns, City and County Design Standards apply to areas outside the curb or outside the paved shoulder where no curb exists.
(19) The funding sources for bridge rail are a function of the length of the bridge. Consult programming personnel.
(20) Applies to median elements only.
(21) Analyses required. See 325.03(5) for details.
(22) Upgrade barrier, if necessary, within 200 ft of the end of the bridge.
(23) See description of Guardrail Upgrades Project Type, 325.03(1) regarding length of need.
(24) Apply Full design level to projects that realign or reconstruct significant portions of the alignment.
(26) Sidewalk ramps must be addressed for ADA compliance. See Chapter 1025.

Design Matrix 3:
Main Line NHS Routes (Except Interstate)
Figure 325-5

Ramps and Collector Distributors

⇩ Project Type / Design Elements ⇨	Horiz. Align.	Vert. Align.	Lane Width	Shldr Width	Lane Tran-sition	On/Off Conn.	Cross Slope Lane	Cross Slope Shldr	Fill/ Ditch Slopes	Access (3)	Clear Zone	Sign, Del., Illumin.	Basic Safety	Bike & Ped.	Ramp Terminals: Turn Radii	Ramp Terminals: Angle	Ramp Terminals: I/S Sight Dist.	Barriers: Term. & Trans. Section (12)	Barriers: Std Run	Barriers: Bridge Rail (14)(19)
Preservation																				
Roadway																				
(4-1) Non-Interstate Freeway	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F		B	B	M	DE/F	DE/F	DE/F	F	B	F
(4-2) HMA/PCCP/BST Overlays Ramps												B	B	M			B	F	B	F
Structures																				
(4-3) Bridge Replacement	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F	F	F	F	F	F
(4-4) Bridge Deck Rehab.												B	B	M				F(6)	F(22)	F
Improvements (16)																				
Mobility																				
(4-5) Non-Interstate Freeway	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F	F	F	F
(4-6) Urban	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F	F	F	F
(4-7) Rural	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F	F	F	F
(4-8) HOV By Pass	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F	F	F	F
(4-9) Bike/Ped. Connectivity	(5)	(5)	(5)	(5)	(5)		(5)	(5)	(5)	(5)	(5)	(5)		F	(5)	(5)	(5)	(5)	(5)	(5)
Safety																				
(4-10) Non-Interstate Freeway	F	F	F	F	F	F	F	F	F	F	F	F		M	F	F	F	F	F	F
(4-11) At Grade (1)(25)	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F	F	F	F
(4-12) Intersection (1)			F(2)	F(2)	F				F(2)	F	F	F		M	F	F	F	F	F	F
(4-13) Guardrail Upgrades				DE/F														F	F(23)	
(4-14) Bridge Rail Upgrades																				
(4-15) Risk: Roadside									F	EU/F	F	F								
(4-16) Risk: Sight Distance	F/M(21)	F/M(21)	F/M(21)	F/M(21)					F/M(21)	F(21)	F(21)	F		F	F/M(21)	F/M(21)	F	F	F	F
(4-17) Risk: Roadway Width			F/M(21)	F/M(21)	F	F(21)	F/M(21)	F/M(21)	F/M(21)	F	F	F		F	F/M(21)	F/M(21)	F	F	F	F
(4-18) Risk: Realignment	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F/M(21)	F/M(21)	F	F	F	F
Economic Development																				
(4-19) Four-Lane Trunk System	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F	F	F	F

Cross Road

⇩ Project Type / Design Elements ⇨	Lane Width	Shldr Width	Fill/ Ditch Slopes	Access (3)	Clear Zone	Sign., Del., Illumin.	Basic Safety	Vert. Clear. (11)	Ped. & Bike	Barriers: Term. & Trans. Section (12)	Barriers: Std . Run	Barriers: Bridge Rail (14)(19)
Preservation												
Roadway												
(4-1) Non-Interstate Freeway	DE/F	DE/F	DE/F			B	B	F	M	F	B	F
(4-2) HMA/PCCP/BST Overlays Ramps						B	B	F	M	F	B	F
Structures												
(4-3) Bridge Replacement	F(2)	F(2)	F(2)	F	F	F		F	F	F	F	F
(4-4) Bridge Deck Rehab.						B	B	F	M	F(6)	F(22)	F
Improvements (16)												
Mobility												
(4-5) Non-Interstate Freeway	F	F	F	F	F	F		F	F	F	F	F
(4-6) Urban	F(2)	F(2)	F(2)	F	F	F		F	F	F	F	F
(4-7) Rural	F(2)	F(2)	F(2)	F	F	F		F	F	F	F	F
(4-8) HOV By Pass	F(2)	F(2)	F(2)	F	F	F		F	F	F	F	F
(4-9) Bike/Ped. Connectivity	(5)	(5)	(5)			(5)		(5)	F	(5)	(5)	(5)
Safety												
(4-10) Non-Interstate Freeway	F	F	F	F	F	F		F	M	F	F	F
(4-11) At Grade (1)(25)	F(2)	F(2)	F(2)	F	F	F		F	F	F	F	F
(4-12) Intersection (1)			F(2)	F	F	F		F	M	F	F	F
(4-13) Guardrail Upgrades										F	F(23)	
(4-14) Bridge Rail Upgrades										F	F(22)	F
(4-15) Risk: Roadside			F	EU/F	F	F				F	F	F
(4-16) Risk: Sight Distance			F/M(21)	F(21)	F(21)			F(21)	F			
(4-17) Risk: Roadway Width	F/M(21)	F/M(21)	F/M(21)	F	F			F(21)	F	F	F	F
(4-18) Risk: Realignment	F(2)	F(2)	F(2)	F	F			F(21)	F	F	F	F
Economic Development												
(4-19) Four-Lane Trunk System	F	F	F	F	F	F		F		F	F	F

☐ Not Applicable
F Full design level. See Chapter 440.
M Modified design level. See Chapter 430.
B Basic design level. See Chapter 410.
F/M Full for freeways/Modified for nonfreeway
DE Design Exception
EU Evaluate Upgrade

(1) Collision Reduction (HAL, HAC, PAL), or Collision Prevention (At-Grade Removal, Signalization & Channelization). Specific deficiencies that created the project must be upgraded to design level as stated in the matrix.
(2) Modified design level may apply based on a corridor or project analysis. See 325.03(5).
(3) If designated as L/A acquired in the Access Control Tracking System, limited access requirements apply. If not, managed access applies. See 325.03(5).
(4) Full design level may apply based on a corridor or project analysis. See 325.03(5).
(5) For bike/pedestrian design see Chapters 1020 and 1025.
(6) Applies only to bridge end terminals and transition sections.
(11) See Chapter 1120.
(12) Impact attenuators are considered as terminals.
(14) Includes crossroad bridge rail. See Chapter 710.
(16) For design elements not in the matrix headings, apply full design level as found in the applicable chapters and see 325.03(2).
(19) The funding sources for bridge rail are a function of the length of the bridge. Consult programming personnel.
(21) Analyses required. See 325.03(5) for details.
(22) Upgrade barrier, if necessary, within 200 ft of the end of the bridge.
(23) See description of Guardrail Upgrades Project Type, 325.03(1) regarding length of need.
(25) For main line, use the Project Type row for Safety, Non-Interstate Freeway on Matrix 3 for NHS and on Matrix 5 for non-NHS.

Design Matrix 4: Interchange Areas, NHS (Except Interstate) and Non-NHS

Figure 325-6

⇩ Project Type / Design Elements ⇨	Horiz. Align.	Vert. Align.	Lane Width	Shldr Width	Lane Tran-sition	Median Width	Cross Slope Lane	Cross Slope Shldr	Fill/ Ditch Slopes	Access (3)	Clear Zone (18)	Sign, Del., Illumin.	Basic Safety	Bike & Ped.	Bridges (11) Lane Width	Bridges (11) Shldr Width	Bridges (11) Vertical Clear.	Bridges (11) Structural Capacity	Intersections Turn Radii	Intersections Angle	Intersections I/S Sight Dist.	Barriers Term. & Trans. Section (12)	Barriers Std Run	Barriers Bridge Rail (19)
Preservation																								
Roadway																								
(5-1) HMA/PCCP												B	B	M			F				B	F	B	F
(5-2) BST																								
(5-3) BST Routes/Basic Safety												B	B								B	F	B	F
(5-4) Replace HMA with PCCP at I/S			EU/M	EU/M		DE/M	EU/M					B	B	M			F					F	B	F
Structures																								
(5-5) Bridge Replacement	M	F	M	M	F		M	M	M		F	F		F	F(2)	F(2)	F	F	M	M	F	F	F	F
(5-6) Bridge Repl. (Multilane)	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)		F	F		F	F(2)	F(2)	F	F	F(2)	F(2)	F	F	F	F
(5-7) Bridge Deck Rehab												B	B	M								F(6)	F(22)	F
Improvements (16)																								
Mobility																								
(5-8) Urban (Multilane)	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F	F	EU/F	EU/F	F	F	F	F
(5-9) Urban	M	M	M	M	F		M	M	M	F	F	F		F	M	M	F	F	EU/M	EU/M	F	F	F	F
(5-10) Rural	M	M	M	M	F	M	M	M	M	F	F	F		F	M	M	F	F	EU/M	EU/M	F	F	F	F
(5-11) HOV	M	M	M	M	F	M	M	M	M	F	F	F		F	M	M	F	F	EU/M	EU/M	F	F	F	F
(5-12) Bike/Ped. Connectivity	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)		F	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
Safety																								
(5-13) Non-Interstate Freeway	F(2)	F(2)	F(2)	F(2)	F(2)	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F		F(2)	F(2)	F	F	F	F
(5-14) Intersection (1)			M(4)	M(4)	F				M(4)	F	F	F		M					M(4)	M(4)	F	F	F	F
(5-15) Corridor (1)	M(4)	M(4)	M(4)	M(4)	F	M(4)	M(4)	M (4)	M(4)	F	F	F		M	M(4)	M(4)	F		M(4)	M(4)	F	F	F	F
(5-16) Median Barrier				DE/F																		F(20)	F(20)	
(5-17) Guardrail Upgrades				DE/F																		F	F(23)	
(5-18) Bridge Rail Upgrades																						F	F(22)	F
(5-19) Risk: Roadside									M(4)	EU/F	F	F										F	F	F
(5-20) Risk: Sight Distance	F/M(21)	F/M(21)	F/M(21)	F/M(21)					F/M(21)	F(21)	F(21)	F		F	F(21)	F(21)	F(21)		F/M(21)	F/M(21)	F(21)	F	F	F
(5-21) Risk: Roadway Width			F/M(21)	F/M(21)	F	F/M(21)	F/M(21)	F/M(21)	F/M(21)	F	F	F		F	F(21)	F(21)	F(21)		F/M(21)	F/M(21)	F(21)	F	F	F
(5-22) Risk: Realignment	F/M	F/M	F/M	F/M	F	F/M	F(2)	F(2)	F/M	F	F	F		F	F(21)	F(21)	F(21)		F/M(21)	F/M(21)	F(21)	F	F	F
Economic Development																								
(5-23) Freight & Goods (Frost Free) (8)	EU/M	EU/M	EU/M	EU/M	EU/F	EU/M	M	M	EU/M		F	B	B	EU/F(26)	DE/M	DE/M	F		EU/M	EU/M	EU/F	F	B	F
(5-24) Rest Areas (New)	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F			F	F	F	F	F	F
(5-25) Bridge Restrictions	M	F	M	M	F	M	M	M	M		F	F		EU/F(26)	M	M	F	F	M	M	F	F	F	F
(5-26) Bike Routes (Shldrs)			EU/M	(7)	EU/F			EU/M	EU/M			B	B	F	EU/M	EU/M					B	F	B	EU/F

☐ Not Applicable
F Full design level. See Chapter 440.
M Modified design level. See Chapter 430.
F/M Full for freeways/Modified for nonfreeway
B Basic design level. See Chapter 410.
DE Design Exception
EU Evaluate Upgrade

(1) Collision Reduction (HAL, HAC, PAL), or Collision Prevention (At Grade Removal, Signalization & Channelization). Specific deficiencies that created the project must be upgraded to design level as stated in the matrix.
(2) Modified design level may apply based on a corridor or project analysis. See 325.03(5).
(3) If designated as L/A acquired in the Access Control Tracking System, limited access requirements apply. If not, managed access applies. See 325.03(5).
(4) Full design level may apply based on a corridor or project analysis. See 325.03(5).
(5) For bike/pedestrian design see Chapters 1020 and 1025.
(6) Applies only to bridge end terminals and transition sections.
(7) 4 ft minimum shoulders.
(8) If all weather structure can be achieved with spot digouts and overlay, modified design level applies to NHS highways and basic design level applies to non-NHS highways.
(11) See Chapter 1120.
(12) Impact attenuators are considered as terminals.
(16) For design elements not in the matrix headings, apply full design level as found in the applicable chapters and see 325.03(2).
(18) On managed access highways within the limits of incorporated cities and towns, City and County Design Standards apply to areas outside the curb or outside the paved shoulder where no curb exists.
(19) The funding sources for bridge rail are a function of the length of the bridge. Consult programming personnel.
(20) Applies to median elements only.
(21) Analyses required. See 325.03(5) for details.
(22) Upgrade barrier, if necessary, within 200 ft of the end of the bridge.
(23) See description of Guardrail Upgrades Project Type, 325.03(1) regarding length of need.
(26) Sidewalk ramps must be addressed for ADA compliance. See Chapter 1025.

Design Matrix 5:
Main Line Non-NHS Routes
Figure 325-7

Chapter 330 — Design Documentation, Approval, and Process Review

330.01 General

The Project File (PF) contains the documentation for planning, scoping, programming, design, approvals, contract assembly, utility relocation, needed right of way, advertisement, award, construction, and maintenance review comments for a project. A Project File is completed for all projects and is retained by the Region office responsible for the project. Responsibility for the project may pass from one office to another during the life of a project, and the Project File follows the project as it moves from office to office. Portions of the Project File that are not designated as components of the Design Documentation Package (DDP) may be purged when retention of the construction records is no longer necessary.

The Design Documentation Package is a part of the Project File. It documents and justifies design decisions and the design process that was followed. The Design Documentation Package is retained in a permanent, retrievable file for a period of 75 years, in accordance with WSDOT records retention policy.

For operational changes and developer projects, design documentation is also required and is retained by the Region office responsible for the project, in accordance with WSDOT records retention policy. All participants in the design process must provide the appropriate documentation for their decisions.

330.02 References

(1) Federal/State Laws and Codes

23 CFR 635.111, Tied bids

23 CFR 635.411, Material or product selection

RCW 47.28.030, Contracts – State forces – Monetary limits – Small businesses, minority, and women contractors – Rules

RCW 47.28.035, Cost of project, defined

"Washington Federal-Aid Stewardship Agreement," as implemented in the design matrices (Chapter 325)

(2) Design Guidance

Advertisement and Award Manual, M 27-02, WSDOT

Directional Documents Index, WSDOT: wwwi.wsdot.wa.gov/docs/

Executive Order E 1010.00, "Certification of Documents by Licensed Professionals," WSDOT

Hydraulics Manual, M 23-03, WSDOT

Master Plan for Limited Access Highways, WSDOT

Plans Preparation Manual, M 22-31, WSDOT

Roadside Classification Plan, M 25-31, WSDOT

Route Development Plan, WSDOT

Washington State Highway System Plan, WSDOT

(3) Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

330.03 Definitions

Design Approval Documented approval of the design criteria, which becomes part of the Design Documentation Package. This approval is an endorsement of the design criteria by the designated representative of the approving organization, as shown in Figures 330-2a and 2b.

design exception (DE) Preauthorization to omit correction of an existing design element for various types of projects, as designated in the design matrices (see Chapter 325). A DE designation indicates that the design element is normally outside the scope of the project type (see Figure 330-1).

design variance A recorded decision to differ from the design level specified in the *Design Manual*, such as an Evaluate Upgrade (EU) not upgraded, a DE, or a deviation. EUs leading to an upgrade are documented but are not considered to be variances. A project or corridor analysis may also constitute a design variance if that analysis leads to a decision to use a design level or design classification that differs from what the *Design Manual* specifies for the project type.

Design Variance Inventory (DVI) A list of design elements that will not be improved in accordance with the *Design Manual* criteria designated for the project.

Design Variance Inventory System (DVIS) A database application developed to generate the DVI form. The DVIS also provides query functions, giving designers an opportunity to search for previously granted variances. The DVIS database is intended for internal WSDOT use only, and WSDOT staff access it from: www.wsdot.wa.gov/design/projectdev

deviation A documented decision granting approval at project-specific locations to differ from the design level specified in the *Design Manual* (see Figures 325-3 through 7 and Figure 330-1).

environmental documents:

- ***NEPA*** National Environmental Policy Act
- ***SEPA*** [Washington] State Environmental Policy Act
- ***CE*** NEPA: Categorical Exclusion
- ***CE*** SEPA: Categorical Exception
- ***EA*** Environmental Assessment
- ***ECS*** Environmental Classification Summary
- ***EIS*** Environmental Impact Statement
- ***ERS*** Environmental Review Summary
- ***FONSI*** Finding Of No Significant Impact
- ***ROD*** Record of Decision

evaluate upgrade (EU) A decision-making process to determine whether or not to correct an existing design element as designated in the design matrices. Documentation is required (see Figure 330-1)

FHWA Federal Highway Administration.

HQ The Washington State Department of Transportation Headquarters organization.

Project Change Request Form A form used to document and approve revisions to project scope, schedule, or budget, from a previously approved Project Definition (see Project Summary).

Project Development Approval Final approval of all project development documents by the designated representative of the approving organization prior to the advertisement of a capital transportation project (see Figures 330-2a and 2b).

Project File (PF) A file containing all documentation and data for all activities related to a project (see 330.01 and 330.04).

- ***Design Documentation Package (DDP)*** The portion of the Project File, including Project Development Approval, that will be retained long term in accordance with WSDOT document retention policies. Depending on the scope of the project, it contains the Project Summary and some or all of the other documents discussed in this chapter. Common components are listed in Figure 330-5. Technical reports and calculations are part of the Project File, but are not designated as components of the DDP. Include estimates and justifications for decisions made in the DDP (see 330.04(2)). The DDP explains how and why the design was chosen, and documents approvals (see 330.01).

Project Summary A set of electronic documents consisting of the Design Decisions Summary (DDS), the Environmental Review Summary (ERS), and the Project Definition (PD). The Project Summary is part of the design documentation required to obtain Design Approval and is ultimately part of the design documentation required for Project Development Approval (see 330.06).

- ***Design Decisions Summary*** An electronic document that records major design decisions regarding roadway geometrics, roadway and roadside features, and other issues that influence the project scope and budget.
- ***Environmental Review Summary*** An electronic document that records the environmental requirements and considerations for a specific project.
- ***Project Definition*** An electronic document that records the purpose and need of the project, along with program level and design constraints.

scoping phase The first phase of project development for a specific project. It follows identification of the need for a project and precedes detailed project design. It is the process of identifying the work to be done and developing a cost estimate for completing the design and construction. The Project Summary, engineering and construction estimates, and several technical reports (geotechnical, surfacing, bridge condition, etc.) are developed during this phase.

330.04 Design Documentation

(1) Purpose

Design documentation records the evaluations and decisions by the various disciplines that result in design recommendations. Design assumptions and decisions made prior to and during the scoping phase are included. Changes that occur throughout project development are documented. Required justifications and approvals are also included.

The DDP identifies the purpose of and need for the project and documents how the project addresses the purpose and need. The "Design Documentation Checklist" has been developed as a tool (optional) to assist in generating the contents of the DDP and the PF: www.wsdot.wa.gov/design/projectdev/

(2) Design Documents

The DDP portion of the PF preserves the decision documents generated during the design process. In each package, a summary (list) of the documents is recommended.

The design documents commonly included in the PF and DDP for all but the simplest projects are listed in Figure 330-5.

Documentation is not required for components not related to the project.

The DVI is *required* for all projects on the National Highway System (NHS) having design variances; it is recommended for all projects having design variances. The DVI lists all EUs not upgraded to the applicable design level, DEs, and deviations as indicated by the design matrices. Record variances resulting from a project or corridor analysis in the DVI. Use the DVIS database application to record and manage design variances: www.wsdot.wa.gov/design/projectdev

The ERS and the PD are required for most projects. Exceptions will be identified by the Project Control and Reporting Office.

The DDS is not required for the following project types unless they involve reconstructing the lanes, shoulders, or fill slopes. Since these and some other project types are not included in the design matrices, evaluate them with respect to modified design level (M) for non-NHS routes and full design level (F) for NHS routes. Include in the evaluation only those design elements specifically impacted by the project. Although the following list illustrates some of the project types that do not require a DDS, the list is not intended to be a complete accounting of all such projects. Consult with the HQ System Analysis and Program Development Office for projects not included in the list.

- Bridge painting
- Crushing and stockpiling
- Pit site reclamation
- Lane marker replacement

- Guidepost replacement
- Signal rephasing
- Signal upgrade
- Seismic retrofit
- Bridge joint repair
- Navigation light replacement
- Signing upgrade
- Illumination upgrade
- Rumble strips
- Electrical upgrades
- Major drainage
- Bridge scour
- Fish passage
- Other projects as approved by the HQ Design Office

(3) Certification of Documents by Licensed Professionals

All original technical documents must bear the certification of the responsible licensee (see Executive Order E 1010.00).

(4) Design Exception (DE), Evaluate Upgrade (EU), and Deviation Documentation

In special cases, projects may need to address design elements, which are shown as blank cells in a design matrix (see Figure 330-1). These special cases must be coordinated with the appropriate Assistant State Design Engineer (ASDE) and the HQ Project Control and Reporting Office. When this is necessary, document the reasons for inclusion of that work in your project.

When the design matrices specify a DE for a design element, the DE documentation must specify the matrix and row, the design element, and the limits of the exception. When a DVI is required for the project, the DE locations must be recorded in the inventory.

The EU process determines if an item of work will or will not be done, through analysis of factors such as benefit/cost, route continuity, accident reduction potential, environmental impact, and economic development. Document all EU decisions to the DDP using the list in Figure 330-6 as a guide for the content. The cost of the improvement must always be considered when making EU decisions. EU examples on the Internet can serve as models for development of EU documentation. The appropriate approval authority for EUs is designated in Figures 330-2a and 2b.

Deviation requests are stand-alone documents requiring enough information and project description for an approving authority to make an informed decision of approval or denial. Documentation of a deviation must contain justification and must be approved at the appropriate administrative level, as shown in Figures 330-2a and 2b. Submit the request as early as possible because known deviations are to be approved prior to Project Development Approval or Intersection/Interchange Plan approval.

When applying for deviation approval, it is necessary to provide two explanations. The first identifies the design element and explains why the design level specified in the design matrices was not or cannot be used. The second provides the justification for the design that is proposed. Justification for a deviation must be supported by at least two of the following:

- Accident history and accident analysis
- Benefit/cost analysis
- Engineering judgment
- Environmental issues
- Route continuity

Engineering judgment includes a reference to another publication, with an explanation of why that reference is applicable to the situation encountered on the project.

If the element meets current AASHTO guidance adopted by FHWA, such as *A Policy on Geometric Design of Highways and Streets*, but not the *Design Manual* criteria, it is a deviation from the *Design Manual* that does not require approval by FHWA or the HQ Design Office. However, it only requires documentation and justification in the DDP to support the use of the AASHTO guidance. The following documentation is required:

- Identify the design element
- Explain why the design level specified in the design matrices was not used
- Explain which AASHTO guidance was used (including the title of the AASHTO guidance, the publication date, and the chapter and page number of the guidance)

Deviation approval is at the appropriate administrative level, as shown in Figures 330-2a and 2b.

Reference a corridor or project analysis as supporting justification for design deviations dealing with route continuity issues (see Chapter 325).

Once a deviation is approved, it applies to that project only. When a new project is programmed at the same location, the subject design element must be reevaluated and either (1) the subject design element is rebuilt to conform to the applicable design level, or (2) a new deviation is developed, approved, and preserved in the DDP for the new project. Check the DVIS for help in identifying previously granted deviations.

A change in a design level resulting from an approved *Route Development Plan* or a corridor or project analysis, as specified in design matrix notes, is documented similar to a deviation. Design elements that do not comply with the design level specified in an approved corridor or project analysis are documented as deviations.

To prepare a deviation request, use the list in Figure 330-7 as a general guide for the sequence of the content. The list is not all-inclusive of potential content and it might include suggested topics that do not apply to a particular project. For Design deviation examples, see: www.wsdot.wa.gov/design/projectdev

Matrix Cell Contents	Project Corrects Design Elements That Do Not Conform to Specified Design Level	Document to File[1]	Record in DVIS[2]
Blank cell in design matrix		No[3]	No
Cell Entry			
Full (F), Modified (M), or Basic (B) (with no DE or EU qualifiers)	Yes	No	No
	No[4]	Yes[5]	Yes
Design Exception (DE)	Yes[3]	DDP	No
	No	DDP	Yes
Evaluate Upgrade (EU)[5]	Yes	DDP	No
	No	DDP	Yes

DDP = Document to Design Documentation Package

Notes:

[1] See 330.04(3).

[2] See 330.04(2).

[3] Document to the DDP if the element is included in the project as identified in the Project Summary or Project Change Request Form.

[4] Nonconformance with specified design level (see Chapter 325) requires an approved deviation.

[5] Requires supporting justification (see 330.04(4)).

Design Matrix Documentation Requirements
Figure 330-1

330.05 Project Development

In general, the Region initiates the development of a specific project by preparing the Project Summary. Some project types may be initiated by other WSDOT groups such as the HQ Bridge and Structures Office or the HQ Traffic Office, rather than the Region. The project coordination with other disciplines (such as Real Estate Services, Roadside and Site Development, Utilities, and Environmental) is started in the project scoping phase and continues throughout the project's development. The Region coordinates with state and federal resource agencies and local governments to provide and obtain information to assist in developing the project.

The project is developed in accordance with all applicable Directives, Instructional Letters, Supplements, and manuals; the *Master Plan for Limited Access Highways*; the *Washington State Highway System Plan*; the *Route Development Plan*; the Washington Federal-Aid Stewardship Agreement, as implemented in the design matrices (see Chapter 325); and the Project Summary.

The Region develops and maintains documentation for each project. The Project File includes documentation of project work including planning; scoping; public involvement; environmental action; design decisions; right of way acquisition; Plans, Specifications, and Estimates (PS&E) development; project advertisement; and construction. Refer to the *Plans Preparation Manual* for PS&E documentation.

All projects involving FHWA action require NEPA clearance. Environmental action is determined through the ECS form. The environmental approval levels are shown in Figure 330-3.

Upon receipt of the ECS approval for projects requiring an EA or EIS under NEPA, the Region proceeds with environmental documentation, including public involvement, appropriate for the magnitude and type of the project (see Chapter 210).

Design Approval and approval of Right of Way plans are required prior to acquiring property. If federal funds are used to purchase the property, then NEPA clearance is also required.

The ASDEs work with the Regions on project development and conduct process reviews on projects as described in 330.10.

330.06 Scoping Phase

Development of the project scope is the initial phase of project development. This effort is prompted by the *Washington State Highway System Plan*. The project scoping phase consists of determining a project description, schedule, and cost estimate. The intent is to make design decisions early in the project development process that focus the scope of the project. During the project scoping phase, the Project Summary documents are produced.

(1) Project Summary

The Project Summary provides information on the results of the scoping phase; links the project to the *Washington State Highway System Plan* and the *Capital Improvement and Preservation Program* (CIPP); and documents the design decisions, the environmental classification, and agency coordination. The Project Summary is developed and approved before the project is funded for design and construction, and consists of ERS, DDS, and PD documents, which are electronic forms. The Project Summary database contains specific online instructions for completing the documents.

(a) **Environmental Review Summary (ERS)**. Lists the environmental permits and approvals that will be required, environmental classifications, and environmental considerations. This form lists requirements by environmental and permitting agencies. If there is a change in the PD or DDS, the information in the ERS must be reviewed and revised to match the rest of the Project Summary. The ERS is prepared during the scoping phase and is approved by the Region. During final design and permitting, revisions may need to be made to the ERS and be reapproved by the Region.

(b) **Design Decisions Summary (DDS)**. Provides the design matrix used to develop the project, and the roadway geometrics, design deviations, EUs, other roadway features, roadside restoration, and any design decisions made during the scoping of a project. The information contained in this form is compiled from various databases of departmental information, field data collection, and evaluations made in development of the PD and the ERS. Design decisions may be revised throughout the project development process based on continuing evaluations.

The DDS is approved by the appropriate ASDE for new construction and reconstruction projects on the Interstate System before submittal to FHWA (see 330.07). The Region design authority approves the DDS for all other types of projects. To approve the Design Decisions Summary, the Region must be confident that there will be no significant change in the PD or estimated cost. However, if there is a change to the PD or a significant change in the cost estimate, the DDS is to be revised or supplemented and reapproved. Significant cost changes require a Project Change Request Form to be submitted and approved by the appropriate designee.

(c) **Project Definition (PD)**. Identifies the various disciplines and design elements that will be encountered in project development. The PD states the purpose and need for the project, the program categories, and the recommendations for project phasing. This information determines the level of documentation and evaluation that is needed for Project Development Approval. The PD is completed early in the scoping phase to provide a basis for full development of the ERS, DDS, schedule, and estimate. If circumstances necessitate a change to an approved PD, process a Project Change Request Form for approval by the appropriate designee, revise the original PD form, and obtain approval of the revisions.

330.07 FHWA Approval

For all NHS projects, the level of FHWA oversight varies according to the type of project, the agency doing the work, and the funding source as shown in Figures 330-2a and 2b. Oversight and funding do not affect the level of design documentation required for a project.

FHWA approval is required for any new or revised access point (including interchanges, temporary access breaks, and locked gate access points) on the Interstate System, regardless of funding (see Chapter 1425).

Documents for projects requiring FHWA review, Design Approval, and Project Development Approval are submitted through the HQ Design Office. Include applicable project documents as specified in Figure 330-5.

330.08 Design Approval

When the Project Summary documents are complete, and the Region is confident that the proposed design adequately addresses the purpose and need for the project, a Design Approval may be entered into the Design Documentation Package. Approval levels for design and PS&E documents are presented in Figures 330-2a through 330-4.

The following items must be provided for Design Approval:

- A one- or two-page reader-friendly memo that describes the project
- Project Summary documents
- Corridor or project analysis
- Design Criteria worksheets: www.wsdot.wa.gov/design/projectdev
- Design Variances Inventory (for known variances)
- Channelization plans, Intersection plans, or Interchange plans (if applicable)
- Alignment plans and profiles (if project significantly modifies either the existing vertical or horizontal alignment)
- Current cost estimate with a confidence level

Design Approval remains valid for three years. Evaluate policy changes or revised design criteria that are adopted by the department during this time to determine if these changes would have a significant impact on the scope or schedule of the project. If it is determined that these changes will not be incorporated into the project, document this decision with a memo from the Region Project Development Engineer that is included in the DDP. For an overview of design policy changes, consult the Detailed Chronology of Design Policy Changes Affecting Shelved Projects:
www.wsdot.wa.gov/design/policy/designpolicy

(1) Alternative Project Delivery Methods

Design Approval applies to projects delivered using alternative means, including design-build projects. Design documentation begins in the project scoping phase and continues through the life of the design-build project. This documentation is thus started by WSDOT and is completed by the design-builder. Since Design Approval is related to project scoping, this milestone may very well be accomplished prior to issuing a Design-Build Request for Proposal (see Figure 110-1). However, the design-builder shall refer to the RFP for direction on approval milestones.

330.09 Project Development Approval

When all project development documents are complete and approved, Project Development Approval is granted by the approval authority designated in Figures 330-2a and 2b. The Project Development Approval becomes part of the DDP. (See 330.04 and Figure 330-5 for design documents that may lead to Project Development Approval.) Figures 330-2a through 330-4 provide approval levels for project design and PS&E documents.

The following items must be approved prior to Project Development Approval:

- Required environmental documents
- Design Approval documents (and any supplements)
- Design Variance Inventory (as required)
- Cost estimate
- Stamped cover sheet (project description)

Project Development Approval remains valid for three years. Evaluate policy changes or revised design criteria that are adopted by the department during this time to determine if these changes would have a significant impact on the scope or schedule of the project. If it is determined that these changes will not be incorporated into the project, document this decision with a memo from the Region Project Development Engineer that is included in the DDP. For an overview of design policy changes, consult the Detailed Chronology of Design Policy Changes Affecting Shelved Projects at: www.wsdot.wa.gov/design/policy/designpolicy

(1) Alternative Project Delivery Methods

For projects delivered using alternative methods, such as design-build, the design-builder shall refer to the project RFP for specification on final and intermediate deliverables and final records for the project. Project Development Approval is *required* prior to project completion.

It is a prudent practice to start the compilation of design documentation early in a project and to acquire Project Development Approval before the completion of the project. At the start of a project, it is critical WSDOT project administration staff recognize the importance of all required documentation and how it will be used in the design-build project delivery process.

330.10 Process Review

The process review is done to provide reasonable assurance that projects are prepared in compliance with established policies and procedures and that adequate records exist to show compliance with state and federal requirements. Process reviews are conducted by WSDOT, FHWA, or a combination of both.

The design and PS&E process review is performed in each Region at least once each year by the HQ Project Development Branch. The documents used in the review process are (1) the Design Documentation Checklist, (2) the PS&E Review Checklist, and (3) the PS&E Review Summary. These are generic forms used for all project reviews. Copies of these working documents are available for reference when assembling project documentation. The HQ Design Office, Project Development Branch, maintains current copies at: www.wsdot.wa.gov/design/projectdev

Each project selected for review is examined completely and systematically beginning with the scoping phase (including planning documents) and continuing through contract plans and, when available, construction records and change orders. Projects are normally selected after contract award. For projects having major traffic design elements, the HQ Maintenance and Operations Programs' Traffic Operations personnel are involved in the review. The WSDOT process reviews may be held in conjunction with FHWA process reviews.

The HQ Project Development Branch schedules the process review and coordinates it with the Region and FHWA.

A process review follows this general agenda:

1. Review team meets with Region personnel to discuss the object of the review.
2. Review team reviews the design and PS&E documents, and the construction documents and change orders (if available) using the checklists.
3. Review team meets with Region personnel to ask questions and clarify issues of concern.
4. Review team meets with Region personnel to discuss findings.
5. Review team submits a draft report to the Region for comments and input.
6. If the review of a project shows a serious discrepancy, the Region design authority is asked to report the steps that will be taken to correct the deficiency.
7. The process review summary forms are completed.
8. The summary forms and checklists are evaluated by the State Design Engineer.
9. The findings and recommendations of the State Design Engineer are forwarded to the Region design authority for action and/or information within 30 days of the review.

Project Design	FHWA Oversight Level	Deviation and Corridor/Project Approval[a][b]	EU Approval[b]	Design Approval and Project Development Approval
Interstate				
New/Reconstruction[c] • Federal funds • No federal funds	 (d) (e)	FHWA	Region	FHWA*
Intelligent Transportation Systems (ITS) over $1 million	(f)	HQ Design	Region	HQ Design
All Other[g] • Federal funds • State funds • Local agency funds	 (f) (f) (e)	HQ Design	Region	Region
National Highway System (NHS)				
Managed access highway outside incorporated cities and towns or inside unincorporated cities and towns, or limited access highway	(f)	HQ Design	Region	Region
Managed access highway within incorporated cities and towns[h] • Inside curb or EPS[i] • Outside curb or EPS	 (f) (f)	 HQ Design HQ H&LP	 Region N/A	 Region City/Town

FHWA = Federal Highway Administration

HQ = WSDOT Headquarters

H&LP = WSDOT Highways & Local Programs Office

EPS = Edge of paved shoulder where curbs do not exist

Notes:

(a) These approval levels also apply to deviation processing for local agency work on a state highway.

(b) See 330.04(4).

(c) For definition, see Chapter 325.

(d) Requires FHWA review and approval (full oversight) of design and PS&E submitted by HQ Design Office.

(e) To determine the appropriate oversight level, FHWA reviews the Project Summary (or other programming document) submitted by HQ Design Office, or by WSDOT Highways & Local Programs through the HQ Design Office.

(f) FHWA oversight is accomplished by process review (see 330.10).

(g) Reduction of through lane or shoulder widths (regardless of funding) requires FHWA review and approval of the proposal.

(h) Applies to the area within the incorporated limits of cities and towns.

(i) Includes raised medians.

* FHWA will accept design criteria prior to NEPA approval, but will not approve the design until NEPA is complete.

Design Approval Level

Figure 330-2a

Project Design	FHWA Oversight Level	Deviation and Corridor/ Project Approval[(a)(b)]	EU Approval[(b)]	Design Approval and Project Development Approval
Non-National Highway System (Non-NHS)				
Improvement project on managed access highway outside incorporated cities and towns or within unincorporated cities and towns, or on limited access highway (Matrix lines 5-8 through 5-26)	N/A	HQ Design	Region	Region
Improvement project on managed access highway within incorporated cities and towns[(h)] • Inside curb or EPS[(i)] • Outside curb or EPS (Matrix lines 5-8 through 5-26)	N/A N/A	HQ Design HQ H&LP	Region N/A	Region City/Town
Preservation project on managed access highway outside incorporated cities and towns or within unincorporated cities and towns, or on limited access highway[(j)] (Matrix lines 5-1 through 5-7)	N/A	Region[(k)]	Region	Region
Preservation project on managed access highway within incorporated cities and towns[(h)(j)] • Inside curb or EPS[(i)] • Outside curb or EPS (Matrix lines 5-1 through 5-7)	N/A N/A	Region HQ H&LP	Region N/A	Region City/Town

FHWA = Federal Highway Administration

HQ = WSDOT Headquarters

H&LP = WSDOT Highways & Local Programs Office

EPS = Edge of paved shoulder where curbs do not exist

Notes:

(a) These approval levels also apply to deviation processing for local agency work on a state highway.

(b) See 330.04(4).

(h) Applies to the area within the incorporated limits of cities and towns.

(i) Includes raised medians.

(j) For Bridge Replacement projects in the preservation program, follow the approval level specified for improvement projects.

(k) For guidance on access deviations, see Chapters 1430 and 1435.

Design Approval Level

Figure 330-2b

Item	Approval Authority		
	Region	HQ	FHWA
Program Development			
Work Order Authorization		X	X[1]
Public Hearings			
Corridor Hearing Summary		X[2]	
Design Summary		X[3]	
Access Hearing Plan		X[4]	
Access Findings and Order		X[5]	
Environmental by Classification			
Summary (ECS) NEPA			X
Class I NEPA (EIS)		[7]	X
Class I SEPA (EIS)		X	
Class II NEPA – Programmatic Categorical Exclusion (CE)*	X		
Class II NEPA – Documented Categorical Exclusion (CE)	[6]		X
Class II SEPA – Categorical Exemption (CE)	X		
Class III NEPA – Environmental Assessment (EA)		[7]	X
SEPA Checklist	X		
Design			
Design Deviations	[8]	[8]	[8]
Experimental Features		X	X[9]
Environmental Review Summary	X		
Final Design Decisions Summary	X	X[3]	
Final Project Definition		X[10]	
Interchange Justification Report		[7]	X
Non-Interstate Interchange Justification Report		X	
Interstate Interchange Plans (includes Intersection Plans)		[7]	X[9][11]
Non-Interstate Interchange Plans	X[11]		
Intersection Plans	X[11]		
Right of Way Plans	[12]	X	
Monumentation Map	X		
Materials Source Report		X[13]	
Pavement Determination Report		X[13]	
Roundabout Geometric Design	X[11]	X[11]	
Design Approval	[8]	[8]	[8]
Project Development Approval	[8]	[8]	[8]

Approvals
Figure 330-3

Item	Approval Authority		
	Region	HQ	FHWA
Design (continued)			
Resurfacing Report		X[13]	
Signal Permits	X[14]		
Geotechnical Report		X[13]	
Tied Bids	X[15]		X[9][15]
Bridge Design Plans (Bridge Layout)	X	X	
Hydraulic Report	X[16][17]	X[16][17]	
Preliminary Signalization Plans		X[6]	
Rest Area Plans		X	
Roadside Restoration Plans	X[18]	X[19]	
Structures Requiring TS&L's		X	X
Planting Plans	X[18]	X[19]	
Grading Plans	X[18]	X[19]	
Continuous Illumination – Main Line		X[20]	
Project Change Request Form	X[21]	X[21]	
Work Zone Transportation Management Plan/Traffic Control Plan	X[22]		
Public Art Plan – Interstate (see Chapter 1360)	X[18][23]	X[19][23]	X[9][19][23]
Public Art Plan – Non-Interstate (see Chapter 1360)	X[18][23]	X[19][23]	

X Normal procedure * If on the preapproved list

Notes:

[1] Federal-aid projects only.

[2] Approved by Environmental and Engineering Programs Director.

[3] Approved by State Design Engineer.

[4] Approved by Right of Way Plans Engineer.

[5] Refer to Chapter 210 for approval requirements.

[6] Final review & concurrence required at the Region prior to submittal to approving authority.

[7] Final review & concurrence required at HQ prior to submittal to approving authority.

[8] Refer to Figures 330-2a & 2b for Design Approval and Project Development Approval levels.

[9] Applies to new/reconstruction projects on Interstate routes.

[10] Approved by HQ Project Control & Reporting.

[11] Include channelization details.

[12] Certified by the responsible professional licensee.

[13] Submit to HQ Materials Laboratory for review and approval.

[14] Approved by Region Administrator or designee.

[15] See 23 CFR 635.111.

[16] For additional guidance, see the *Hydraulics Manual*, M 23-03.

[17] Region to submit Hydraulic Report. Refer to *Hydraulics Manual*.

[18] Applies only to Regions with a Landscape Architect.

[19] Applies only to Regions without a Landscape Architect.

[20] Approved by State Traffic Engineer.

[21] Consult HQ Project Control & Reporting for clarification on approval authority.

[22] Region Traffic Engineer.

[23] The State Bridge and Structures Architect reviews and approves the Public Art Plan (see Chapter 1360 for further details on approvals).

Approvals

Figure 330-3 (continued)

Item	New/Reconstruction (Interstate only)	NHS and Non-NHS
DBE/training goals* **	(a)	(a)
Right of way certification for federal-aid projects	FHWA(b)	FHWA(b)
Right of way certification for state-funded projects	Region(b)	Region(b)
Railroad agreements	(c)	(c)
Work performed for public or private entities*	[1][2]	Region[1][2]
State force work*	FHWA[3](d)	Region[3](d)
Use of state-furnished stockpiled materials*	FHWA[4]	FHWA[4]
Stockpiling materials for future projects*	FHWA[4]	FHWA[4]
Work order authorization	[5](d)	[5](d)
Ultimate reclamation plan approval through DNR	Region	Region
Proprietary item use*	FHWA[4]	[4](c)
Mandatory material sources and/or waste sites*	FHWA[4]	Region[4]
Nonstandard bid item use*	Region	Region
Incentive provisions	FHWA	(e)
Nonstandard time for completion liquidated damages*	FHWA(e)	(e)
Interim liquidated damages*	(f)	(f)

Notes:

[1] This work requires a written agreement.

[2] Region approval subject to $250,000 limitation.

[3] Use of state forces is subject to $60,000 limitation and $100,000 in an emergency situation, as stipulated in RCWs 47.28.030 and 47.28.035.

[4] Applies only to federal-aid projects; however, document for all projects.

[5] Prior FHWA funding approval required for federal-aid projects.

Region or Headquarters approval authority:

(a) Office of Equal Opportunity

(b) Real Estate Services Office

(c) Design Office

(d) Project Control & Reporting Office

(e) Construction Office

(f) Transportation Data Office

References:

**Plans Preparation Manual*

***Advertisement and Award Manual*

PS&E Process Approvals

Figure 330-4

Document[1]	Required for FHWA Oversight
Project Definition	X
Design Decisions Summary	X
Environmental Review Summary	X
Design Variance Inventory (and supporting information for DEs, EUs not upgraded, and deviations)[2]	X
Cost Estimate	X
SEPA & NEPA documentation	X
Design Clear Zone Inventory (see Chapter 700)	X
Interchange plans, profiles, roadway sections	X
Interchange Justification Report (if requesting new or revised access points)	X
Corridor or project analysis (see Chapter 325)	X
Traffic projections and analysis	
Accident analysis	
Right of way plans	
Work zone traffic control strategy	
Record of Survey or Monumentation Map	
Documentation of decisions to differ from WSDOT design guidance	
Documentation of decisions for project components for which there is no WSDOT design guidance	
Paths and Trails Calculations[3]	

Notes:

[1] For a complete list, see the Design Documentation Checklist.

[2] Required for NHS highways; recommended for all highways.

[3] See the *Plans Preparation Manual*.

Common Components of Design Documentation Package

Figure 330-5

1. **Design Element Upgraded to the Level Indicated in the Matrix**
   (a) Design element information
   - Design element
   - Location
   - Matrix number and row

   (b) Cost estimate[1]
   (c) B/C ratio[2]
   (d) Summary of the justification for the upgrade[3]

2. **Design Element Not Upgraded to the Level Indicated in the Matrix**
   (a) Design element information
   - Design element
   - Location
   - Matrix number and row

   (b) Existing conditions
   - Description
   - Accident Summary
   - Advantages and disadvantages of leaving the existing condition unchanged

   (c) Design using the *Design Manual* criteria
   - Description
   - Cost estimate[1]
   - B/C ratio[2]
   - Advantages and disadvantages of upgrading to the level indicated in the matrix

   (d) Selected design, if different from existing but less than the level indicated in the matrix
   - Description
   - Cost estimate[1]
   - B/C ratio[2]
   - Advantages and disadvantages of the selected design

   (e) Summary of the justification for the selected design[3]

Notes:

[1] An estimate of the approximate total additional cost for the proposed design. Estimate may be based on experience and engineering judgment.

[2] Include only when B/C is part of the justification. An approximate value based on engineering judgment may be used.

[3] A brief (one or two sentence) explanation of why the proposed design was selected.

Evaluate Upgrade (EU) Documentation Contents List
Figure 330-6

1. **Overview**
   (a) The safety or improvement need that the project is to meet
   (b) Description of the project as a whole
   (c) Highway classification and applicable design matrix number and row
   (d) Funding sources
   (e) Evidence of deviations approved for previous projects (same location)

2. **Design Alternatives in Question**
   (a) Existing conditions and design data
   - Location in question
   - Rural, urban, or developing
   - *Route development plan*
   - Environmental issues
   - Right of way issues
   - Number of lanes and existing geometrics
   - Present and 20-year projected ADT
   - Design speed, posted speed, and operating speed
   - Percentage of trucks
   - Terrain Designation
   - Managed access or limited access

   (b) Accident Summary and Analysis
   (c) Design using the *Design Manual* criteria
   - Description
   - Cost estimate
   - B/C ratio
   - Advantages and disadvantages
   - Reasons for considering other designs

   (d) Other alternatives (may include "No-build" alternative)
   - Description
   - Cost estimate
   - B/C ratio
   - Advantages and disadvantages
   - Reasons for rejection

   (e) Selected design requiring justification or documentation to file
   - Description
   - Cost estimate
   - B/C ratio
   - Advantages and disadvantages

3. **Concurrences, Approvals, and Professional Seals**

Deviation Request Contents List
Figure 330-7

Chapter 340 Minor Operational Enhancement Projects

340.01 General

This chapter complements Chapter 325 by providing guidance for development of minor operational enhancement projects. Do not use this chapter to develop Preservation or Improvement projects. Refer to Chapter 325 for guidance in development of Preservation and Improvement projects and also for projects initiated by local agencies or developers. The minor operational enhancement matrices contained in this chapter identify the design level(s) for a project, the associated approval level, and the documentation requirements for the most common minor operational enhancement projects. The matrices focus on the various elements of greatest concern during project development.

Minor enhancement projects are categorized as low-cost enhancements to improve the operational safety and efficiency of the highway system. These enhancements are most often installed by state forces through work orders, but may be accomplished through a stand-alone state contract funded entirely through the Q Program; a Q Program-funded bid item within a larger Improvement project; a change order to an existing state contract; or agreements with local agencies. An important characteristic of these projects is the ability to quickly develop and implement them without a cumbersome approval process. Balanced with this is a need to apply consistency in design policies and guidelines in the development and approval processes. Therefore, the intent of this chapter is to clarify the design guidelines and documentation requirements for minor operational enhancement projects without unduly impeding the process.

The objective of the Q Program is to maximize highway transportation system safety and efficiency through a statewide program focused on the WSDOT business function for "Traffic Operations." It is the smallest of the four major highway programs that comprise the *Highway System Plan* (Improvement, Maintenance, Preservation, and Traffic Operations). Elements within the Q Program include:

- Q1 – Traffic Operations Program Management
- Q2 – Traffic Operations Program Operations
- Q3 – Special Advanced Technology Projects

This chapter is intended to guide the development of projects in the Low-Cost Enhancements subcategory within the Q2 program. Large capital improvement projects developed for the Q3 subprogram are beyond the scope and intent of this chapter. Normally, these projects are developed using *Design Manual* guidelines for Preservation and Improvement projects. Consult the HQ Traffic Office for guidance when designing Q3 subprogram projects.

The minor operational enhancement matrices consist of three tables and are identified by route type. One of the matrices applies to Interstate and NHS freeways, one applies to NHS Nonfreeway routes, and the third matrix applies to non-NHS routes.

340.02 References

(1) Federal/State Laws and Codes

RCW 47.28.030, Contracts – State forces – Monetary limits – Small businesses, minority, and women contractors – Rules

(2) Supporting Information

Chart of Accounts, M 13-02, WSDOT

340.03 Definitions

National Highway System (NHS) For the definition and a list of specific routes on the NHS, see Chapter 325.

freeway Applies to multilane, divided highways with full access control.

minor operational enhancement projects These projects usually originate from the Q2 component of the Q Program and are quick responses to implement low-cost improvements. They are typically narrow in scope, and focus on improvements to traffic operations and modifications to traffic control devices. Guidance on the type of work included in the Q subprograms is in the *Chart of Accounts*.

(1) Project Types

Regulatory projects include actions undertaken to manage or regulate traffic conflict, movement, and use of the roadway. Potential projects in this category include revisions to speed limits, parking restrictions, turn restrictions, truck restrictions, signal operations, unsignalized intersection control, intersection lane use control, ramp meters, no passing zones, crosswalks, special traffic control schemes, and lane use restrictions.

Driver Guidance projects are actions to improve driver guidance, clarify options, or reduce hazards in the roadway setting. Potential projects include informational signs, warning signs, lighting and supplemental illumination, supplemental delineation, glare screen, signals, roadside guidance, and intelligent transportation systems (ITS).

Pavement Widening projects involve expansion of the roadway surface for vehicular use and may include earthwork, drainage, and paving elements. Consult with the Region bicycle/pedestrian coordinator to ensure that the concerns of bicyclists and pedestrians are given adequate consideration. These projects are considered alterations of the roadway and must address Americans with Disabilities Act (ADA) accessibility for pedestrians. (See Chapter 1025 for guidance on pedestrian facilities.) Potential projects are:

- **Turn lane**. The addition of a new channelized turn bay at an intersection.
- **Pullout**. Pavement widening to provide auxiliary highway uses, including transit stops, Washington State Patrol (WSP) enforcement pullouts, snow chain-up areas, and maintenance vehicle turnouts.

- **Expansion**. Widen at intersection corners, lengthen existing channelized turn bays, widen shoulders, and flatten approach tapers. This type of work is not anticipated for main line sections on interstate freeways.
- **Median Crossover**. Restricted-use median crossover on separated highways for emergency or maintenance use. (See Chapter 960 for design of median crossovers.)

Rechannelize Existing Pavement projects alter the use of the roadway without additional widening. These projects may add, delete, or modify channelization features and may include reduction of existing shoulder or lane widths. Consult with the Region bicycle/pedestrian coordinator to ensure that the concerns of bicyclists and pedestrians are given adequate consideration. Projects that change the traffic configuration by reducing shoulders to add turn lanes are considered an alteration of the existing roadway and have the same requirements as Preservation projects for ADA accessibility. (See Chapter 1025 for guidance on pedestrian facilities.) Potential projects are:

- **Pavement Markings**. Develop added storage, additional lanes, or altered lane alignment. This work may modify tapers, radii, or painted islands, or channelize bicycle lanes, preferential-use lanes, or shoulders.
- **Raised Channelization**. New or altered raised curbing to channelization islands to enhance guidance, curtail violation or misuse, or introduce access control.
- **Left-Turn Channelization (two-lane highways)**. Restriping two-lane highways with a minimum pavement width of 39 feet to provide left-turn channelization at existing intersections. Restripe to provide a minimum of 11-foot lanes and 3-foot shoulders. Ensure that the pavement is structurally adequate for the anticipated traffic loads. Within this configuration at “T” intersections, a reduced length refuge lane may be provided for traffic entering the main line from the intersecting roadway. (See Figure 340-6 for minimum dimensional characteristics of the refuge lane.)

Nonmotorized Facilities projects add adjacent roadside features for bicycle or pedestrian use. Involve the Region bicycle/pedestrian coordinator in the project development process. Potential projects are:

- **Sidewalk**. Installation of sidewalks, which might involve preserving existing shoulder or converting some portion of existing shoulder for use as a new sidewalk.
- **Walkway**. Adds to the existing roadway’s overall width to provide a wider walkable shoulder.
- **Separated Trails**. Separated bike lane or pedestrian paths on independent alignment or parallel to the highway.
- **Spot Improvement**. Installation of ADA sidewalk curb cuts, new pedestrian landings, sidewalk bulbouts at intersections, or new or revised trailhead features.

Roadside projects are modifications to roadside features for safety purposes. Potential projects are:

- **Cross Section**. Altering roadway cross sections to address clear zone hazard or sight distance concerns such as slope flattening, recontouring a ditch, closing a ditch with culvert, or removing a hazard.

- **Protection**. Installation of hazard protection for clear zone mitigation, including guardrail, barrier, and impact attenuator.
- **New Object**. Placement within clear zone of new hardware or fixed object unable to meet breakaway criteria.

(2) Design Elements

The following elements are shown on the minor operational enhancement matrices. If full design level applies, see the chapters listed below. If modified design level applies, see Chapter 430.

Sight Distance. Any combination of horizontal and vertical stopping sight distance, decision sight distance, passing sight distance, and intersection sight distance. (See Chapters 650 and 910 for definitions and guidance.)

Lane Width. Definition is in Chapter 325.

Lane Transition. Definition is in Chapter 325.

Shoulder Width. Definition is in Chapter 325.

Fill/Ditch Slope. Definition is in Chapter 325.

Clear Zone. Definition is in Chapter 325.

Ramp Sight Distance. Any combination of horizontal and vertical stopping sight distance, decision sight distance, and intersection sight distance. (See Chapters 650 and 910 for definitions and guidance.)

Ramp Lane Width. The lane width for ramp alignments. (See Lane Width definition in Chapter 325.)

Ramp Lane Transition. The lane transition applied to a ramp alignment. (See definition for Lane Transitions in Chapter 325; also see Chapter 940.)

Ramp Shoulder Width. The shoulder width for a ramp alignment. (See Shoulder Width definition in Chapter 325.)

Ramp Fill/Ditch Slopes. The fill/ditch slope along a ramp alignment. (See Fill/Ditch Slope definition in Chapter 325.)

Ramp Clear Zone. The clear zone along a ramp alignment. (See Clear Zone definition in Chapter 325.)

Ramp Terminals or Intersection Turn Radii. Definition is in Chapter 910.

Ramp Terminals or Intersection Angle. Definition is in Chapter 910.

Ramp Terminals or Intersection Sight Distance. Definition is in Chapter 910.

Pedestrian and Bike. The facilities along a route for accommodation of pedestrians and/or bicycles. (See Chapter 1020 for bicycles and Chapter 1025 for pedestrians.)

Crossroads at Ramps Lane Width. The lane width on a crossing alignment intersected by a ramp. (See Lane Width definition in Chapter 325.)

Crossroads at Ramps: Shoulder Width. The shoulder width on a crossing alignment intersected by a ramp. (See Shoulder Width definition in Chapters 325 and 440.)

Crossroads at Ramps: Pedestrian and Bike. The facilities on a crossing alignment intersected by a ramp for accommodation of pedestrians and/or bicycles. (See Pedestrian and Bike definition.)

Crossroads at Ramps: Fill/Ditch Slopes. The fill/ditch slope along a crossroad intersected by a ramp. (See Fill/Ditch Slope definition in Chapter 325.)

Crossroads at Ramps: Clear Zone. The clear zone along a crossroad intersected by a ramp. (See Clear Zone definition in Chapter 325.)

Barriers: Terminals and Transition Sections. Definition is in Chapter 325.

Barriers: Standard Run. Definition is in Chapter 325.

340.04 Minor Operational Enhancement Matrix Procedures

During Project Definition and design, the following steps are used to select and apply the appropriate *minor operational enhancement matrix*. Each step is further explained in this chapter.

- Select a *minor operational enhancement matrix* by identifying the route: Interstate/NHS Freeway, NHS nonfreeway, or non-NHS.
- Within the minor operational enhancement matrix, select the *row* by the type of work.
- Use the minor operational enhancement matrix to determine the *documentation and approval levels for the various design elements* in the project. Apply the appropriate design levels and document the design decisions as required by this chapter and Chapter 330.

340.05 Selecting a Minor Operational Enhancement Matrix

Selection of a minor operational enhancement matrix is based on highway system: Interstate/NHS Freeway, NHS nonfreeway, non-NHS (see Figure 340-1). Figure 325-2 provides a list of the NHS and the Interstate routes in Washington. The minor operational enhancement matrices are shown in Figures 340-2 through 340-4. Follow *Design Manual* guidance for all projects except as noted in the minor operational enhancement matrices.

Route	Project	
	Freeway	Nonfreeway
Interstate	Matrix 1	
NHS	Matrix 1	Matrix 2
Non-NHS	Matrix 1	Matrix 3

Minor Operational Enhancement Matrix Selection Guide
Figure 340-1

340.06 Project Type

Row selection in the design matrices is based on project type or type of work (see 340.03(1)). For projects not listed in the matrices, consult the Headquarters (HQ) Traffic Office and the HQ Design Office.

Some projects might include work from several project types. In such cases, identify the design and approval level for each project element. In all cases, select the higher design level and approval level where overlaps are found.

340.07 Using a Minor Operational Enhancement Matrix

The column headings on a minor operational enhancement matrix are design elements. They are based on the following thirteen Federal Highway Administration (FHWA) controlling design criteria: design speed, lane width, shoulder width, bridge width, structural capacity, horizontal alignment, vertical alignment, grade, stopping sight distance, cross slope, superelevation, vertical clearance, and horizontal clearance. For the column headings, some of the controlling criteria are combined (for example, design speed is part of horizontal and vertical alignment).

Unlike the design matrices described in Chapter 325, designers using a minor operational enhancement matrix are not required to inventory deficiencies for elements not improved by the minor enhancement project. Similarly, they are not required to justify existing deficiencies not addressed by minor enhancement projects. In the case where improvements to existing features surpass the existing condition but do not meet the design guidelines, Basic Documentation plus Supplemental Coordination (BD+) is required (see 340.09(1)).

A **blank cell** on a minor operational enhancement matrix signifies that the design element is beyond the scope of the project and need not be addressed.

For work on ramps on interstate or NHS freeway routes, there is a requirement to provide assurance of no adverse effect to main line flow. Forward to FHWA a copy of the documentation providing assurance, or process a deviation through FHWA if there is an adverse effect.

(1) Design Level

The minor operational enhancement matrices specify the appropriate design level for the various project elements. The design levels specified are “full” and “modified.”

Full design level (F) improves roadway geometrics, safety, and operational elements. (See Chapter 440 and other applicable chapters for design guidance.) Use the current traffic volume with Chapter 440 to evaluate design class for Q Program projects.

Modified design level (M) preserves and improves existing roadway geometrics, safety, and operational elements (see Chapter 430).

Design levels specified in a matrix cell are supplemented with notations for design variances.

(2) Design Variances

Design variances are information packages that justify the introduction of features that are not in accordance with design guidelines. Variances specified in minor operational enhancement project cells include Design Justification: Level 2, Level 3, or Level 4. (See 340.09 for details on documentation requirements.)

340.08 Project Approval

Project approval for minor operational enhancement projects authorizes expenditures for the project. The State and/or Region Traffic Engineer have the responsibility and authority to authorize all expenditures for Q2 Low-Cost Enhancements. Delegation of design and/or expenditure approval authority for Q Program-funded projects must be identified in writing from the appropriate Traffic Engineer to the person receiving the delegated authority. Such written delegation must identify the specific conditions for which approval authority has been delegated. Design Approval authority for Plans, Specifications, and Estimates (PS&E) contracts cannot be delegated.

Mechanisms for project expenditure approval vary with the types of projects and the costs involved.

- **Minor-cost projects** are projects normally implemented by state forces directed through maintenance task orders within the monetary limits established in RCW 47.28.030. Expenditure authority is granted by initialing the work order.
- **Midrange projects** include all contract change orders, local agency agreements, or Q Program bid items included in an Improvement or Preservation project, regardless of cost. Maintenance task orders exceeding the monetary limits established in RCW 47.28.030 are included in this category. Expenditure authority is granted by initialing the task order, change order, or agreement memo.
- **PS&E contracts** are stand-alone contracts funded through the Q Program for minor operational enhancement projects. A Design Summary/Approval memorandum must be prepared and signed by the Region Traffic Engineer to approve a project in this category. Figure 340-5 provides a template for the approval memo.

Project development decisions and approvals for “Regulatory” and for “Driver Guidance” projects reside within Region or HQ Traffic offices. Projects impacting roadway geometric features in the “Pavement Widening,” “Rechannelizing Existing Pavement,” “Nonmotorized Facilities” or “Roadside” categories are developed jointly by Region Traffic and Project Development offices. Depending on the route type, the approval authority may involve the Assistant State Design Engineer and the FHWA.

340.09 Documentation

The minor operational enhancement matrices include a column that specifies the documentation levels for each project type listed. The documentation levels are categorized as Basic Documentation (BD) and Basic Documentation plus Supplemental Coordination (BD+).

In all cases, the documentation must outline the rationale for the project and include backup information sufficient to support the design decisions. Document the roadway configuration prior to implementing a minor operational enhancement project. Retain the documentation in a permanent retrievable file at a central location in each Region.

(1) Projects

Basic Documentation (BD) level applies to regulatory or driver guidance projects. Documentation consists of an unstructured compilation of materials sufficient to validate the designer's decisions. Materials may include meeting notes, printed e-mails, records of phone conversations, copies of memos, correspondence, and backup data such as level of service modeling, accident data, and design drawings.

A single narrative outlining the decision-making process from start to finish is not required, provided that the materials retained in the file can be traced to a decision consistent with the project design. This level of documentation includes a requirement for inputting the project information into the TRaffic ACtion Tracking System (TRACTS) database at the conclusion of the project.

Basic Documentation plus Supplemental Coordination (BD+) level applies to all projects except regulatory or driver guidance projects.

A more comprehensive evaluation of options and constraints is required for this documentation level. Documentation includes basic documentation with additional information describing coordination efforts with other WSDOT groups having a stake in the project. Document the coordination efforts with the following disciplines: Environmental, Hydraulics, Local Agencies and WSDOT Local Programs, Maintenance, Materials, Program Management, Real Estate Services, Urban Corridors, Utilities, and the general public. This level of documentation also includes a requirement for inputting the project information into the TRACTS database at the conclusion of the project.

(2) Design Deviations

Design Justification (DJ) is a written narrative summarizing the rationale for introduction of a feature that varies from the applicable *Design Manual* guidelines. Include in the narrative sufficient information to describe the problem, the constraints, and the trade-offs at a level of detail that provides a defendable professional judgment. DJs are not intended to have the same level of formality as Level 2, 3, and 4 deviations. DJs may use written memos, e-mails, or documented discussions with the approving traffic authority. The Region Traffic Engineer has responsibility for approving Design Justifications, and the DJ documentation must include the name and date of the approving authority. At the time the work order is approved, the Region Project Development Engineer and the Assistant State Design Engineer are to be sent informational copies of the Design Justification to provide them an opportunity to communicate their concerns. Comment on the informational copy is not mandatory and progress toward project implementation does not wait on a response.

Level 2 documentation serves to justify a deviation to the specified design guidance. Within the document, summarize the project, the design guidelines, the proposed elements that vary from design guidelines, alternatives analyzed, constraints and impacts of each alternative, and the recommended alternative. Level 2 documentation requires the joint approval of the Region Traffic Engineer and the Region Project Development Engineer. At the time the work order is approved, the Assistant State Design Engineer is to be sent an informational copy of the Level 2 documentation to provide an opportunity to communicate concerns. Comment on the informational copy is not mandatory, and progress toward project implementation does not wait on a response.

Level 3 documentation requirements include the Level 2 requirements; however, the approval process is through the Region Traffic Engineer and Region Project Development Engineer, with final approval from the Assistant State Design Engineer.

Level 4 documentation requirements include the Level 3 requirements; however, the approval process is through the Region Traffic Engineer, the Region Project Development Engineer, and the Assistant State Design Engineer, with final approval from the Federal Highway Administration on interstate routes.

Level 2, 3, and 4 design deviation requests are intended to be stand-alone documentation describing the project, design criteria, proposed element(s), why the desired design level was not or cannot be used, alternatives evaluated, and a request for approval. Include funding source(s), type of route, project limits, design classification, posted speed, current ADT, and percent truck traffic in the project description. Justification for the design deviation can include project costs, but must be supported by at least two of the following:

- Accident history or potential
- Engineering judgment
- Environmental issues
- Route continuity (consistency with adjoining route sections)
- The project is an interim solution (covering a 4- to 6-year time horizon)

⇩ Project Type	Main Line						Ramps (1)						Ramp Terminalsor Intersections			Crossroads at Ramps					Barriers All		Doc. Level
Design Elements ⇨	Sight Dist.	Lane Width	Lane Tran-sition	Shldr Width	Fill/ Ditch Slopes	Clear Zone	Sight Dist.	Lane Width	Lane Tran-sition	Shldr Width	Fill/ Ditch Slopes	Clear Zone	Turn Radii	Angle	Sight Dist.	Lane Width	Shldr Width	Ped & Bike	Fill/ Ditch Slopes	Clear Zone	Term. & Trans. Section	(2)Std Run	
Regulatory - (Traffic Office Authority)																							**BD**
Driver Guidance - (Traffic Office Authority)																							**BD**
Pavement Widening																							
(1-1Q) Turn Lane								**F/DJ**	**F/DJ**	**F/DJ**			**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(1-2Q) Pullout							**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**	**M/DJ**		**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(1-3Q) Expansion	**F/3**	**F/4**	**F/3**	**F/4**	**F/3**	**F/3**		**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**	**M/DJ**		**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(1-4Q) Median Crossover	**F/3**	**F/4**	**F/3**	**F/4**	**F/3**	**F/3**															**F/3**	**F/3**	**BD+**
Rechannelize Existing Pavement																							
(1-5Q) Pavement Markings	**F/3**	**F/4**	**F/3**	**F/4**		**F/3**	**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**		**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**		**F/DJ**	**F/3**	**F/3**	**BD+**
(1-6Q) Raised Channelization							**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**		**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**		**F/DJ**	**F/3**	**F/3**	**BD+**
(1-7Q) Left-Turn Channelization 2-Lane Hwys (3)																**DJ**	**DJ**	**M**					
Nonmotorized Facilities																							
(1-8Q) Sidewalk/Walkway													**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(1-9Q) Separated Trails																		**F/DJ**			**F/3**	**F/3**	**BD+**
(1-10Q) Spot Improvement													**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**		**F/DJ**			**BD+**
Roadside																							
(1-11Q) Cross Section	**F/3**				**F/3**	**F/3**	**F/DJ**				**F/DJ**	**F/DJ**			**F/DJ**				**M/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(1-12Q) Protection	**F/3**			**F/4**	**F/3**	**F/3**	**F/DJ**			**F/DJ**	**F/DJ**	**F/DJ**			**F/DJ**		**M/DJ**		**M/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(1-13Q) New Object	**F/3**					**F/3**	**F/DJ**					**F/DJ**			**F/DJ**					**F/DJ**	**F/3**	**F/3**	**BD+**

□ Not Applicable
F Full design level
M Modified design level. See Chapter 430.
DJ Design Justification required and Project Approval by region Traffic, with notification to Headquarters Design.
2 Deviation approval through the region's Traffic and Project Development Engineers, with notification to Headquarters Design.
3 Deviation approval through level 2 and the Assistant State Design Engineer.
4 Deviation approval through level 3, and FHWA on Interstate routes.
BD Basic Documentation required.
BD+ Basic Documentation plus supplemental coordination required.

If a project impacts any design element, the impacted elements are addressed. Elements not impacted, are not ddressed.

For items not meeting the design level provided in the matrix, justification or deviation is required and is processed through the designated approval level, DJ, 2, 3, or 4

For at-grade intersections on NHS routes, apply Matrix 2.

(1) Documentation must provide assurance of no adverse effect to main line flow. Otherwise process a deviation through level 4
(2) If existing shoulder width is decreased below minimum values, when placing new guardrail or concrete barrier, a deviation request justifying the proposal is required.
(3) Where existing pavement width is 39 feet or greater.

Minor Operational Enhancement Matrix 1: Interstate and NHS Freeway Routes

Figure 340-2

⇩ **Project Type**	**Main Line**						**Intersections**				**Barriers All**		**Doc. Level**
Design Elements ⇨	Sight Dist.	Lane Width	Lane Tran-sition	Shldr Width	Fill/ Ditch Slopes	Clear Zone	Turn Radii	Angle	Sight Dist.	Ped & Bike	Term. & Trans. Section	(2)Std Run	
Regulatory - (Traffic Office Authority)													**BD**
Driver Guidance - (Traffic Office Authority)													**BD**
Pavement Widening													
(2-1Q) Turn Lane	**M/2**	**M/3**	**F/2**	**M/3**	**M/2**	**F/2**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(2-2Q) Pullout	**M/2**	**M/3**	**F/2**	**M/3**	**M/2**	**F/2**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(2-3Q) Expansion	**M/2**	**M/3**	**F/2**	**M/3**	**M/2**	**F/2**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
Rechannelize Existing Pavement													
(2-4Q) Pavement Markings	**M/2**	**M/3**	**F/2**	**M/3**		**F/2**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(2-5Q) Raised Channelization	**M/2**	**M/3**	**F/2**	**M/3**		**F/2**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(2-6Q) Left-Turn Channelization 2-Lane Hwys (3)		**DJ**		**DJ**						**M**			
Nonmotorized Facilities													
(2-7Q) Sidewalk/Walkway	**M/2**	**M/3**	**F/2**	**M/3**	**M/2**	**F/2**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(2-8Q) Separated Trails	M/2				M/2	F/2				F/DJ	F/3	F/3	BD+
(2-9Q) Spot Improvement	M/2	M/3	F/2	M/3	M/2	F/2	M/DJ	M/DJ	F/DJ	F/DJ	F/3	F/3	BD+
Roadside													
(2-10Q) Cross Section	**M/2**				**M/2**	**F/2**			**F/DJ**		**F/3**	**F/3**	**BD+**
(2-11Q) Protection	**M/2**				**M/2**	**F/2**			**F/DJ**		**F/3**	**F/3**	**BD+**
(2-12Q) New Object	**M/2**				**M/2**	**F/2**			**F/DJ**		**F/3**	**F/3**	**BD+**

□ Not Applicable
F Full design level
M Modified design level. See Chapter 430.
DJ Design Justification required and Project Approval by region Traffic, with notification to Headquarters Design.
2 Deviation approval through the region's Traffic and Project Development Engineers, with notification to Headquarters Design.
3 Deviation approval through level 2 and the Assistant State Design Engineer.
BD Basic Documentation required.
BD+ Basic Documentation plus supplemental coordination required.

If a project impacts any design element, the impacted elements are addressed. Elements not impacted, are not addressed.

For items not meeting the design level provided in the matrix, justification or deviation is required and is processed through the designated approval level, DJ, 2 or 3.

For interchange features, apply Matrix 1.

(2) If existing shoulder width is decreased below minimum values, when placing new guardrail or concrete barrier, a deviation request justifying the proposal is required.

(3) Where existing pavement width is 39 feet or greater.

Minor Operational Enhancement Matrix 2: NHS Nonfreeway Routes

Figure 340-3

⇩ Project Type	Main Line						Intersections				BarriersAll		Doc. Level
Design Elements ⇨	Sight Dist.	Lane Width	Lane Tran-sition	Shldr Width	Fill/ Ditch Slopes	Clear Zone	Turn Radii	Angle	Sight Dist.	Ped & Bike	Term. & Trans. Section	(2)Std Run	
Regulatory - (Traffic Office Authority)													**BD**
Driver Guidance - (Traffic Office Authority)													**BD**
Pavement Widening													
(3-1Q) Turn Lane	**M/DJ**	**M/2**	**F/DJ**	**M/2**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
(3-2Q) Pullout	**M/DJ**	**M/2**	**F/DJ**	**M/2**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
(3-3Q) Expansion	**M/DJ**	**M/2**	**F/DJ**	**M/2**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
Rechannelize Existing Pavement													
(3-4Q) Pavement Markings	**M/DJ**	**M/2**	**F/DJ**	**M/2**		**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
(3-5Q) Raised Channelization	**M/DJ**	**M/2**	**F/DJ**	**M/2**		**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
(3-6Q) Left-Turn Channelization 2-Lane Hwys (3)		**DJ**		**DJ**						**M**			
Nonmotorized Facilities													
(3-7Q) Sidewalk/Walkway	**M/DJ**	**M/2**	**F/DJ**	**M/2**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
(3-8Q) Separated Trails	**M/DJ**				**M/DJ**	**F/DJ**				**F/DJ**	**F/2**	**F/2**	**BD+**
(3-9Q) Spot Improvement	**M/DJ**	**M/2**	**F/DJ**	**M/2**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
Roadside													
(3-10Q) Cross Section	**M/DJ**				**M/DJ**	**F/DJ**			**F/DJ**		**F/2**	**F/2**	**BD+**
(3-11Q) Protection	**M/DJ**				**M/DJ**	**F/DJ**			**F/DJ**		**F/2**	**F/2**	**BD+**
(3-12Q) New Object	**M/DJ**				**M/DJ**	**F/DJ**			**F/DJ**		**F/2**	**F/2**	**BD+**

□ Not Applicable
F Full design level
M Modified design level. See Chapter 430.
DJ Design Justification required and Project Approval by region Traffic, with notification to Headquarters Design.
2 Deviation approval through the region's Traffic and Project Development Engineers, with notification to Headquarters Design.
3 Deviation approval through level 2 and the Assistant State Design Engineer.
BD Basic Documentation required.
BD+Basic Documentation plus supplemental coordination required.

If a project impacts any design element, the impacted elements areaddressed. Elements not impacted, are not addressed.

For items not meeting the design level provided in the matrix, justification or deviationis required and is processed through the designated approval level, DJ, 2 or 3.

For interchange features, apply Matrix 1.

(2) If existing shoulder width is decreased below minimum values, when placing new guardrail or concrete barrier, a deviation request justifying the proposal is required.

(3) Where existing pavement width is 39 feet or greater.

Minor Operational Enhancement Matrix 3: Non-NHS Routes

Figure 340-4

Date Placeholder

TO: (Specify) Region Traffic Engineer[1]

THRU:

FROM:

SUBJECT:

Design Approved By:

____
(Specify) Region Traffic Engineer[1]

____
Date

General Information
SR is a (*NHS or Non-NHS*) route, and classified as a (*Urban or Rural*) (*Interstate, Principal Arterial, Minor Arterial, Collector or Urban Managed Access Roadway*) in _________________ County. The posted speed limit is _________________ mph. The ADT is, _________________ with _________________ percent trucks. The project is within a (*full, partial, or modified limited access control, or Class 1 - 5 managed access controlled*) area.

Project Initiation
How did the project get started? Accident history, constituent call, e-mail, or letter?

Existing Geometrics
What is out there today? Lane, shoulder, sidewalk widths? Turn pockets, etc.?

Project Description
How did you come to the design decision being proposed? What does it resolve for the situation at hand? What options have you looked at? Why were other options not selected?

Proposed Geometrics
What will be out there when you are through? Lane, shoulder, sidewalk widths? Turn pockets, etc.?

[1] For example "Eastern Region Traffic Engineer"

Q Project Design Summary/Approval Template
Figure 340-5

Resurfacing
If pavement is involved what does the resurfacing report say to use?

Pavement Marking/Traffic Control Devices

What happens with the pavement markings? Signing? Illumination? Signals? Etc.?

Environmental Approval
Did you check with the Environmental Services Office? Are there any issues or permits that need to be addressed? Hydraulics?

Deviations
Are there any deviations? Describe briefly what features are deviated and the date of approval.

Permits
Are there any permits or easements needed? Construction permits? Noise variances? Utility relocations? Detours? Signal? Others?

Project Cost and Schedule
How much do you anticipate spending? When is the project scheduled for advertisement? When do you anticipate the project will be completed?

Sole Source Justification
Some traffic items are sole source and require justification. Have you completed the process?

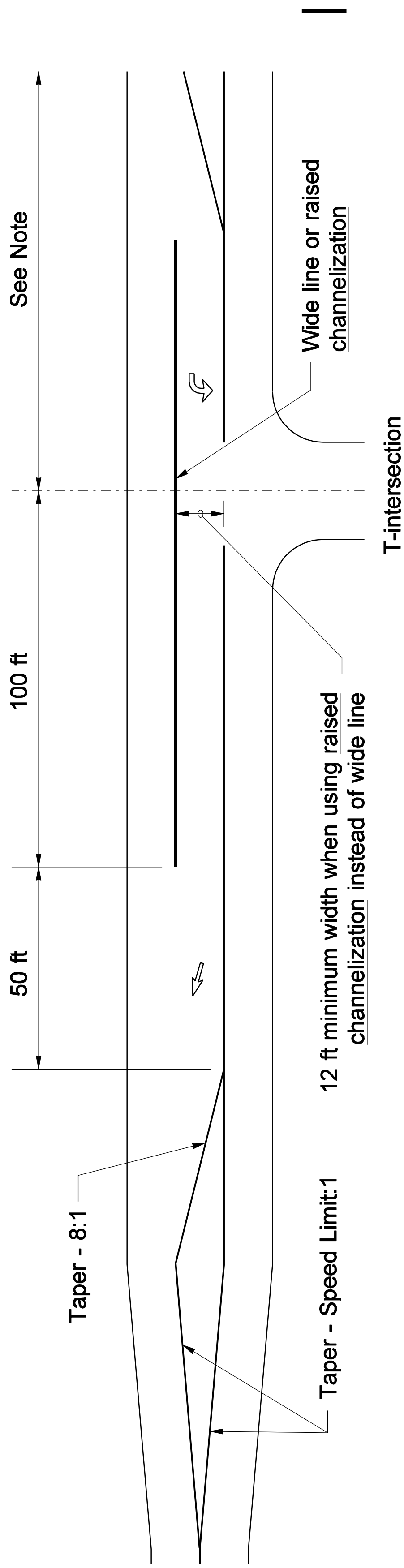
Work Zone Traffic Control
What happens to traffic, pedestrians, and bicyclists during construction? Is a lane taken or reduced in width? Night work? Shoulder work? Duration? Does Washington State Patrol (WSP) need to be involved?

Local Agency Coordination
Do we need to coordinate with, or notify the city or county? WSP?
We are requesting approval for the Subject project. This project was designed in accordance with Q Program guidelines for Minor Operational Enhancements, Matrix ____________ *note matrix title and project type line.*

Typist's Initials Placeholder

Attachments: Channelization Plan? Permits? Deviations?
cc: Headquarters Design 47329

Q Project Design Summary/Approval Template
Figure 340-5 (continued)



Note:
For left-turn channelization, see Chapter 910.

Refuge Lane for T-Intersections on Two-Lane Highways
Figure 340-6

Chapter 410 Basic Design Level

410.01 General

Basic design level (B) preserves pavement structures, extends pavement service life, and maintains safe operations of the highway. Basic design level includes restoring the roadway for safe operations and may include safety enhancement. Flexibility is provided so that other conditions can be enhanced while remaining within the scope of pavement preservation work.

The required safety items of work listed below may be programmed under a separate project from the paving project as long as there is some benefit to the delay, the safety features remain functional, and the work is completed within two years after the completion of the paving project. If some of the required items are separated from the paving project, maintain a separate documentation file that addresses the separation of work during the two-year time period.

For bituminous surface treatment projects on non-NHS routes, the separation of required safety items is not limited to the two-year time period. The safety work can be accomplished separately using a corridor-by-corridor approach.

410.02 Required Basic Safety Items of Work

For basic design level, the following items of work are required:

- Install and replace delineation in accordance with Chapter 830
- Install and replace rumble strips in accordance with the design matrices (see Chapter 325) and Chapter 700
- Adjust existing features such as monuments, catch basins, and access covers that are affected by resurfacing
- Adjust guardrail height in accordance with Chapter 710
- Replace deficient signing as needed (this does not include replacement of sign bridges or cantilever supports)
- Relocate, protect, or provide breakaway features for sign supports, luminaires, and WSDOT electrical service poles inside the Design Clear Zone
- Restore sight distance at public road intersections and the inside of curves through low-cost measures (when available) such as removal or relocation of signs and other obstructions and cutting of vegetative matter
- Upgrade nonstandard bridge rail in accordance with the matrices and Chapter 710
- Upgrade barrier terminals and bridge end protection, including transitions, in accordance with Chapter 710
- Restore the cross slope to 1.5% when the existing cross slope is flatter than 1.5% and, in the engineer's judgment, the steeper slope is needed to solve highway runoff problems in areas of intense rainfall
- Remove the rigid top rail and brace rails from Type 1 and Type 6 chain link fence and retrofit with a tension wire design (see Chapter 1460)

410.03 Minor Safety and Minor Preservation Work

Consider the following items, where appropriate, within the limits of a pavement preservation project:

- Spot safety enhancements, which are modifications to isolated roadway or roadside features that, in the engineer's judgment, reduce potential accident frequency or severity.
- When recommended by the Region Traffic Engineer, additional or improved channelization to address intersection-related accident concerns, where sufficient pavement width and structural adequacy exist or can be obtained. With justification, and considering the impacts to all roadway users, channelization improvements may be implemented, with lane and shoulder widths no less than the design criteria specified in the "Rechannelize Existing Pavement projects" section in Chapter 340. Consider illumination of these improvements. Document decisions when full illumination is not provided, including an analysis of the frequency and severity of nighttime accidents.
- Roadside safety hardware (such as guardrail, signposts, and impact attenuators).
- Addressing Location 1 Utility Objects in accordance with the *Utilities Accommodation Policy*.

Consider the following items when restoration, replacement, or completion is necessary to ensure that an existing system can function as intended:

- Right of way fencing
- Drainage
- Illumination
- Electrical
- Pedestrian and bicycle use

Examples of the above include, but are not limited to, the following:

- Installing short sections of fence needed to control access
- Replacing grates that are a hazard to bicycles
- Upgrading electrical system components that require excessive maintenance
- Beveling culverts

Chapter 430 Modified Design Level

430.01 General

Modified design level (M) preserves and improves existing roadway geometrics, safety, and operational elements. This chapter provides the design criteria that are unique to the modified design level.

The modified design level design criteria have been developed to apply to all applicable functional classes. As a result, for the lower volumes and urban highways, modified design level design criteria might exceed full level design criteria. In these cases, full level design criteria may be used.

Projects developed to correct a deficiency must address all design elements contributing to that deficiency, even when those elements meet modified design level design criteria.

Design elements that do not have modified design level guidance include:

- Lane transitions – Chapter 620
- On- and off-connections – Chapter 940
- Access control – Chapter 1420
- Clear zone – Chapter 700
- Signing, delineation, and illumination – Chapters 820, 830, and 840
- Basic safety – Chapter 410
- Structural capacity – Chapter 1120
- Vertical clearance – Chapter 1120
- Intersection sight distance – Chapter 910
- Traffic barriers – Chapter 710

430.02 Design Speed

When applying modified design level to a project, select a design speed for use in the design process that reflects the character of the terrain and the type of highway. The desirable design speed for modified design level is given in Figure 430-1. The minimum design speed is not less than the posted speed or the *proposed* posted speed. Document the speed used, including any supporting studies and data. (See Chapter 440 for additional information on design speed.)

Route Type	Posted Speed	Desirable Design Speed
Freeways	All	10 mph over the posted speed
Nonfreeways	45 mph or less	Not less than the posted speed
	Over 45 mph	5 mph over posted speed

Desirable Design Speed
Figure 430-1

When the posted speed exceeds the design speed for existing geometric features that are to remain in place (curve radius, superelevation, sight distance, or other elements that the design speed controls), one of two choices must be made:

- When appropriate, work with the Region Traffic Office to lower the posted speed to be consistent with the existing design speeds for the geometric features on the facility.
- Complete a corridor analysis in order to leave the posted speed unchanged and identify all design elements that do not meet the criteria for the existing posted speed. Identify each appropriate location for cautionary signing (including road approach sight distance) and work with the Region Traffic Office to install the cautionary signing as provided for in the MUTCD (either by contract or Region sign personnel). Consult with and obtain guidance from Region project development leadership prior to progressing with the corridor analysis and the design.

430.03 Alignment

(1) Horizontal Alignment

Consideration of horizontal alignment for modified design level is normally limited to curves. Curve design is controlled by the design speed (see 430.02), superelevation (see 430.03(4)), and stopping sight distance (see 430.03(3)).

Identify major modifications to horizontal alignment in the Project Summary. Total removal of pavement and reconstruction of the subgrade are examples of major modifications.

(2) Vertical Alignment

Vertical alignment consists of a series of profile grades connected by vertical curves.

(a) **Vertical Curves**. Stopping sight distance controls crest vertical curves. Figure 430-8 gives the minimum curve length for crest vertical curves to remain in place for modified design level stopping sight distance. (See 430.03(3) for additional information on modified design level stopping sight distance.)

When modified design level is being applied, existing sag vertical curves are not normally addressed.

When either a crest or a sag vertical curve is to be reconstructed, use full design level design criteria (see Chapters 630 and 650).

(b) **Profile Grades**. When applying modified design level, profile grades generally are not flattened. However, corrective action may be justified for combinations of steep grades and restricted horizontal or vertical curvature. Identify major modifications to vertical alignment in the Project Summary. Total removal of pavement and reconstruction of the subgrade are examples of major modifications. When changing the profile grade, see Chapter 440 for the maximum grade for the functional class of the route.

(3) Stopping Sight Distance

Stopping sight distance is a controlling factor for both vertical and horizontal alignment. A 2-foot object height is used for modified design level stopping sight distance evaluation. Figure 430-2 gives the minimum stopping sight distances allowed to remain in place.

Design Speed (mph)	Design Stopping Sight Distance (ft)
40 or less	155
45	200
50	250
55	305
60	360
65	425
70	495
75	570
80	645

Stopping Sight Distance: Modified Design Level
Figure 430-2

(a) **Stopping Sight Distance for Horizontal Curves**. For modified design level, use the existing lateral clearance to the sight obstruction and the curve radius to compare the existing condition to Figure 430-9a. When reconstructing a horizontal curve, apply full design level criteria for sight distance (see Chapter 650).

For Figure 430-9a, an obstruction is any object with a height of greater than 2.75 feet above the roadway surface on the inside of a curve. Examples of possible obstructions are median barrier, guardrail, bridges, walls, cut slopes, wooded areas, and buildings. Objects between 2.75 feet and 2.00 feet above the roadway surface within the M distance might be a sight obstruction (see Figure 430-9b for guidance) depending on the distance from the roadway.

(b) **Stopping Sight Distance for Vertical Curves**. For existing crest vertical curves, use the algebraic difference in grades and the length of curve to compare the existing condition to the stopping sight distance requirements from Figure 430-2. Use the equations in Figure 430-3 or use Figure 430-8 to evaluate the existing curve.

When a crest vertical curve is lengthened, the minimum sight distance is increased; however, the length of the roadway that has the minimum sight distance is also increased. This results in a questionable benefit when the new sight distance is less than for full design level. Therefore, when the existing roadway is reconstructed to improve stopping sight distance, apply full design level criteria (see Chapter 650).

When $s < L$:
$$L = \frac{As^2}{2158}$$
When $s > L$:
$$L = 2s - \frac{2158}{A}$$
Where: L = Length of vertical curve (ft) s = Sight distance from Figure 430-2 (ft) A = Absolute value of the algebraic difference in grades (%)

Minimum Crest Vertical Curve Length: Modified Design Level
Figure 430-3

(4) Superelevation

Evaluate existing superelevation using the equation in Figure 430-4 with the friction factors from Figure 430-5 or with a ball banking analysis. When the existing superelevation equals or exceeds the value from the equation or when the maximum speed determined by a ball banking analysis equals or exceeds the design speed, the modified design level design criteria are met.

When modifying the superelevation of an existing curve where the existing pavement is to remain in place, the equation in Figure 430-4 may be used to determine the required superelevation.

For curves on realigned roadways or where the roadway is to be rebuilt, provide full design-level superelevation (see Chapter 642).

The "minimum radius for normal 2% crown" values from Figure 430-5 are the radii that, with the design speed and side friction factor, result in a 2% adverse crown (e=-2%) (see the equation in Figure 430-4). The modified design-level design criteria are met when a roadway has not more than 2% crown in both directions and a radius equal to or greater than the minimum radius for normal 2% crown.

$$e = \left(\frac{6.69V^2}{R}\right) - f$$
Where: R = Existing curve radius (ft) V = Design speed from 430.02 (mph) e = Superelevation rate (%) f = Side friction factor from Figure 430-5

Minimum Superelevation: Modified Design Level
Figure 430-4

Design Speed (mph)	Side Friction Factor (*f*)	Minimum Radius for Normal 2% Crown (ft)
15	32	51
20	27	107
25	23	199
30	20	335
35	18	512
40	16	764
45	15	1041
50	14	1392
55	13	1838
60	12	2405
65	11	3137
70	10	4092
75	9	5369
80	8	7126

Side Friction Factor
Figure 430-5

430.04 Roadway Widths

Review route continuity and roadway widths. Select widths on the tangents to be consistent throughout a given section of the route. Make any changes where the route characteristics change. The design of a project must not decrease the existing roadway width.

(1) Lane and Shoulder Width

Lane and shoulder widths are shown in Figures 430-10 and 11. Consider joint use with other modes of transportation in shoulder design.

Minimum ramp lane and shoulder widths are shown in Figure 430-14. Use full design level lane and shoulder widths (see Chapter 940) for new and rebuilt ramps.

(2) Turning Roadway Widths

It might be necessary to widen the roadway on curves to accommodate large vehicles. The proposed roadway width for a curve shall not be less than that of the adjacent tangent sections.

Widening of the total roadway width of a curve by less than 2 feet is not required for existing two-lane roadways that are to remain in place.

(a) **The two-lane two-way roadway** width of a curve may not be less than that shown in Figure 430-12a or, if the internal angle (delta) is less than 90°, Figure 430-12b. The minimum total roadway width from Figure 430-12a or 12b may include the shoulder. When the shoulder is included, full-depth pavement is required.

(b) **One-way roadway and ramp** widths on a curve are shown in Figure 430-6 for existing roadways that are to remain in place. Use full design level width (see Chapters 641 and 940) for new and rebuilt ramps.

(3) Median Width

Minimum median widths are given in Figure 430-10.

Curve Radius (ft)	One-Lane[1]	Two-Lane[2]
Tangent to 1001	20	24
500	21	25
400	21	25
300	22	25
200	22	26
150	23	26
100	25	28
75	27	29
50	30	31

Notes:

[1] Includes the shoulder width.

[2] Add shoulder widths from Figure 430-10 for highways and 10 ft for ramps.

One-Way Roadway and Ramp Turning Roadway Widths: Modified Design Level
Figure 430-6

430.05 Cross Slopes

On all tangent sections, the normal cross slopes of the traveled way are 2%.

If a longitudinal contiguous section of pavement is to be removed or is on a reconstructed alignment, or if a top course is to be placed over existing pavement, design the restored pavement cross slope to full design level criteria (see Chapter 640).

The algebraic difference in cross slopes is an operational factor during a passing maneuver on a two-lane two-way roadway. Its influence increases when increased traffic volumes decrease the number and size of available passing opportunities.

A somewhat steeper cross slope may be necessary to facilitate pavement drainage in areas of intense rainfall, even though this might be less desirable from the operational point of view. In such areas, the design cross slopes may be increased to 2.5% with an algebraic difference of 5%.

For existing pavements, cross slopes within a range of 1% to 3% may remain if there are no operational or drainage problems and, on a two-lane two-way roadway, the following conditions are met:

- The algebraic difference is not greater than 4% where the ADT is greater than 2000.
- The algebraic difference is not greater than 5% where the ADT is 2000 or less.
- The algebraic difference is not greater than 6% and the road is striped or signed for no passing.

For a two-lane two-way roadway, provide an algebraic difference to meet the appropriate conditions stated above, except when facilitating drainage in areas of intense rainfall. When applying modified design level to a road with bituminous surface treatment (BST), cross slope correction is not required on the basis of algebraic differences alone.

To maintain or restore curb height, consider lowering the existing pavement level and correcting cross slope by grinding before an asphalt overlay. The cross slope of the shoulder may be steepened to maximize curb height and minimize other related impacts. The shoulder may be up to 6% with a rollover between the traveled way and the shoulder of no more than 8% (see Chapter 640).

430.06 Side Slopes

(1) Fill/Ditch Slopes

Foreslopes (fill slopes and ditch inslopes) and cut slopes are designed as shown in the Fill and Ditch Slope Selection Table in Figure 430-13 for modified design level main line roadway sections. After the foreslope has been determined, use the guidance in Chapter 700 to determine the need for a traffic barrier.

When a crossroad or road approach has steep foreslopes, there is the possibility that an errant vehicle could become airborne. Therefore, flatten crossroad and road approach foreslopes to 6H:1V where feasible and at least to 4H:1V. Provide smooth transitions between the main line foreslopes and the crossroad or road approach foreslopes. Where possible, move the crossroad or road approach drainage away from the main line. This can locate the pipe outside the Design Clear Zone and reduce the length of pipe required.

(2) Cut Slopes

Existing stable backslopes (cut slopes) are to remain undisturbed unless disturbed by other work. When changes are required to a cut slope, design them as shown in the Cut Slope Selection Table in Figure 430-13.

430.07 Bike and Pedestrian

Sidewalk ramps must be addressed for Americans with Disabilities Act of 1990 (ADA) compliance on projects that include hot mix asphalt (HMA) or Portland cement concrete pavement (PCCP) overlays or inlays. Evaluate existing sidewalk ramps for compliance. Construct ADA-compliant sidewalk ramps as required.

On Interstate Pavement Rehab./Resurface projects (see Chapter 325) that include HMA or PCCP overlays, or inlays on ramps or crossroads, sidewalk ramps must be addressed for ADA compliance. Other bicycle or pedestrian elements are design exceptions on HMA or PCCP overlays or inlays on Interstate ramps or crossroads.

Projects that widen the roadway or change the traffic configuration by reducing the shoulders to add turn lanes are considered alterations of the roadway. Such alterations include a requirement to address ADA compliance for sidewalk ramps. (See Chapter 1025 for guidance on pedestrian facilities.)

430.08 Bridges

Design all new and replacement bridges to full design level (see Chapter 440) unless a corridor or project analysis justifies the use of modified design level lane and shoulder widths. Evaluate bridges to remain in place using Figures 430-10 and 11. Whenever possible, continue the roadway lane widths across the bridge and adjust the shoulder widths.

Consider joint use with other modes of transportation in lane and shoulder design (see Chapters 1020, 1025, 1050, and 1060).

430.09 Intersections

Except as given below, design intersections to meet the requirements in Chapter 910.

(1) Turn Radii

The intersection turn radii (or right-turn corners) are controlled by the design vehicle. Figure 430-7 is a guide for determining the design vehicle for modified design level. Perform a field review to determine intersection type, types of vehicles that use the intersection, and adequacy of the existing geometrics. When the crossroad is a city street or county road, consider the requirements of the city or county when selecting a design vehicle.

Design right-turn corners to meet the requirements of Chapter 910 using the design vehicle selected from Figure 430-7 or from the field review.

(2) Angle

The allowable angle between any two respective legs is between 60° and 120°. When realignment is required to meet this angle requirement, consider realigning to an angle between 75° and 105°.

Intersection Type	Design Vehicle
Junction of Major Truck Routes	WB-67
Junction of State Routes	WB-40
Ramp Terminals	WB-40
Other Rural	SU[1]
Urban Industrial	SU[1]
Urban Commercial	P[1]
Residential	P[1]

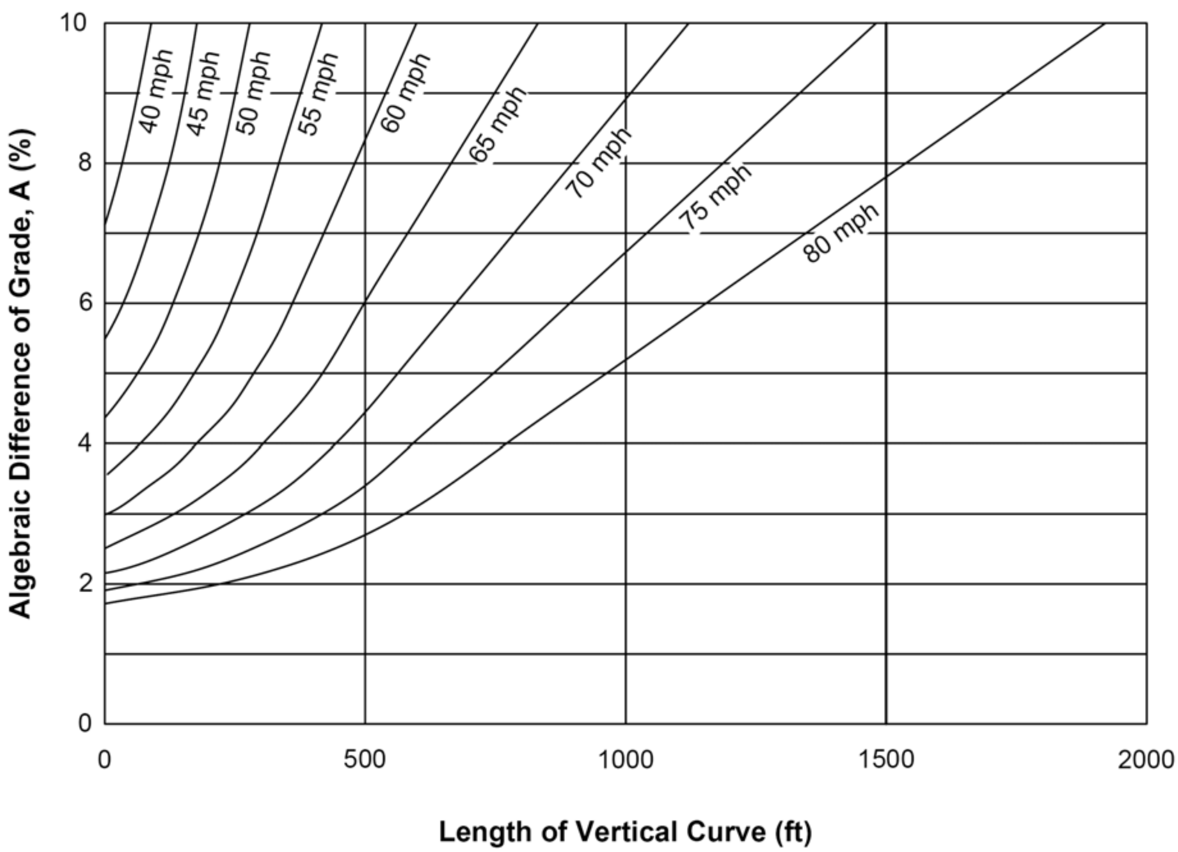
Note:

[1] When the intersection is on a transit or school bus route, use the BUS design vehicle. (See Chapter 1060 for additional guidance on transit facilities and for the BUS turning path templates.)

Design Vehicles: Modified Design Level
Figure 430-7

430.10 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

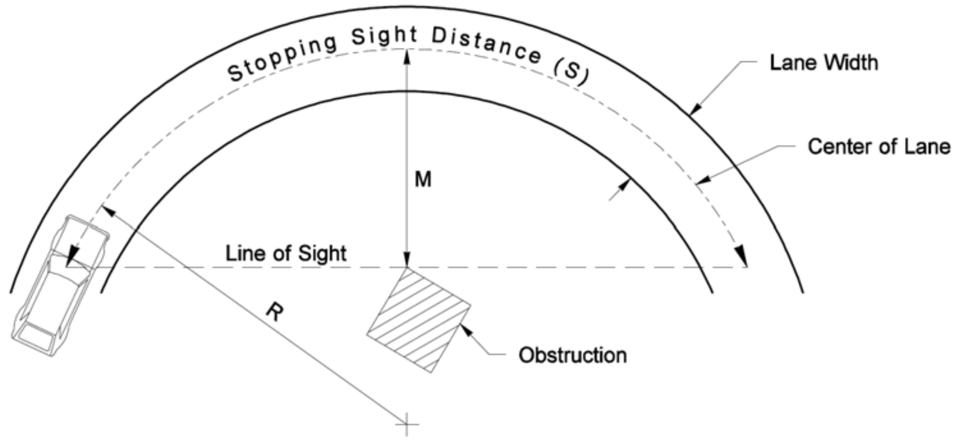


Note:

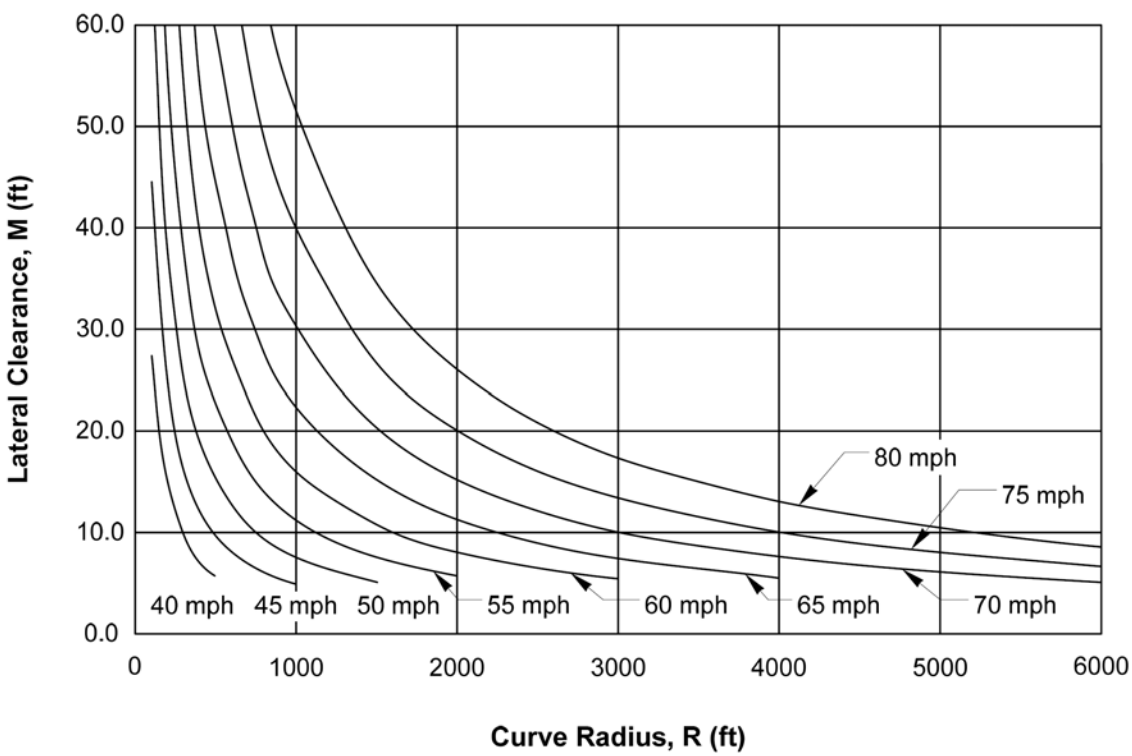
When the intersection of the algebraic difference of grade with the length of vertical curve is below the selected design speed line, modified design level design criteria are met.

Evaluation for Stopping Sight Distance for Crest Vertical Curves: Modified Design Level

Figure 430-8



M is the distance in ft from the centerline of the inside lane to the obstruction. The obstruction is a cut slope or other object 2.75 ft or more above the inside lane. Objects between 2.75 ft and 2.00 ft above the roadway surface within the M distance might be a sight obstruction, depending on the distance from the roadway (see Figure 430-9b).

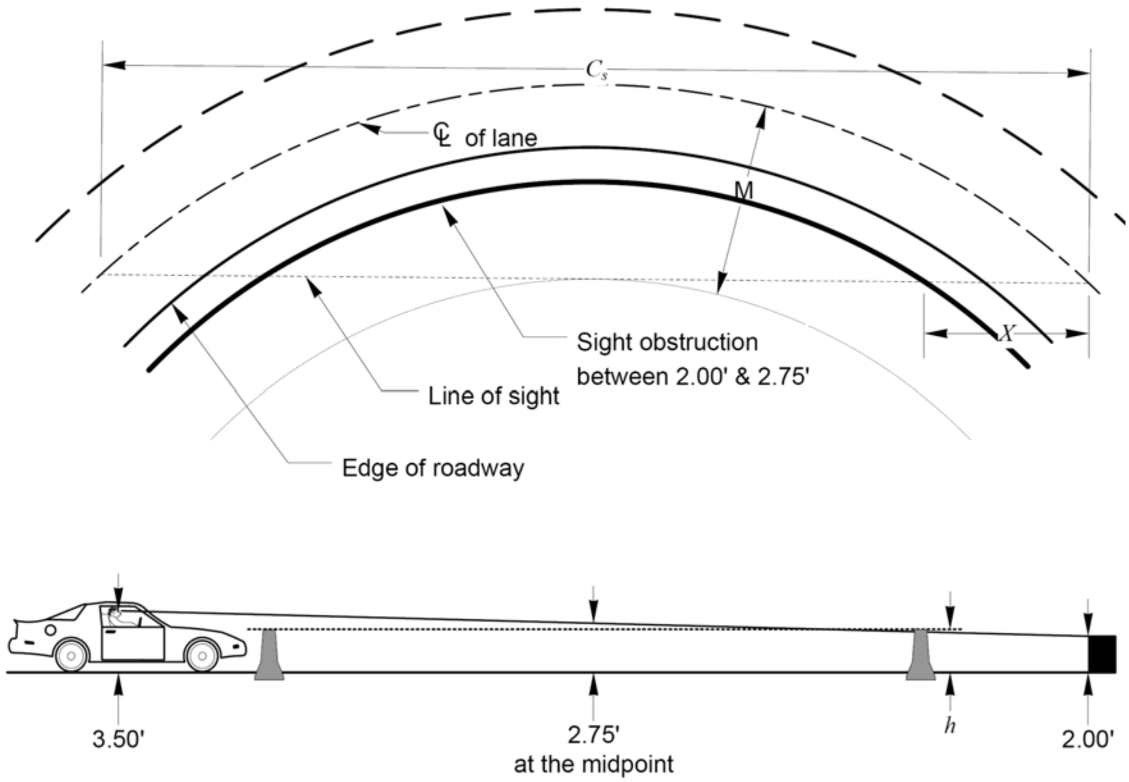


Note:

When the intersection of the lateral clearance (M) with the curve radius (R) falls above the curve for the selected design speed, modified design criteria are met.

Evaluation for Stopping Sight Distance for Horizontal Curves: Modified Design Level

Figure 430-9a



When $h \leq \left(2 + \frac{1.5X}{C_s}\right)$ modified design criteria are met.

Where:

M = Lateral clearance for sight distance (ft) (see Figure 430-9a)

Cs = Stopping sight distance chord (ft)

X = Distance from sight obstruction to the end of sight distance chord (ft)

h = Height of sight obstruction above the inside lane

Evaluation for Stopping Sight Distance Obstruction for Horizontal Curves: Modified Design Level

Figure 430-9b

	Multilane Divided				Multilane Undivided			
	Trucks Under 10%		Trucks 10% and Over		Trucks Under 10%		Trucks 10% and Over	
Design Class	**MDL-1**	**MDL-2**	**MDL-3**	**MDL-4**	**MDL-5**	**MDL-6**	**MDL-7**	**MDL-8**
Current ADT[1]	Under 4000	Over 4000	Under 4000	Over 4000	Under 4000	Over 4000	Under 4000	Over 4000
Design Speed	**See Figure 430-1**							
Traffic Lanes Number Width	4 or more 11 ft	4 or more 11 ft	4 or more 11 ft`	4 or more 12 ft	4 or more 11 ft	4 or more 11 ft	4 or more 11 ft	4 or more 12 ft
Parking Lanes Urban	None	None	None	None	8 ft	8 ft[2]	8 ft	8 ft[2]
Median Width[15] Rural Urban	Existing Existing	Existing Existing	Existing Existing	Existing Existing	2 ft 2 ft	4 ft 2 ft	4 ft 2 ft	4 ft 2 ft
Shoulder Width Right[3] Left[4]	4 ft 2 ft	6 ft 2 ft	4 ft 2 ft	6 ft 2 ft	4 ft	6 ft[5]	4 ft	6 ft[5]
Minimum Width for Bridges to Remain in Place[6][7][8]	24 ft[9]	26 ft[9]	24 ft[9]	26 ft[10]	48 ft[9]	50 ft[9][11]	50 ft[9][11]	54 ft[10][11]
Minimum Width for Rehabilitation of Bridges to Remain in Place[6][8][12]	28 ft[9]	30 ft[9]	28 ft[9]	32 ft[10]	54 ft[9]	60 ft[9][11][13]	56 ft[9][11]	64 ft[10][11][13]
Minimum Width for Replacement Bridges	Full Design Level Applies[14]							
Access Control	For Limited Access Highways, see Chapters 1430 and 1435 and the Master Plan, or WAC 468-52 and the Region's Highway Management Classification Report.							

Notes:

[1] If current ADT is approaching a borderline condition, consider designing for the higher classification.

[2] Parking restricted when ADT is over 15,000.

[3] When curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 4 ft. In urban areas, see Chapter 440. On a route identified as a local, state, or regional significant bicycle route, the minimum shoulder width is 4 ft (see Chapter 1020).

[4] When a curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 1 ft on the left.

[5] May be reduced by 2 ft under urban conditions.

[6] Width is the clear distance between curbs or rails, whichever is less.

[7] Use these widths when a bridge within the project limits requires deck treatment or thrie beam retrofit only.

[8] For median widths 25 ft or less, see Chapter 1120.

[9] Add 11 ft for each additional lane.

[10] Add 12 ft for each additional lane.

[11] Includes a 4-ft median, which may be reduced by 2 ft under urban conditions.

[12] Use these widths when a bridge within the project limits requires any work beyond the treatment of the deck such as bridge rail replacement, deck replacement, or widening.

[13] Includes 6-ft shoulders; may be reduced by 2 ft on each side under urban conditions.

[14] Modified design level lane and shoulder widths may be used, when justified, with a corridor or project analysis.

[15] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced by up to 4 inches.

Multilane Highways and Bridges: Modified Design Level
Figure 430-10

	Two-Lane Highways					
	Trucks Under 10%			Trucks 10% and Over		
Design Class	**MDL-9**	**MDL-10**	**MDL-11**	**MDL-12**	**MDL-13**	**MDL-14**
Current ADT[1]	Under 1000	1000-4000	Over 4000	Under 1000	1000-4000	Over 4000
Design Speed	**See Figure 430-1**					
Traffic Lane Width[2]	11 ft	11 ft	11 ft	11 ft	11 ft	12 ft
Parking Lanes Urban	8 ft	8 ft	8 ft[3]	8 ft	8 ft	8 ft[3]
Shoulder Width[4]	2 ft	3 ft[5]	4 ft	2 ft	3 ft[5]	4 ft
Minimum Width for Bridges to Remain in Place[6][7]	22 ft[8]	24 ft	28 ft	22 ft[8]	24 ft	28 ft
Minimum Width for Rehabilitation of Bridges to Remain in Place[7][9]	28 ft[10]	32 ft	32 ft	28 ft[10]	32 ft	32 ft
Minimum Width for Replacement Bridges	Full Design Level Applies[11]					
Access Control	For Limited Access Highways, see Chapters 1430 and 1435 and the Master Plan, or WAC 468-52 and the Region's Highway Management Classification Report.					

Notes:

[1] If current ADT is approaching a borderline condition, consider designing for the higher classification.

[2] For turning roadways, see Figures 430-12a and 12b.

[3] Parking restriction recommended when ADT exceeds 7500.

[4] When a curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 4 ft. In urban areas, see Chapter 440. On a route identified as a local, state, or regional significant bicycle route, the minimum shoulder width is 4 ft (see Chapter 1020).

[5] For design speeds of 50 mph or less on roads of 2000 ADT or less, width may be reduced by 1 ft, with justification.

[6] Use these widths when a bridge within the project limits requires deck treatment or thrie beam retrofit only.

[7] Width is the clear distance between curbs or rails, whichever is less.

[8] 20 ft when ADT is 250 or less.

[9] Use these widths when a bridge within the project limits requires any work beyond the treatment of the deck such as bridge rail replacement, deck replacement, or widening.

[10] 26 ft when ADT is 250 or less.

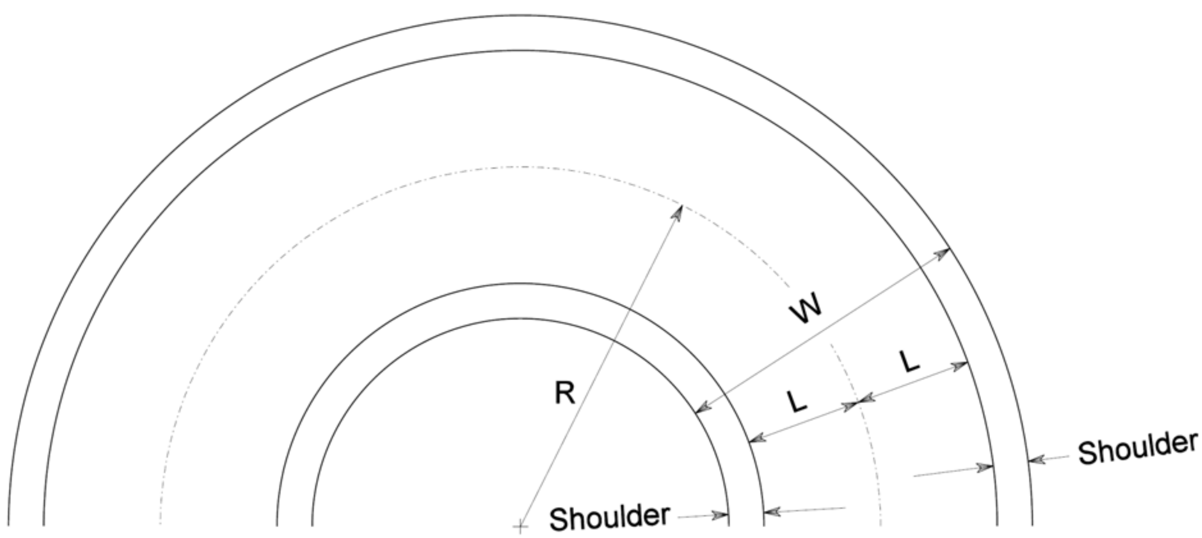
[11] Modified design level lane and shoulder widths may be used, when justified, with a corridor or project analysis.

Two-Lane Highways and Bridges: Modified Design Level
Figure 430-11

Radius of Center Line R (ft)	Minimum Total Roadway Width W (ft)	Minimum Lane Width L (ft)
Tangent	26	11
900	26	11
800	27	12
700	27	12
600	28	12
500	28	12
400	29	12
350	30	12
300	31	12
250	33	13
200	35	13
150	39	13

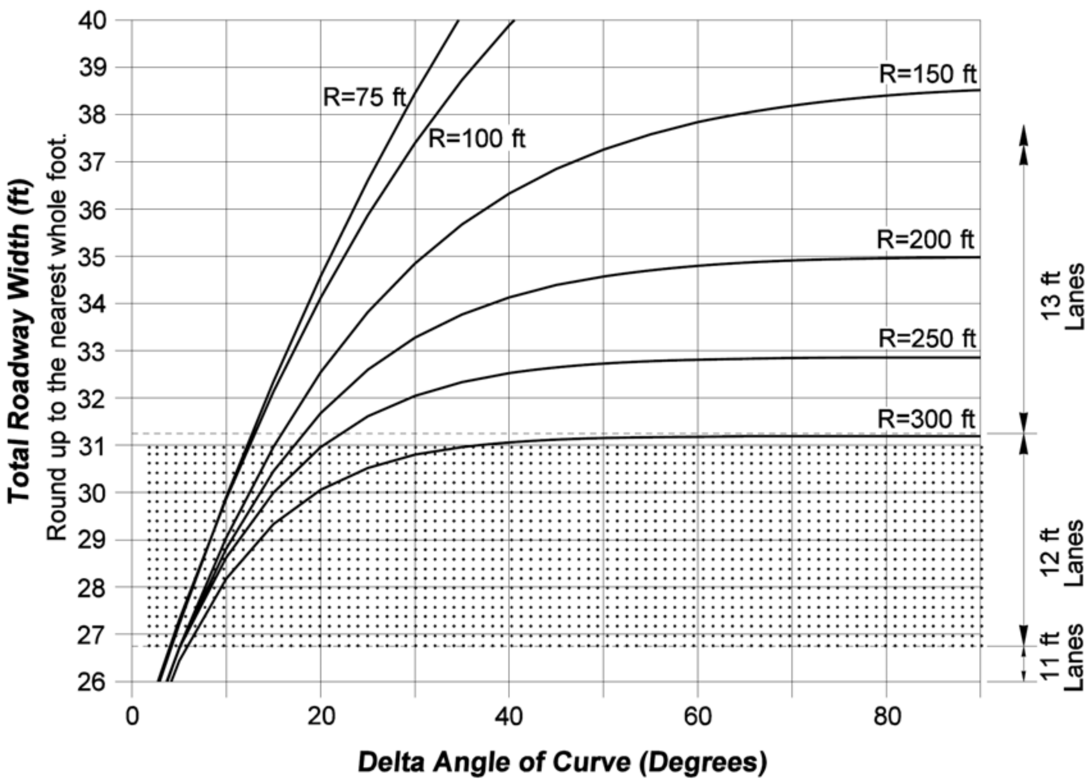
Note:

Also see minimums from Figure 430-11. If the minimum total roadway width is greater than the sum of the shoulders and lane widths, apply the extra width to the inside of the curve.



Minimum Total Roadway Widths for Two-Lane Two-Way Highway Curves: Modified Design Level

Figure 430-12a



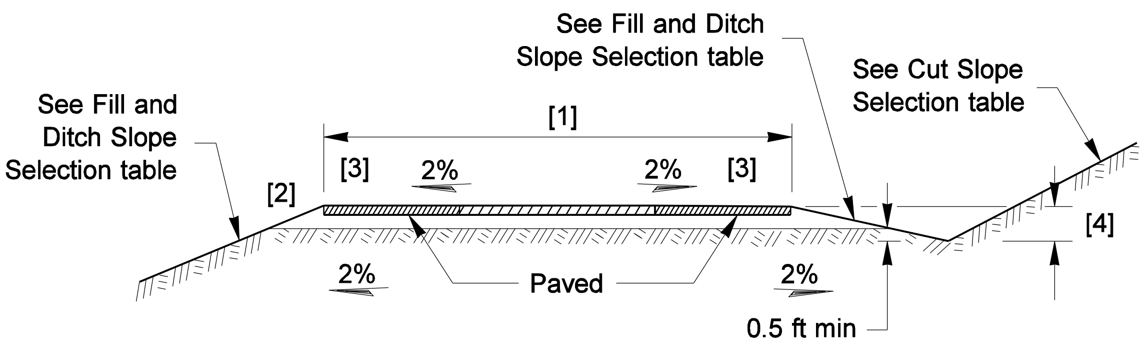
Notes:

May be used when the internal angle (delta) is less than 90°.

If result is less than the total roadway width from Figure 430-11, use the greater.

Minimum Total Roadway Widths for Two-Lane Two-Way Highway Curves: Modified Design Level

Figure 430-12b



Height of Cut (ft)	Slope not Steeper Than[5]
0 - 5	4H:1V
5 - 20	3H:1V
over 20	2H:1V

Cut Slope Selection Table

Height of Fill/Depth of Ditch (ft)	Slope not Steeper Than
0 - 20	4H:1V
20 - 30	3H:1V
over 30	2H:1V[6][7]

Fill and Ditch Slope Selection Table

Notes:

[1] For minimum roadway widths, see Figures 430-10 and 11. For turning roadway widths, see Figures 430-12a and 12b.

[2] Widen and round embankments steeper than 4H:1V.

[3] For shoulder slope requirements, see Chapter 640.

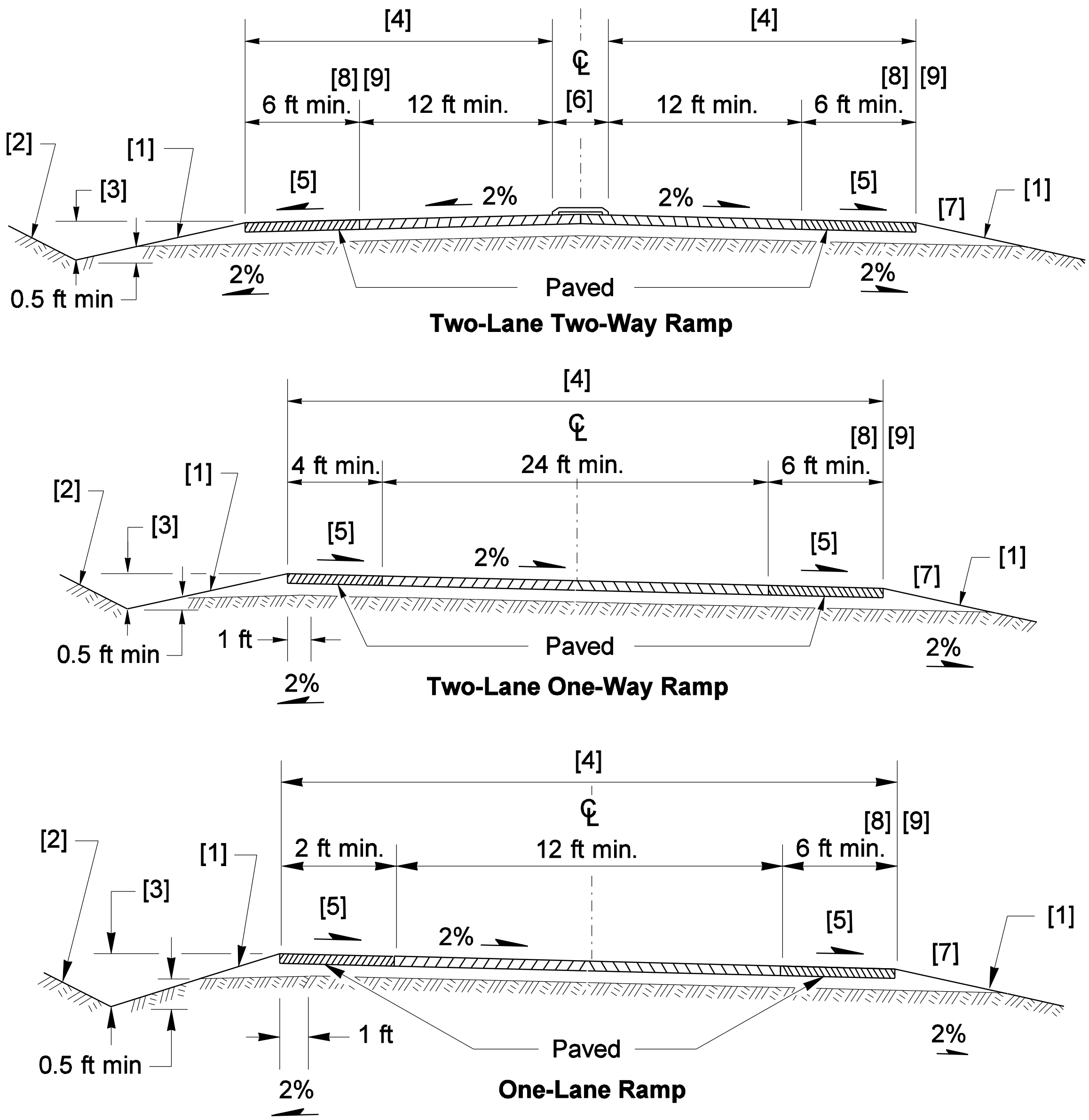
[4] Minimum ditch depth is 2 ft for design speeds over 40 mph and 1.5 ft for design speeds 40 mph or less.

[5] Or as recommended by the soils or geotechnical report. (See Chapter 700 for clear zone/barrier requirements.)

[6] Where feasible, provide flatter slopes for the greater fill heights and ditch depths.

[7] Fill slopes up to 1½H:1V may be used where favorable soil conditions exist. (See Chapter 640 for additional details and Chapter 700 for clear zone and barrier requirements.)

Main Line Roadway Sections: Modified Design Level
Figure 430-13



Notes:

[1] See Fill and Ditch Slope Selection Table in Figure 430-13.

[2] See Cut Slope Selection Table in Figure 430-13.

[3] Minimum ditch depth is 2 ft for design speeds over 40 mph and 1.5 ft for design speeds at and under 40 mph.

[4] For minimum ramp width, see 430.04(2)(b) and Figure 430-6.

[5] For shoulder slope requirements, see Chapter 640.

[6] The median width of a two-lane two-way ramp shall not be less than that required for traffic control devices and their required shy distances.

[7] Widen and round embankments steeper than 4H:1V.

[8] Existing 6 ft may remain. When the roadway is to be widened, 8 ft is preferred.

[9] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced by up to 4 inches.

Ramp Roadway Sections: Modified Design Level
Figure 430-14

440.01 General

Full design level is the highest level of design and is used on new and reconstructed highways. These projects are designed to provide optimum mobility, safety, and efficiency of traffic movement. The overall objective is to move the greatest number of vehicles, at the highest allowable speed, and at optimum safety. Major design controls are: functional classification; terrain classification; urban or rural surroundings; traffic volume; traffic character and composition; design speed; and access control.

440.02 References

(1) Federal/State Laws and Codes

RCW 46.61.575, Additional parking regulations

RCW 47.05.021, Functional classification of highways

Chapter 47.24 RCW, City streets as part of state highways

WAC 468-18-040, Design standards for rearranged county roads, frontage roads, access roads, intersections, ramps and crossings

(2) Design Guidance

Local Agency Guidelines (LAG), M 36-63, WSDOT

Plans Preparation Manual, M 22-31, WSDOT

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

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

(3) Supporting Information

A Policy on Design Standards – Interstate System, AASHTO, 2005

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

440.03 Definitions

collector system Routes that primarily serve the more important intercounty, intracounty, and intraurban travel corridors; collect traffic from the system of local access roads and convey it to the arterial system; and on which, regardless of traffic volume, the predominant travel distances are shorter than on arterial routes (RCW 47.05.021).

design speed The speed used to determine the various geometric design features of the roadway.

divided multilane A roadway with two or more through lanes in each direction and a median that physically or legally prohibits left turns, except at designated locations.

expressway A divided highway that has a minimum of two lanes in each direction for the exclusive use of traffic and that may or may not have grade separations at intersections.

freeway A divided highway that has a minimum of two lanes in each direction for the exclusive use of traffic and with full control of access.

frontage road A road that is a local road or street located parallel to a highway for service to abutting property and adjacent areas and for control of access.

functional classification The grouping of streets and highways according to the character of the service they are intended to provide.

high pavement type Portland cement concrete pavement or hot mix asphalt (HMA) pavement on a treated base.

highway A general term denoting a street, road, or public way for the purpose of vehicular travel, including the entire area within the right of way.

incorporated city or town A city or town operating under Title 35 or 35A RCW.

intermediate pavement type Hot mix asphalt pavement on an untreated base.

Interstate System A network of routes designated by the state and the Federal Highway Administration (FHWA) under terms of the federal-aid acts as being the most important to the development of a national system. The Interstate System is part of the principal arterial system.

lane A strip of roadway used for a single line of vehicles.

lane width The lateral design width for a single lane, striped as shown in the *Standard Plans* and the *Standard Specifications*. The width of an existing lane is measured from the edge of traveled way to the center of the lane line or between the centers of adjacent lane lines.

limited access highway All highways where the rights of direct access to or from abutting lands have been acquired from the abutting landowners.

low pavement type Bituminous surface treatment (BST).

managed access highway All highways where the rights of direct access to or from abutting lands have not been acquired from the abutting landowners.

median The portion of a highway separating the traveled ways for traffic in opposite directions.

minor arterial system A rural network of arterial routes linking cities and other activity centers that generate long distance travel and, with appropriate extensions into and through urban areas, form an integrated network providing interstate and interregional service (RCW 47.05.021).

National Highway System (NHS) An interconnected system of principal arterial routes that serves interstate and interregional travel; meets national defense requirements; and serves major population centers, international border crossings, ports, airports, public transportation facilities, other intermodal transportation facilities, and other major travel destinations. The Interstate System is a part of the NHS.

operating speed The speed at which drivers are observed operating their vehicles during free-flow conditions. The 85^{th} percentile of the distribution of observed speeds is most frequently used.

outer separation The area between the outside edge of traveled way for through traffic and the nearest edge of traveled way of a frontage road or collector-distributor (C-D) road.

posted speed The maximum legal speed as posted on a section of highway using regulatory signs.

principal arterial system A connected network of rural arterial routes with appropriate extensions into and through urban areas, including all routes designated as part of the Interstate System, that serves corridor movements with travel characteristics indicative of substantial statewide and interstate travel (RCW 47.05.021).

roadway The portion of a highway, including shoulders, for vehicular use.

rural design area An area that meets none of the conditions to be an urban design area.

shoulder The portion of the roadway contiguous with the traveled way, primarily for accommodation of stopped vehicles, emergency use, lateral support of the traveled way, and use by pedestrians and bicycles.

shoulder width The lateral width of the shoulder, measured from the edge of traveled way to the edge of roadway or the face of curb.

suburban area A term for the area at the boundary of an urban design area. Suburban settings may combine higher speeds common in rural design areas with activities that are more common to urban settings.

traveled way The portion of the roadway intended for the movement of vehicles, exclusive of shoulders and lanes for parking, turning, and storage for turning.

two-way left-turn lane (TWLTL) A lane, located between opposing lanes of traffic, to be used by vehicles making left turns from either direction, from or onto the roadway.

undivided multilane A roadway with two or more through lanes in each direction on which left turns are not controlled.

urban area An area designated by WSDOT in cooperation with the Transportation Improvement Board and Region transportation planning organizations, subject to the approval of the FHWA.

urban design area An area where urban design criteria are appropriate, that is defined by one or more of the following:

- An urban area.
- An area within the limits of an incorporated city or town.
- An area characterized by intensive use of the land for the location of structures, that receives such urban services as sewer, water, and other public utilities, as well as services normally associated with an incorporated city or town. This may include an urban growth area defined under the Growth Management Act (see Chapter 36.70A RCW, Growth management – planning by selected counties and cities), but outside the city limits.
- An area with not more than 25% undeveloped land.

urbanized area An urban area with a population of 50,000 or more.

usable shoulder The width of the shoulder that can be used by a vehicle for stopping.

440.04 Functional Classification

The state highway system is divided and classified according to the character and volume of traffic carried by the routes and distinguished by specific geometric design criteria (RCW 47.05.021). The functional classifications (from highest to lowest) used on highways are: Interstate, principal arterial, minor arterial, and collector. The higher functional classes give more priority to through traffic and less to local access. NHS routes are usually designed to a higher level of design than non-NHS routes.

For functional classification maps and criteria see:
http://www.wsdot.wa.gov/mapsdata/tdo/functionalclass.htm

440.05 Terrain Classification

To provide a general basis of reference between terrain and geometric design, three classifications of terrain have been established:

- **Level**. Level to moderately rolling, this terrain offers few or no obstacles to the construction of a highway having continuously unrestricted horizontal and vertical alignment.
- **Rolling**. Hills and foothills, with slopes that rise and fall gently; however, occasional steep slopes might offer some restriction to horizontal and vertical alignment.
- **Mountainous**. Rugged foothills; high, steep drainage divides; and mountain ranges.

Terrain classification pertains to the general character of the specific route corridor. Roads in valleys or passes of mountainous areas might have all the characteristics of roads traversing level or rolling terrain and are usually classified as level or rolling, rather than mountainous.

440.06 Geometric Design Data

(1) State Highway System

For projects on all highways in rural design areas and on limited access highways in urban design areas, the geometric design data is controlled by the functional class and traffic volume (see Figures 440-5 through 440-8). The urban managed access highway design class, based on traffic volume and design speed (see Figure 440-9), may be used on managed access highways in urban design areas, regardless of the functional class.

(2) State Highways as City Streets

When a state highway within an incorporated city or town is a portion of a city street, the design features must be developed in cooperation with the local agency. For facilities on the NHS, use *Design Manual* criteria as the minimum for the functional class of the route. For facilities not on the NHS, the *Local Agency Guidelines* may be used as the minimum design criteria; however, the use of *Design Manual* criteria is encouraged where feasible. On managed access highways within the limits of incorporated cities and towns, the cities or towns have full responsibility for design elements, including access, outside of curb, or outside the paved shoulder where no curb exists, using the *Local Agency Guidelines.*

(3) City Streets and County Roads

Plan and design facilities that cities or counties will be requested to accept as city streets or county roads according to the applicable design criteria shown in:

- WAC 468-18-040.
- *Local Agency Guidelines*.
- The standards of the local agency that will be requested to accept the facility.

440.07 Design Speed

Vertical and horizontal alignment, sight distance, and superelevation will vary with design speed. Such features as traveled way width, shoulder width, and lateral clearances are usually not affected. For the relationships between design speed, geometric plan elements, geometric profile elements, superelevation, and sight distance, see Chapters 620, 630, 642, and 650.

The choice of a design speed is primarily influenced by functional classification, posted speed, operating speed, terrain classification, traffic volumes, accident history, access control, and economic factors. A geometric design that adequately allows for future improvements is also a major criterion. Categorizing a highway by a terrain classification often results in arbitrary reductions of the design speed, when, in fact, the terrain would allow a higher design speed without materially affecting the cost of construction. Savings in vehicle operation and other costs alone might be sufficient to offset the increased cost of right of way and construction.

It is important to consider the geometric conditions of adjacent sections. Maintain a uniform design speed for a significant segment of highway.

The desirable design speed is not less than that given in Figure 440-1. Do not select a design speed less than the posted speed.

For new/reconstruction projects on all rural highways and limited access highways in urban design areas, the design speed for each design class is given in Figures 440-5 through 440-8.

When terrain or existing development limits the ability to achieve the design speed for the design class, use a corridor analysis to determine the appropriate design speed.

Route Type	Posted Speed	Desirable Design Speed
Freeways	All	10 mph over the posted speed
Nonfreeways	45 mph or less	Not less than the posted speed
	Over 45 mph	5 mph over the posted speed

Desirable Design Speed
Figure 440-1

On urban managed access highways, the design speed is less critical to the operation of the facility. Closely spaced intersections and other operational constraints usually limit vehicular speeds more than the design speed.

For managed access facilities in urban design areas, select a design speed based on Figure 440-1. In cases where the Figure 440-1 design speed does not fit the conditions, use a corridor analysis to select a design speed. Select a design speed not less than the posted speed that is logical with respect to topography, operating speed (or anticipated operating speed for new alignment), adjacent land use, design traffic volume, accident history, access control, and the functional classification. Consider both year of construction and design year. Maintain continuity throughout the corridor, with changes (such as a change in roadside development) at logical points.

440.08 Traffic Lanes

Lane width and condition have a great influence on safety and comfort. The minimum lane width is based on the highway design class, terrain type, and whether it is in a rural or urban design area. Lanes 12 feet wide provide desirable clearance between large vehicles where traffic volumes are high and a sizable number of large vehicles is expected. The added cost for 12-foot lanes is offset, to some extent, by the reduction in shoulder maintenance costs due to the lessening of wheel load concentrations at the edge of the lane.

Highway capacity is also affected by the width of the lanes. With narrow lanes, drivers must operate their vehicles closer (laterally) to each other than they normally desire. To compensate, drivers increase the headway, which results in reduced capacity.

Figures 440-5 through 440-8 give the minimum lane widths for the various design classes for use on all rural highways and limited access highways in urban design areas. Figure 440-9 gives the minimum lane widths for urban managed access highways.

The roadway on a curve may need to be widened to make the operating conditions comparable to those on tangents. For guidance on width requirements on turning roadways, see Chapter 641.

440.09 Shoulders

Shoulder width is controlled by the functional classification of the roadway, the traffic volume, and the shoulder function.

The more important shoulder functions and the associated minimum widths are given in Figure 440-2. In addition to the functions in Figure 440-2, shoulders also:

- Provide space to escape potential accidents or reduce their severity.
- Provide a sense of openness, contributing to driver ease and freedom from strain.
- Reduce seepage adjacent to the traveled way by discharging stormwater farther away.

Contact the Region Maintenance Office to determine the shoulder width for maintenance operations. When shoulder widths wider than called for in Figures 440-5 through 440-9 are requested, compare the added cost of the wider shoulders to the added benefits to maintenance operations, as well as other benefits that may be derived. When the Maintenance Office requests a shoulder width different than the design class, justify the width selected.

Shoulder Function	Minimum Shoulder Width
Stopping out of the traffic lanes	8 ft
Minimum lateral clearance	2 ft[1]
Pedestrian or bicycle use	4 ft[2]
Large-vehicle off-tracking on curves	See Chapters 641 & 910
Maintenance operations	Varies[3]
Law enforcement	8 ft[4]
Bus stops	See Chapter 1060
Slow-vehicle turnouts and shoulder driving	See Chapter 1010
Ferry holding	8 ft[5]
For use as a lane during reconstruction of the through lanes	8 ft[5]
Structural support	2 ft
Improve sight distance in cut sections	See Chapter 650
Improve capacity	See Chapter 610

Notes:

[1] See Chapters 700 and 710.

[2] Minimum usable shoulder width for bicycles. For additional information, see Chapter 1020 for bicycles and Chapter 1025 for pedestrians.

[3] 10-ft usable width to park a maintenance truck out of the through lane; 12-ft clearance (14 ft preferred) for equipment with outriggers to work out of traffic.

[4] For additional information, see Chapters 1040 and 1050.

[5] Minimum usable shoulder width (10 ft preferred).

Minimum Shoulder Width
Figure 440-2

Minimum shoulder widths for use on all rural highways and limited access highways in urban design areas are based on functional classification and traffic volume (see Figures 440-5 through 440-8). Figure 440-9 gives the minimum shoulder widths for urban managed access highways without curb.

When curb with a height less than 24 inches is present on urban managed access highways, provide the minimum shoulder widths shown in Figure 440-3. For information on curbs, see 440.11.

When traffic barrier with a height of 2 feet or greater is used adjacent to the roadway, the minimum shoulder width from the edge of traveled way to the face of the traffic barrier is 4 feet. Additional width for traffic barrier shy distance (see Chapter 710) is normally not required on urban managed access highways.

Where there are no sidewalks, the minimum shoulder width is 4 feet. Shoulder widths less than 4 feet will require that wheelchairs using the roadway encroach on the through lane. For additional information and requirements regarding pedestrians and accessible routes, see Chapter 1025.

Lane Width	Posted Speed			
	>45 mph	≤45 mph	>45 mph	≤45 mph
	On Left		On Right[3]	
12 ft or wider	4 ft	[1][2]	4 ft	2 ft
11 ft	4 ft	[1][2]	4 ft	3 ft[4]

Notes:

[1] When mountable curb is used on routes with a posted speed of 35 mph or less, shoulder width is desirable; however, with justification, curb may be placed at the edge of traveled way.

[2] 1 ft for curbs with a height of 8 inches or less. 2 ft for curbs or barriers with a height between 8 and 24 inches.

[3] When the route has been identified as a local, state, or regional significant bike route, the minimum shoulder width is 4 ft or as indicated in Chapter 1020 for signed bike lanes.

[4] When bikes are not a consideration, width may be reduced to 2 ft with justification.

[5] Measured from the edge of traveled way to the face of curb.

Shoulder Width for Curbed Sections[5] in Urban Areas
Figure 440-3

The usable shoulder width is less than the constructed shoulder width when vertical features (such as traffic barrier or walls) are at the edge of the shoulder. This is because drivers tend to shy away from the vertical feature. For traffic barrier shy distance widening, see Chapter 710.

Shoulders on the left between 4 feet and 8 feet wide are undesirable. A shoulder in this width range might appear to a driver to be wide enough to stop out of the through traffic, when it is not. To prevent the problems that can arise from this situation, when the shoulder width and any added clearance result in a width in this range, consider increasing the width to 8 feet.

Provide a minimum clearance to roadside objects so that the shoulders do not require narrowing. At existing bridge piers and abutments, a shoulder less than full width to a minimum of 2 feet is a design exception. For Design Clear Zone and safety treatment requirements, see Chapter 700.

For routes identified as local, state, or regional significant bicycle routes, provide a minimum 4-foot shoulder. Maintain system continuity for the bicycle route, regardless of jurisdiction and functional class. For additional information on bicycle facilities, see Chapter 1020.

Shoulder widths greater than 10 feet may encourage use as a travel lane. Therefore, use shoulders wider than this only where required to meet one of the listed functions (see Figure 440-2).

When walls are placed adjacent to shoulders, see Chapter 1130 for barrier requirements.

440.10 Medians

Medians are either restrictive or nonrestrictive. Restrictive medians limit left turns, physically or legally, to defined locations. Nonrestrictive medians allow left turns at any point along the route. Consider restrictive medians on multilane limited access highways and multilane managed access highways when the design hourly volume (DHV) is over 2000.

The primary functions of a median are to:

- Separate opposing traffic.
- Provide for recovery of out-of-control vehicles.
- Reduce head-on accidents.
- Provide an area for emergency parking.
- Allow space for left-turn lanes.
- Minimize headlight glare.
- Allow for future widening.
- Control access.

Medians may be depressed, raised, or flush with the through lanes. For maximum efficiency, make medians highly visible both night and day.

The width of a median is measured from edge of traveled way to edge of traveled way and includes the shoulders. The desirable median width is given in Figure 440-4. The minimum width is the width required for shoulders and barrier (including required shy distance) or ditch.

When selecting a median width, consider future needs such as wider left shoulders when widening from four to six lanes. A median width of 22 feet is desirable on a four-lane highway when additional lanes are anticipated. The minimum width required to provide additional lanes in the median, without widening to the outside, is 46 feet. On freeways or expressways requiring less than eight lanes within the 20-year design period, provide sufficient median or lateral clearance and right of way to permit the addition of a lane in each direction, if required by traffic increase after the 20-year period.

A two-way left-turn lane (TWLTL) may be used as a nonrestrictive median for an undivided managed access highway (see Figure 440-9). The desirable width of a TWLTL is 13 feet, with a minimum width of 11 feet. For more information on traffic volume limits for TWLTLs on managed access highways, see Chapter 1435. For additional information on TWLTL design, see Chapter 910.

A common form of restrictive median on urban managed access highways is the raised median. The width of a raised median can be minimized by using a dual-faced cement concrete traffic curb, a precast traffic curb, or an extruded curb. For more information on traffic volume limits for restrictive medians on managed access highways, see Chapter 1435.

Median Usage	Desirable Width (ft)[1]
Separate opposing traffic on freeways and expressways	
Rural	60[2]
Urban – 4-lane	18
Urban – 6 or more lanes	22
Allow for future widening	46[4]
Left-turn lanes[3]	13[2]
Control access on divided multilane urban managed access highways	
Design speed 45 mph or less with raised medians	3[5][6]
Design speed greater than 45 mph or barrier separated	10[6]

Notes:

[1] The minimum width is the width required for shoulders and barrier (including required shy distance) or ditch. For barrier requirements, see Chapter 710.

[2] Additional width required at rural expressway intersections for storage of vehicles crossing expressway or entering expressway with a left turn.

[3] For additional information, see Chapter 910.

[4] Narrower width will require widening to the outside for future lanes.

[5] Using a Dual-Faced Cement Concrete Traffic Curb 1 ft face of curb to face of curb.

[6] 12 ft preferred to allow for left-turn lanes.

Median Width
Figure 440-4

At locations where the median will be used to allow vehicles to make a U-turn, consider increasing the width to meet the needs of the vehicles making the U-turn. For information on U-turn locations, see Chapter 910.

Widen medians at intersections on rural divided multilane highways. Provide sufficient width to store vehicles crossing the expressway or entering the expressway with a left turn.

For undivided multilane highways, desirable median width is 4 feet in rural design areas and 2 feet in urban design areas. When signing is required in the median of six-lane undivided multilane highways, the minimum width is 6 feet. If barrier is to be installed at a future date, median widths for the ultimate divided highway are desirable.

When the median is to be landscaped or where rigid objects are to be placed in the median, see Chapter 700 for traffic barrier and clear zone requirements. When the median will include a left-turn lane, see Chapter 910 for left-turn lane design.

440.11 Curbs

(1) General

Curbs are designated as either *vertical* or *sloped*. Vertical curbs have a face batter not flatter than 1H:3V. Sloped curbs have a sloping face that is more readily traversed.

Curbs can also be classified as *mountable*. Mountable curbs are sloped curb with a height of 6 inches or less, preferably 4 inches or less. When the face slope is steeper than 1H:1V, the height of a mountable curb is limited to 4 inches or less.

Where curbing is to be provided, ensure that surface water that collects at the curb will drain and not pond or flow across the roadway.

For all existing curb, evaluate the continued need for the curb. Remove all curbing that is no longer needed.

When an overlay will reduce the height of a vertical curb, evaluate grinding to maintain curb height (or replacing the curb) versus the need to maintain the height of the curb.

Curbs can hamper snow-removal operations. The area Maintenance Superintendent's review and approval is required for the use of curbing in areas of heavy snowfall.

For curbs at traffic islands, see Chapter 910.

(2) Curb Usage

Curbing is used for the following purposes:

- Control drainage
- Delineate the roadway edge
- Delineate pedestrian walkways
- Delineate islands
- Reduce right of way
- Assist in access control
- Inhibit midblock left turns

Avoid using curbs if the same objective can be attained with pavement markings.

In general, curbs are not used on facilities with a posted speed greater than 45 mph. The exceptions are for urban design areas where sidewalks are provided or where traffic movements are to be restricted. Justify the use of curb when the posted speed is greater than 45 mph.

Do not use vertical curbs along freeways or other facilities with a posted speed greater than 45 mph. When curb is needed, use mountable curb with the height limited to 4 inches and located no closer to the traveled way than the outer edge of the shoulder. Provide sloping end treatments where the curb is introduced and terminated.

(a) Vertical curbs with a height of 6 inches or more are required:

- To inhibit or at least discourage vehicles from leaving the roadway.
- For walkway and pedestrian refuge separations.
- For raised islands on which a traffic signal or traffic signal hardware is located.

When an overlay is planned, do not reduce the height of the curb to less than 4 inches.

(b) Consider vertical curbs with a height of 6 inches or more:
- To inhibit midblock left turns.
- For divisional and channelizing islands.
- For landscaped islands.

(c) Provide mountable curbs where a curb is needed but higher vertical curb is not justified.

440.12 Parking

In urban design areas and rural communities, land use might require parking along the highway. In general, on-street parking decreases capacity, increases accidents, and impedes traffic flow; therefore, it is desirable to prohibit parking.

Although design data for parking lanes are included in Figures 440-6 through 440-9, consider them only in cooperation with the municipality involved. The lane widths given are the minimum for parking; provide wider widths when feasible.

Angle parking is not permitted on any state route without WSDOT approval (RCW 46.61.575). This approval is delegated to the State Traffic Engineer. Angle parking approval is to be requested through the Headquarters (HQ) Design Office. Provide an engineering study, approved by the Region Traffic Engineer, with the request documenting that the parking will not unduly reduce safety and that the roadway is of sufficient width that the parking will not interfere with the normal movement of traffic.

440.13 Pavement Type

The pavement types given in Figures 440-5 through 440-8 are those recommended for each design class. (See Chapter 520 for information on pavement type selection.) When a roadway is to be widened and the existing pavement will remain, the new pavement type may be the same as the existing without a pavement type determination.

440.14 Structure Width

Provide a clear width between curbs on a structure not less than the approach roadway width (lanes plus shoulders). The structure widths given in Figures 440-5 through 440-9 are the minimum structure widths for each design class.

Additional width for barriers is not normally added to the roadway width on structures. When a structure is in a run of roadside barrier with the added width, consider adding the width on shorter structures to prevent narrowing the roadway.

440.15 Right of Way Width

Right of way width must be sufficient to accommodate all roadway elements and required appurtenances necessary for the current design and known future improvements. To allow for construction and maintenance activities, provide 10 feet desirable, 5 feet minimum, wider than the slope stake for fill and slope treatment for cut. For slope treatment information, see Chapter 640 and the *Standard Plans*.

The right of way widths given in Figures 440-5 through 440-8 are desirable minimums for new alignment requiring purchase of new right of way. For additional information and consideration on right of way acquisition, see Chapter 1410.

440.16 Grades

Grades can have a pronounced effect on the operating characteristics of the vehicles negotiating them. Generally, passenger cars can readily negotiate grades as steep as 5% without appreciable loss of speed from that maintained on level highways. Trucks, however, travel at the average speed of passenger cars on the level roadway but display up to a 5% increase in speed on downgrades and a 7% or greater decrease in speed on upgrades (depending on length and steepness of grade as well as weight-to-horsepower ratio).

The maximum grades for the various functional classes and terrain conditions are shown in Figures 440-5 through 440-8. For the effects of these grades on the design of a roadway, see Chapters 630, 650, 910, 940, and 1010.

440.17 Fencing

Remove rigid top rails and brace rails from existing fencing and retrofit with a tension wire design. For information on fencing, see Chapter 1460.

440.18 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

Divided Multilane		
Design Class	I-1	
Design Year	[1]	
Access Control[2]	Full	
Separate Cross Traffic		
Highways	All	
Railroads	All	
Design Speed (mph)[3]		
Rural	80[4]	
Urbanized	70[5]	
Traffic Lanes		
Number	4 or more divided	
Width (ft)	12	
Median Width (ft)[6]	Minimum width is as required for shoulders and barrier (including required shy distance) or ditch (see 440.10).	
Shoulder Width (ft)[7]	4 lanes	6 or more lanes
Right of Traffic	10[8]	10[8]
Left of Traffic	4	10[8][9]
Pavement Type[10]	High	
Right of Way[11]		
Rural – Width (ft)	63 from edge of traveled way	
Urban – Width (ft)	As required[12]	
Structures Width (ft)[13]	Full roadway width each direction[14]	

Type of Terrain	**Design Speed (mph)**						
	50	55	60	65	70	75	80
	Grades (%)[15]						
Level	4	4	3	3	3	3	3
Rolling	5	5	4	4	4	4	4
Mountainous	6	6	6	6	5	5	5

Interstate Notes:

[1] The design year is 20 years after the year the construction is scheduled to begin.

[2] For access control requirements, see Chapter 1430.

[3] For new/reconstruction projects. For design speed on existing roadways, see 440.07.

[4] 80 mph is the desirable design speed; with a corridor analysis, the design speed may be reduced to 60 mph in mountainous terrain and 70 mph in rolling terrain. Do not select a design speed that is less than the posted speed.

[5] 70 mph is the desirable design speed; with a corridor analysis, the design speed may be reduced to 50 mph. Do not select a design speed that is less than the posted speed.

[6] Independent alignment and grade are desirable in all rural areas and where terrain and development permit in urban areas.

[7] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced up to 4 inches.

[8] 12-ft shoulders are desirable when the truck DDHV is 250 or greater.

[9] For existing 6-lane roadways, an existing 6-ft left shoulder is a design exception when the shoulder is not being reconstructed and no other widening is required.

[10] For pavement type determination, see Chapter 520.

[11] Desirable width. Provide right of way width 10 ft desirable, 5 ft minimum, wider than the slope stake for fill and slope treatment for cut (see 440.15).

[12] In urban areas, make right of way widths not less than those required for necessary cross section elements.

[13] For minimum vertical clearance, see Chapter 1120.

[14] For median widths 26 ft or less, address bridge(s) in accordance with Chapter 1120.

[15] Grades 1% steeper may be provided in urban areas and mountainous terrain with critical right of way controls.

Geometric Design Data: Interstate

Figure 440-5

Design Class	Divided Multilane				Two-Lane						Undivided Multilane	
	P-1		P-2		P-3		P-4		P-5		P-6[1]	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
DHV in Design Year[2] NHS Non-NHS	Over 1500		Over 700[3]		Over 201[4] Over 301		61–200 101–300		60 and Under 100 and Under		Over 700[3]	
Access Control[5]	Full		Partial[6]									
Separate Cross Traffic Highways Railroads[7]	All All		Where Justified All		Where Justified All[8]		Where Justified Where Justified[9]		Where Justified Where Justified[9]		Where Justified Where Justified[9]	
Design Speed (mph)[10] Desirable[11] Minimum[12]	80 60[13]		70 50[14]		70 50	60 40[14]	70 50	60 40[14]	60 40	60 30[14]	70 40	60 30[14]
Traffic Lanes Number Width (ft)	4 or more divided 12		4 or 6 divided 12		2 12		2 12		2 12		4 12	4 or 6 11[15]
Shoulder Width (ft)[16] Right of Traffic Left of Traffic	10[17] Variable[19][20]		10 Variable[19][20]		8		6		4		8	8[18]
Median Width (ft)	Minimum width is as required for shoulders and barrier (including required shy distance) or ditch. (See 440.10.)										(See 440.10)	
Parking Lanes Width (ft) – Minimum	None		None		None		None	10	None	10	None	10[21]
Pavement Type[22]	High				High or Intermediate							
Right of Way[23] – Width (ft)	[24]	[25]	[24]	[25]	120	80	120	80	100	80	150	80
Structures Width (ft)[26]	Full Roadway Width[27]				40		40		32		Full Roadway Width	
Other Design Considerations–Urban					[28]		[28]		[28]		[28]	

Type of Terrain	Rural – Design Speed (mph)									Urban – Design Speed (mph)						
	40	45	50	55	60	65	70	75	80	30	35	40	45	50	55	60[29]
	Grades (%)[30]															
Level	5	5	4	4	3	3	3	3	3	8	7	7	6	6	5	5
Rolling	6	6	5	5	4	4	4	4	4	9	8	8	7	7	6	6
Mountainous	8	7	7	6	6	5	5	5	5	11	10	10	9	9	8	8

Geometric Design Data: Principal Arterial

Figure 440-6

Principal Arterial Notes:

[1] Justify the selection of a P-6 design class on limited access highways.

[2] The design year is 20 years after the year the construction is scheduled to begin.

[3] When considering a multilane highway, perform an investigation to determine whether a truck-climbing lane or passing lane will satisfy the need (see Chapter 1010).

[4] Where DHV exceeds 700, consider 4 lanes. When the volume/capacity ratio is equal to or exceeds 0.75, consider the needs for a future 4-lane facility. When considering truck-climbing lanes on a P-3 design class highway, perform an investigation to determine whether a P-2 design class highway is justified.

[5] For access control requirements, see Chapters 1430 and 1435 and the Master Plan for Limited Access Highways. Contact the HQ Design Office Access & Hearings Unit for additional information.

[6] Full or modified access control may also be used.

[7] Contact the Rail Office of the Public Transportation and Rail Division for input on railroad needs.

[8] All main line and major spur railroad tracks will be separated. Consider allowing at-grade crossings at minor spur railroad tracks.

[9] Criteria for railroad grade separations are not clearly definable. Evaluate each site regarding the hazard potential. Provide justification for railroad gradeseparations.

[10] For new/reconstruction projects. (See 440.07 for existing roadways.)

[11] These are the design speeds for level and rolling terrain in rural design areas. They are the preferred design speeds for mountainous terrain and urban design areas. Higher design speeds may be selected, with justification.

[12] These design speeds may be selected in mountainous terrain, with a corridor analysis. Do not select a design speed that is less than the posted speed.

[13] In urbanized areas, with a corridor analysis, 50 mph may be used as the minimum design speed. Do not select a design speed that is less than the posted speed.

[14] In urban design areas, with a corridor analysis, these values may be used as the minimum design speed. Do not select a design speed that is less than the posted speed.

[15] 12-ft lanes are required when the truck DDHV is 150 or greater.

[16] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced up to 4 inches.

[17] 12-ft shoulders are desirable when the truck DDHV is 250 or greater.

[18] When curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 4 ft.

[19] Minimum left shoulder width is to be as follows: 4 lanes – 4 ft: 6 or more lanes – 10 ft. Consider 12-ft shoulders on facilities with 6 or more lanes and a truck DDHV of 250 or greater.

[20] For existing 6-lane roadways, an existing 6-ft left shoulder <u>is a</u> design exception when the shoulder is not being reconstructed and no other widening is required

[21] Restrict parking when DHV is over 1500.

[22] For pavement type determination, see Chapter 520.

[23] Desirable width. Provide right of way width 10 ft desirable, 5 ft minimum, wider than the slope stake for fill and slope treatment for cut (see 440.15).

[24] 63 ft from edge of traveled way.

[25] Make right of way widths not less than those required for necessary cross section elements.

[26] For the minimum vertical clearance, see Chapter 1120.

[27] For median widths 26 ft or less, address bridges in accordance with Chapter 1120.

[28] For bicycle requirements, see Chapter 1020. For pedestrian and sidewalk requirements, see Chapter 1025. Curb requirements are in 440.11. Lateral clearances from the face of curb to obstruction are in Chapter 700.

[29] For grades at design speeds greater than 60 mph in urban design areas, use rural criteria.

[30] Grades 1% steeper may be used in urban design areas and mountainous terrain with critical right of way controls.

Geometric Design Data: Principal Arterial
Figure 440-6 (continued)

Design Class	Divided Multilane		Two-Lane						Undivided Multilane	
	M-1		M-2		M-3		M-4		M-5[1]	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
DHV in Design Year[2] NHS Non-NHS	Over 700[3]		Over 201[4] Over 401		61–200 201–400		60 and Under 200 and Under		Over 700[3]	
Access Control[5]	Partial[6]									
Separate Cross Traffic Highways Railroads[7]	Where Justified All		Where Justified All[8]		Where Justified Where Justified[9]		Where Justified Where Justified[9]		Where Justified Where Justified[9]	
Design Speed (mph)[10] Desirable[11] Minimum[12][13]	70 50		70 50	60 40	70 50	60 40	60 40	60 30	70 40	60 30
Traffic Lanes Number Width (ft)	4 or 6 divided 12		2 12		2 12		2 12		4 12	4 or 6 11[14]
Shoulder Width (ft)[15] Right of Traffic Left of Traffic	10 Variable[17][18]		8		6		4		8	8[16]
Median Width (ft)	[19]								[19]	
Parking Lanes Width (ft) – Minimum	None		None		None	10	None	10	None	10[20]
Pavement Type[21]	High		As Required						High or Intermediate	
Right of Way[22] – Width (ft)	[23]	[24]	120	80	120	80	100	80	150	80
Structures Width (ft)[25]	Full Roadway Width[26]		40		40		32		Full Roadway Width	
Other Design Considerations–Urban			[27]		[27]		[27]		[27]	

Type of Terrain	Rural – Design Speed (mph)									Urban – Design Speed (mph)						
	40	45	50	55	60	65	70	75	80	30	35	40	45	50	55	60[28]
	Grades (%)[29]															
Level	5	5	4	4	3	3	3	3	3	8	7	7	6	6	5	5
Rolling	6	6	5	5	4	4	4	4	4	9	8	8	7	7	6	6
Mountainous	8	7	7	6	6	5	5	5	5	11	10	10	9	9	8	8

Geometric Design Data: Minor Arterial

Figure 440-7

Minor Arterial Notes:

[1] Justify the selection of an M-5 design class on limited access highways.

[2] The design year is 20 years after the year the construction is scheduled to begin.

[3] When considering a multilane highway, perform an investigation to determine whether a truck-climbing lane or passing lane will satisfy the need (see Chapter 1010).

[4] Where DHV exceeds 700, consider 4 lanes. When the volume/capacity ratio is equal to or exceeds 0.75, consider the needs for a future 4-lane facility. When considering truck-climbing lanes on an M-2 design class highway, perform an investigation to determine whether an M-1 design class highway is justified.

[5] For access control requirements, see Chapters 1430 and 1435 and the Master Plan for Limited Access Highways. Contact the HQ Design Office Access & Hearings Unit for additional information.

[6] Full or modified access control may also be used.

[7] Contact the Rail Office of the Public Transportation and Rail Division for input on railroad needs.

[8] All main line and major spur railroad tracks will be separated. Consider allowing at-grade crossings at minor spur railroad tracks.

[9] Criteria for railroad grade separations are not clearly definable. Evaluate each site regarding the hazard potential. Provide justification for railroad grade separations.

[10] For new/reconstruction projects. (See 440.07 for existing roadways.)

[11] These are the design speeds for level and rolling terrain in rural design areas. They are the preferred design speeds for mountainous terrain and urban design areas. Higher design speeds may be selected, with justification.

[12] In urban design areas, with a corridor analysis, these values may be used as the minimum design speed. Do not select a design speed that is less than the posted speed.

[13] These design speeds may be selected in mountainous terrain, with a corridor analysis. Do not select a design speed that is less than the posted speed.

[14] When the truck DDHV is 150 or greater, consider 12-ft lanes.

[15] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced up to 4 inches.

[16] When curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 4 ft.

[17] The minimum left shoulder width is 4 ft for 4 lanes and 10 ft for 6 or more lanes.

[18] For existing 6-lane roadways, an existing 6 ft left shoulder is a design exception when the shoulder is not being reconstructed and no other widening is required.

[19] Minimum median width is as required for shoulders and barrier (including required shy distance) or ditch (see 440.10).

[20] Restrict parking when DHV is over 1500.

[21] For pavement type determination, see Chapter 520.

[22] Desirable width. Provide right of way width 10 ft desirable, 5 ft minimum, wider than the slope stake for fill and slope treatment for cut (see 440.15).

[23] 63 ft from edge of traveled way.

[24] Make right of way widths not less than those required for necessary cross section elements.

[25] For the minimum vertical clearance, see Chapter 1120.

[26] For median widths 26 ft or less, address bridges in accordance with Chapter 1120.

[27] For bicycle requirements, see Chapter 1020. For pedestrian and sidewalk requirements, see Chapter 1025. Curb requirements are in 440.11. Lateral clearances from the face of curb to obstruction are in Chapter 700.

[28] For grades at design speeds greater than 60 mph in urban design areas, use rural criteria.

[29] Grades 1% steeper may be used in urban design areas and mountainous terrain with critical right of way controls.

Geometric Design Data: Minor Arterial
Figure 440-7 (continued)

Design Class	Undivided Multilane		Two-Lane					
	C-1		C-2		C-3		C-4	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
DHV in Design Year[1] NHS	Over 900[2]		Over 301[3]		201–300		200 and Under	
Non-NHS			Over 501		301–500		300 and Under	
Access Control	[4]		[4]		[4]		[4]	
Separate Cross Traffic								
Highways	Where Justified		Where Justified		Where Justified		Where Justified	
Railroads[5]	Where Justified[6]		All[6]		Where Justified[6]		Where Justified[6]	
Design Speed (mph)[7]								
Desirable[8]	70	60	70	60	70	60	60	60
Minimum[9][10]	40	30	50	40	50	40	40	30
Traffic Lanes								
Number	4	4 or 6	2		2		2	
Width (ft)	12	11[11]	12		12		12	
Shoulder Width (ft)[12]	8	8[13]	8		6		4	
Median Width (ft)	[14]							
Parking Lane Width (ft) – Minimum	None	10	None		None	10	None	10
Pavement Type[15]	High or Intermediate		As Required					
Right of Way (ft)[16]	150	80	120	80	120	80	100	80
Structures Width (ft)[17]	Full Roadway Width		40		40		32	
Other Design Considerations – Urban	[18]		[18]		[18]		[18]	

Type of Terrain	Rural – Design Speed (mph)										Urban – Design Speed (mph)								
	25	30	35	40	45	50	55	60	65	70	20	25	30	35	40	45	50	55	60[19]
	Grades (%)[20]																		
Level	7	7	7	7	7	6	6	5	5	4	9	9	9	9	9	8	7	7	6
Rolling	10	9	9	8	8	7	7	6	6	5	12	12	11	10	10	9	8	8	7
Mountainous	11	10	10	10	10	9	9	8	8	6	14	13	12	12	12	11	10	10	9

Geometric Design Data: Collector
Figure 440-8

Collector Notes:

[1] The design year is 20 years after the year the construction is scheduled to begin.

[2] When considering a multilane highway, perform an investigation to determine whether a truck-climbing lane or passing lane will satisfy the need (see Chapter 1010).

[3] Where DHV exceeds 900, consider 4 lanes. When the volume/capacity ratio is equal to or exceeds 0.85, consider the needs for a future 4-lane facility. When considering truck-climbing lanes on a C-2 design class highway, perform an investigation to determine whether a C-1 design class highway is justified.

[4] For access control requirements, see Chapters 1430 and 1435 and the Master Plan for Limited Access Highways. Contact the HQ Design Office Access & Hearings Unit for additional information.

[5] Contact the Rail Office of the Public Transportation and Rail Division for input on railroad needs.

[6] Criteria for railroad grade separations are not clearly definable. Evaluate each site regarding the hazard potential. Provide justification for railroad grade separations.

[7] For new/reconstruction projects. (See 440.07 for existing roadways.)

[8] These are the design speeds for level and rolling terrain in rural design areas. They are the preferred design speeds for mountainous terrain and urban design areas. Higher design speeds may be selected, with justification. Do not select a design speed that is less than the posted speed.

[9] In urban design areas, with a corridor analysis, these values may be used as the minimum design speed. Do not select a design speed that is less than the posted speed.

[10] These design speeds may be selected in mountainous terrain, with a corridor analysis. Do not select a design speed that is less than the posted speed.

[11] Consider 12-ft lanes when the truck DDHV is 200 or greater.

[12] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced up to 4 inches.

[13] When curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 4 ft.

[14] Minimum median width is as required for shoulders and barrier (including required shy distance) or ditch (see 440.10).

[15] For pavement type determination, see Chapter 520.

[16] Desirable width. Provide right of way width 10 ft desirable, 5 ft minimum, wider than the slope stake for fill and slope treatment for cut (see 440.15).

[17] For the minimum vertical clearance, see Chapter 1120.

[18] For bicycle requirements, see Chapter 1020. For pedestrian and sidewalk requirements, see Chapter 1025. Curb requirements are in 440.11. Lateral clearances from the face of curb to obstruction are in with Chapter 700.

[19] For grades at design speeds greater than 60 mph in urban design areas, use rural criteria.

[20] Grades 1% steeper may be used in urban design areas and mountainous terrain with critical right of way controls.

Geometric Design Data: Collector
Figure 440-8 (continued)

Design Class	Divided Multilane		Undivided Multilane		Two-Lane	
	$U_{M/A}$-1	$U_{M/A}$-2	$U_{M/A}$-3	$U_{M/A}$-4	$U_{M/A}$-5	$U_{M/A}$-6
DHV in Design Year[1]	Over 700	Over 700	700–2,500	Over 700	All	All
Design Speed (mph)	Greater than 45	45 or less	35 to 45	30 or less	Greater than 45	45 or less
Access	[2]	[2]	[2]	[2]	[2]	[2]
Traffic Lanes						
Number	4 or more	4 or more	4 or more	4 or more	2	2
Width (ft) NHS	12[3][4]	12[3]	12[3]	12[3]	12[3][6]	12[3]
Non-NHS	11[4]	11[5]	11[5]	11[5]	11[6]	11[7]
Shoulder Width (ft)[8]						
Right of Traffic[9]	10	10	8	8	8[10]	4
Left of Traffic	4	4				
Median Width (ft)[11]			[12]	[12]		
Parking Lane Width (ft)	None	10[13]	10[13]	8[14]	10[15]	8[14]
Structures Width (ft)[16]	Full Roadway Width[17]		Full Roadway Width		32	30
Other Design Considerations	[18]	[18]	[18]	[18]	[18]	[18]

Urban Managed Access Highways Notes:

[1] The design year is 20 years after the year the construction is scheduled to begin.

[2] The urban managed access highway design is only used on managed access highways (see Chapter 1435).

[3] May be reduced to 11 ft, with justification.

[4] Provide 12-ft lanes when truck DDHV is 200 or greater.

[5] Consider 12-ft lanes when truck DDHV is 200 or greater.

[6] Provide 12-ft lanes when truck DHV is 100 or greater.

[7] Consider 12-ft lanes when truck DHV is 100 or greater.

[8] When curb section is used, see Figure 440-3.

[9] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced up to 4 inches.

[10] When DHV is 200 or less, may be reduced to 4 ft.

[11] Minimum width is as required for shoulders and barrier (including required shy distance) or ditch (see 440.10).

[12] 2 ft desirable. When a TWLTL is present, 13 ft is desirable, 11 ft is minimum.

[13] Prohibit parking when DHV is over 1500.

[14] 10 ft is desirable.

[15] Prohibit parking when DHV is over 500.

[16] For minimum vertical clearance, see Chapter 1120.

[17] For median requirements, see Chapter 1120.

[18] For bicycle requirements, see Chapter 1020. For pedestrian and sidewalk requirements, see Chapter 1025. Lateral clearances from face of curb to obstruction are in Chapter 700. For railroad and other roadway grade separation, maximum grade, and pavement type for the functional class, see Figures 440-6 through 440-8. Make right of way widths not less than required for necessary cross section elements.

Geometric Design Data: Urban Managed Access Highways

Figure 440-9

Chapter 510 Investigation of Soils, Rock, and Surfacing Materials

510.01 General

It is WSDOT's responsibility to understand the characteristics of the soil and rock materials that support or are adjacent to a transportation facility to ensure that, when designed, constructed, and maintained, the facility will be adequate to safely carry the estimated traffic. It is also the responsibility of WSDOT to ensure the quality and quantity of all borrow, soils, rock, and surfacing materials used in the construction of transportation facilities. Specific requirements for geotechnical investigation, design, construction, and maintenance support to accomplish these things are set forth in the WSDOT *Geotechnical Design Manual*.

The following information serves as guidance in the above areas. When a project consists of a surface overlay of an existing highway, WSDOT Pavement Policy is used.

Before making project budget and schedule commitments to the Legislature, other agencies, and the public, it is necessary to identify the extent and estimated cost for a project. Contact the Region Materials Engineer (RME) and the Headquarters (HQ) Geotechnical Division as early as possible to obtain conceptual-level recommendations regarding how the project soil, rock, and groundwater conditions may affect the design of the project elements. The project soil, rock, and groundwater conditions, and the availability, quantity, and quality of borrow and surfacing materials, can affect the project scope, schedule, and budget.

The RME and the HQ Geotechnical Division will use existing subsurface information and their knowledge of the project area to assess the subsurface conditions within the project limits. If there is little information available or the information is poor, and the subsurface conditions have the potential to significantly affect the project budget or schedule, it may be necessary to obtain a limited number of geotechnical borings or test pits during Project Definition to assess soil, rock, and groundwater conditions within the project limits. Once the Project Definition has been developed and project funding secured, a more detailed geotechnical investigation follows during the design and Plans, Specifications, and Estimates (PS&E) phases.

Coordinate early in your project for Geotechnical reporting and design

It is essential to involve the RME and the HQ Geotechnical Division in the design as soon as possible once the need for geotechnical work is identified. (See 510.04(3) for time-estimate information.) Furthermore, if major changes occur as the project is developed, inform the RME and the HQ Geotechnical Division as soon as possible so that the geotechnical design can be adapted to the changes without significant delay to the project.

510.02 References

(1) Design Guidance

Construction Manual, M 41-01, WSDOT

Geotechnical Design Manual, M 46-03, WSDOT

Hydraulics Manual, M 23-03, WSDOT

Plans Preparation Manual, M 22-31, WSDOT

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

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

WSDOT Pavement Policy
www.wsdot.wa.gov/biz/mats/pavement/WSDOT_Volume1-PavementPolicy.pdf

510.03 Materials Sources

(1) General

The Region Project Development Engineer (RPDE) determines when a materials source is needed. The RME determines the best materials source for the project (see Figure 510-1). It is preferred that existing approved materials source sites be used when there are suitable sites available. When there are no approved sites available, the RME determines the locations for new materials sources. The RME contacts the HQ Geotechnical Division to provide a geotechnical investigation for the proposed site. The HQ Geotechnical Division provides geologic mapping of the site, develops a subsurface exploration plan and cost estimate, conducts the subsurface investigation, develops a subsurface geologic model including groundwater, evaluates slope stability issues, and makes recommendations. The HQ Geotechnical Division develops and provides a geotechnical report with materials source development recommendations to the RME. The RME uses this report and materials source recommendations to develop the Materials Source Report and to identify the quantity and quality of material that is intended for the life of the materials source.

Specific requirements for materials source investigations are set forth in the *Geotechnical Design Manual*, Chapter 21.

(2) Materials Source Approval

The HQ Geotechnical Division must review and approve the Materials Source Report produced by the RME to ensure consistency with the geotechnical report produced by the HQ Geotechnical Division.

The HQ Materials Office and the HQ Design Office must approve each pit or quarry site before it is purchased, leased, or acquired on a royalty basis. Until the approval process is complete, the project cannot be advertised for bids. Local and state permits are required for materials sources. To avoid delay in advertising the project, begin the site investigations and permitting process in the early stages of the Project Definition phase.

510.04 Geotechnical Investigation, Design, and Reporting

(1) General

A geotechnical investigation is conducted on all projects that involve significant grading quantities (including state-owned materials source development), unstable ground, foundations for structures, and groundwater impacts (including infiltration). The goal of the geotechnical investigation is to preserve the safety of the public who use the facility, as well as to preserve the economic investment by the state of Washington. Additional requirements regarding geotechnical investigations and who can conduct such investigations are set forth in the *Geotechnical Design Manual*, Chapter 1.

(2) Key Contacts for Initiating Geotechnical Work

For Regions, the RME is the first person to contact for geotechnical work. Projects with structures designed by the HQ Bridge and Structures Office, Washington State Ferries (WSF) projects, and Urban Corridors projects generally require the involvement of the HQ Geotechnical Division. These particular WSDOT offices should contact the HQ Geotechnical Division directly for their geotechnical project needs. The specific roles and responsibilities of the RME and HQ Geotechnical Division, including application to the Project Management Process (PMP), are set forth in the *Geotechnical Design Manual*, Chapter 1.

For information on retaining walls and noise walls, see Chapters 1130 and 1140, respectively. For geosynthetic design, see Chapter 530.

(3) Scheduling Considerations for Geotechnical Work

The Region Project Office, the HQ Bridge and Structures Office, the WSF, and the HQ Facilities Office are responsible for identifying the potential need for geotechnical work and requesting time and budget estimates from the RME or the HQ Geotechnical Division, as early as possible to prevent delays to the project.

Once the geotechnical design request and the site data are received by the RME or the HQ Geotechnical Division, it can take from two to six months, or more, to complete the geotechnical design. Design completion depends on the complexity of the project, whether or not test holes are needed, current workload, the need to give the work to consultants, and how long it takes to obtain environmental permits and rights of entry.

If a consultant must be used, the minimum time required to complete a design (for even a simple project) is typically two and a half months.

In true emergency situations (a highway blocked by a landslide or a collapsed bridge, for example), it is possible to get geotechnical design work completed (in-house or by consultants) more rapidly to at least provide a design for temporary mitigation.

Consider all of these factors when deciding how soon (in general, as early as possible) to initiate the geotechnical work for a project.

To incorporate geotechnical scheduling considerations into the overall project schedule, see Chapter 1 of the *Geotechnical Design Manual*, which provides a description and discussion of the Master Deliverables List (MDL) as it applies to geotechnical work.

(4) Site Data and Permits Needed to Initiate Geotechnical Work

To initiate geotechnical work on a project during the Project Definition phase, provide the following information:

(a) Project description.

(b) Plan view or description showing the proposed alignment or alignment alternative(s).

(c) Description of project scope as it relates to geotechnical features such as major cuts and fills, walls, structures, and potential stormwater facilities.

To initiate geotechnical work on a project during the design and PS&E phases, provide the following information:

(a) Project description.

(b) Plan sheets showing the following:

- Station and location of cuts, fills, walls, bridges, retention/detention ponds, or other geotechnical features to be designed
- Existing utilities (as-built plans are acceptable)
- Right of way limits
- Wetlands
- Drainage features
- Existing structures
- Other features or constraints that could affect the geotechnical design or investigation

(c) Electronic files, or cross sections every 50 feet or as appropriate, to define existing and new ground line above and below walls, cuts, fills, and other pertinent information.

- Show stationing
- Show locations of existing utilities, right of way lines, wetlands, and other constraints
- Show locations of existing structures that might contribute load to the cut, fill, wall, or other structure

(d) Right of entry agreements and permits required for geotechnical investigation.

(e) Due date and work order number.

(f) Contact person.

When the alignment and any constraints (as noted above) are staked, the stationing on the plans and in the field must be in the same units. Physical surveys are preferred to photogrammetric surveys to ensure adequate accuracy of the site data.

Permits and agreements to be supplied by the Region might include:

- HPA
- Shoreline permits
- Tribal lands and waters
- Railroad easement and right of way
- City, county, or local agency use permits
- Sensitive area ordinance permits

The Region Project Office is also responsible for providing survey locations of test holes once the test holes have been drilled. The survey information includes the station, offset, elevation, and test hole coordinates. Coordinates are the latitude and longitude or state plane coordinates (North or South as appropriate), but not project coordinates.

(5) Overview of Geotechnical Design Objectives for the Various Project Stages

Geotechnical design objectives for the various design phases are described in the *Geotechnical Design Manual*.

(6) Earthwork

(a) **Project Definition**. The designer contacts and meets with the RME (and the HQ Geotechnical Division as needed) at the project site to conduct a field review to help identify the geotechnical issues for the project.

In general, if soil/rock conditions are poor and/or large cuts or fills are anticipated, the RME requests that the HQ Geotechnical Division participate in the field review and reporting efforts.

The designer provides a description and location of the proposed earthwork to the RME.

- For widening of existing facilities, the anticipated width, length, and location of the widening, relative to the current facility, are provided.
- For realignments, the approximate new location proposed for the facility is provided.
- Locations in terms of length can be by milepost or stations.

A brief conceptual-level report that summarizes the results of the investigation is provided to the designer.

(b) **Project Design**. Geotechnical data necessary to allow completion of the PS&E-level design is compiled during the design phase. This includes soils borings, testing, and geotechnical design based on final geometric data. Detailed design of cut and fill slopes can be done once the roadway geometry is established and geotechnical data are available. The purpose of this design effort is to determine the maximum stable cut or fill slope and, for fills, the potential for short- and long-term settlement. Also, the usability of the cut materials and the type of borrow needed for the project, if any, are evaluated. Evaluate the use of soil bioengineering as an option for building steeper slopes or to prevent surface erosion. (See Chapter 1350, "Soil Bioengineering," for more information.)

The designer requests a geotechnical report from the RME. The site data indicated in 510.04(4), as applicable, is provided. It is important that the request for the geotechnical report be made as early as possible in the design phase. Cost and schedule requirements to generate the report are project specific and can vary widely. The time required to obtain permits and rights of entry must be considered when establishing schedule requirements.

The *Geotechnical Design Manual*, Chapter 24, summarizes the type of information and recommendations that are typically included in the geotechnical report for earthwork. The recommendations should include the background regarding analysis approach and any agreements with the Region or other customers regarding the definition of acceptable level of risk.

The Project Office uses the report to finalize design decisions for the project. To meet slope stability requirements, additional right of way might be required or a wall might be needed. Wall design is covered in Chapter 1130. Construction timing might require importing material rather than using cut materials. The report is used to address this and other constructibility issues. The report is also used to proceed with completion of the PS&E.

(c) **PS&E Development**. Adequate geotechnical design information to complete the PS&E is typically received during the design phase. Additional geotechnical work might be needed when right of way cannot be acquired, restrictions are included in permits, or other requirements are added that result in changes to the design.

Special provisions and plan details, if not received as part of the report provided during design, are developed with the assistance of the RME or the HQ Geotechnical Division. The designer uses this information, as well as the design phase report, to complete the PS&E documents. Both the Region Materials Section and the HQ Geotechnical Division can review (if requested) the contract plans before the PS&E review process begins. Otherwise, they will review the contract plans during the normal PS&E review process.

(7) Hydraulic Structures, Ponds, and Environmental Mitigation

(a) **Project Definition**. The designer provides a description and location of the proposed hydraulic/environmental improvements and other pertinent site information and discusses the extent of the improvements with both the RME and the HQ Hydraulics Branch to identify the geotechnical issues to be investigated. At this stage, only the identification and feasibility of the proposed hydraulic structures or environmental mitigation are investigated. The cost and schedule requirements for the geotechnical investigation are also determined at this time.

Examples of hydraulic structures include, but are not limited to, large culverts, pipe arches, underground detention vaults, and fish passage structures. Examples of environmental mitigation include, but are not limited to, detention/retention ponds, wetland creation, and environmental mitigation measures on fill slopes.

It is especially important to identify the potential to encounter high groundwater at the proposed hydraulic structure or pond location. In general, avoid high groundwater locations (see the *Highway Runoff Manual*) as groundwater can greatly affect design, constructibility, operations, performance, and maintenance.

(b) **Project Design**. The designer requests a geotechnical report from the RME. The site data indicated in 510.04(4), as applicable, is provided along with the following information:

- Pertinent field observations (such as unstable slopes, existing soft soils or boulders, evidence of high groundwater, or erosion around and damage to existing culverts or other drainage structures)
- Jurisdictional requirements for geotechnical design of berms/dams

It is important that the request for the geotechnical report be made as early as possible in the design phase. Cost and schedule requirements to generate the report are project specific and can vary widely. The time required to obtain permits and rights of entry must be considered when establishing schedule requirements. Furthermore, since the depth to groundwater can be critical to the feasibility of these types of facilities, and since seasonal variation of groundwater is typically important to know, it is essential to have adequate time to determine the effect of seasonal variations on groundwater.

The RME, with support from the HQ Geotechnical Division as needed, provides the following information in addition to the overall requirements specified in the *Geotechnical Design Manual*, when requested and where applicable, as part of the project geotechnical report:

- Soil boring logs
- Soil pH and resistivity
- Water table elevation
- Soil infiltration rates (highest rate for assessing spill containment/aquifer protection and long-term rate for determining pond capacity)
- Bearing capacity and settlement for hydraulic structure foundations
- Slope stability for ponds
- Retention berm/dam design
- Potential for and amount of differential settlement along culverts and pipe arches and the estimated time required for settlement to occur
- Soil pressures and properties (primarily for underground detention vaults)
- Erosion potential
- Geosynthetic design per Chapter 530
- Recommendations for mitigation of the effect of soft or unstable soil on the hydraulic structures
- Recommendations for construction

Note that retaining walls that are part of a pond, fish passage, etc., are designed per Chapter 1130 and the *Geotechnical Design Manual*.

The designer uses the geotechnical information to:

- Finalize design decisions.
- Evaluate and mitigate environmental issues.
- Proceed with completion of the PS&E design (includes determining the most cost-effective hydraulic structure/pond to meet the desired objectives; locating and sizing ponds and foundations for hydraulic structures; structural design; mitigating the effects of settlement; and satisfying local jurisdictional requirements for design).

(c) **PS&E Development**. During PS&E development, the designer uses the information provided in the geotechnical report to:

- Select pipe materials in accordance with corrosion, resistivity, and abrasion guidelines in the *Hydraulics Manual*.
- Consider and include construction recommendations.

Additional design and specification guidance and support from the RME or the HQ Geotechnical Division are sought as needed. Both sections provide careful review of the contract plans before the PS&E review process begins, if requested. Otherwise, they will review the contract plans during the normal PS&E review process.

(8) Signals, Sign Bridges, Cantilever Signs, and Luminaire Foundations

(a) **Project Definition and Design**. Geotechnical information is usually not required for signals, sign bridges, cantilever signs, and luminaires during Project Definition.

The Region Traffic Design Office contacts the RME for conceptual foundation recommendations. The conceptual recommendations are based on existing information in the area and identify whether *Standard Plan* foundations are feasible or whether special design foundations are required. If good soils are anticipated or the foundations will be placed in fill, *Standard Plan* foundations can be assumed. If special design foundations are required, additional time and money can be included in the project to accommodate increased field exploration for foundation design, HQ Geotechnical Division involvement, and structural design by the HQ Bridge and Structures Office.

(b) **PS&E Development**. Foundation recommendations are made by either the RME or the HQ Geotechnical Division. The recommendations provide all necessary geotechnical information to complete the PS&E.

The Region Traffic Design Office (or Region Project Engineer in some cases) is responsible for delivering the following project information to the RME:

- Plan sheet showing the location of the structures (station and offset) and the planned structure type
- Applicable values for: XYZ, strain pole class, sign bridge span length, luminaire height, variable message sign weight, wind load, CCTV pole height, and known utility information in the area

The RME provides the following information to the requester if *Standard Plan* foundation types can be used:

- Allowable lateral bearing capacity of the soil
- Results of all field explorations
- Groundwater elevation
- Foundation constructibility

The Region uses this information to complete the plan sheets and prepare any special provisions. If utilities are identified during the field investigation that could conflict with the foundations, the Region pursues moving or accommodating the utility. Accommodation could require special foundation designs.

If special designs are required, the RME notifies the requester that special designs are required and forwards the information received from the Region to the HQ Geotechnical Division. The HQ Geotechnical Division provides the HQ Bridge and Structures Office with the necessary geotechnical recommendations to complete the foundation designs. The Region coordinates with the HQ Bridge and Structures Office to ensure that they have all the information necessary to complete the design. Depending on the structure type and complexity, the HQ Bridge and Structures Office might produce the plan sheets and special provisions for the foundations, or they might provide the Region with information so that they can complete the plan sheets and special provisions.

Additional guidelines and requirements for design of foundations for these types of structures are contained in the *Geotechnical Design Manual*.

(9) Buildings, Park and Ride Lots, Communication Towers, and Rest Areas

In general, the RME functions as the clearing house for the geotechnical work to be conducted in each of the phases, for technical review of the work if it is performed by consultants or for getting the work done in-house. For sites and designs that are more geotechnically complex, the RME contacts the HQ Geotechnical Division for assistance. (See the *Geotechnical Design Manual* for geotechnical investigation and design requirements for these types of facilities.)

Detailed geotechnical investigation guidance is provided in Facilities Operating Procedure 9.18, “Site Development.” In summary, this guidance addresses the following phases of design:

(a) **Site Selection**. Conceptual geotechnical investigation (based on historical data and minimal subsurface investigation) of several alternative sites is performed in which the geotechnical feasibility of each site for its intended use is evaluated, allowing the sites to be ranked. In this phase, geological hazards (such as landslides, rockfall, compressible soils, and liquefaction) are identified, and geotechnical data adequate to determine a preliminary cost to develop and build on the site is gathered.

(b) **Schematic Design**. For the selected site, the best locations for structures, utilities, and other elements of the project are determined based on site constraints and ground conditions. In this phase, the site is characterized more thoroughly than in the site selection phase, but subsurface exploration is not structure specific.

(c) **Design Development**. The final locations of each of the project structures, utilities, and other project elements determined from the schematic design phase are identified. Once these final locations are available, a geotechnical investigation is conducted that is adequate to complete the final design of each of the project elements, such as structure foundations, detention/retention facilities, utilities, parking lots, roadways, and site grading. From this investigation and design, the final PS&E is developed.

(10) Retaining Walls, Reinforced Slopes, and Noise Walls

(a) **Project Definition**. The designer provides the RME with a description and location of the proposed walls or reinforced slopes, including the potential size of the proposed structures and other pertinent site information. At this stage, only the identification and feasibility of the proposed walls or reinforced slopes are investigated. A field review may also be conducted at this time as part of the investigation effort. In general, if soil/rock conditions are poor and/or large walls or reinforced slopes are anticipated, the RME requests that the HQ Geotechnical Division participate in the field review and reporting efforts. The cost and schedule requirements for the geotechnical investigation are also determined at this time.

A brief conceptual-level report that summarizes the results of the investigation may be provided to the designer at this time, depending on the complexity of the geotechnical issues.

(b) **Project Design and PS&E Development**. Geotechnical data necessary to allow completion of the PS&E-level design for walls and reinforced slopes are compiled during the design and PS&E development phases. These include soils borings, testing, and final geometric data. Detailed designs of walls and reinforced slopes can be done once the roadway geometry is established and geotechnical data are available. The purpose of this design effort is to determine the wall and slope geometry needed for stability; noise wall and retaining wall foundation requirements; and the potential for short- and long-term settlement.

The designer requests a geotechnical report from the RME for retaining walls, noise walls, and reinforced slopes that are not part of the bridge preliminary plan. For walls that are part of the bridge preliminary plan, the HQ Bridge and Structures Office requests the geotechnical report for the walls from the HQ Geotechnical Division. (See Chapter 1130 for the detailed design process for retaining walls and reinforced slopes, Chapter 1140 for the detailed design process for noise walls, and the *Geotechnical Design Manual* for design requirements for all walls.) It is important that requests for a geotechnical report be made as early as possible in the design phase. The time required to obtain permits and rights of entry must be considered when establishing schedule requirements.

For retaining walls and reinforced slopes, the site data to be provided with the request for a geotechnical report are as indicated in Chapter 1130. Supply right of entry agreements and permits required for the geotechnical investigation. The site data indicated in 510.04(4), as applicable, are provided for noise walls.

The RME or the HQ Geotechnical Division provides the information (see Chapter 1130 or 1140 for specific responsibilities for design) specified in the *Geotechnical Design Manual* as part of the project geotechnical report.

The recommendations may also include the background regarding analysis approach and any agreements with the Region or other customers regarding the definition of acceptable level of risk. Additional details and design issues to be considered in the geotechnical report are as provided in Chapter 1130 for retaining walls and reinforced slopes and in Chapter 1140 for noise walls. The designer uses this information for final wall/reinforced slope selection and to complete the PS&E.

For final PS&E preparation, special provisions and plan details (if not received as part of the report provided during design) are developed with the assistance of the Region Materials Section or the HQ Geotechnical Division. Both the Region Materials Section and the HQ Geotechnical Division can review the contract plans before the PS&E review process begins, if requested. Otherwise, they will review the contract plans during the normal PS&E review process.

(11) Unstable Slopes

Unstable slope mitigation includes the stabilization of known landslides and rockfall that occur on slopes adjacent to the WSDOT transportation system and that have been programmed under the P3 Unstable Slope Program.

(a) **Project Definition**. The Region Project Office provides the RME with a description and location of the proposed unstable slope mitigation work. Location of the proposed work can be milepost limits or stationing. The designer meets at the project site with the RME and HQ Geotechnical Division to conduct a field review, discuss project requirements, and identify geotechnical issues associated with the unstable slope project. The RME requests that the HQ Geotechnical Division participate in the field review and Project Definition reporting.

The level of work in the Project Definition phase for unstable slopes is conceptual in nature, not a final design. The geotechnical investigation generally consists of a field review, a more detailed assessment of the unstable slope, review of the conceptual mitigation developed during the programming phase of the project, and proposed modification (if any) to the original conceptual-level unstable slope mitigation. The design phase geotechnical services cost and schedule, including any required permits, are determined at this time. A brief conceptual-level report is provided to the designer that summarizes the results of the Project Definition investigation.

(b) **Project Design**. Geotechnical information and field data necessary to complete the unstable slope mitigation design is compiled during this design phase. This work includes, depending on the nature of the unstable slope problem, test borings, rock structure mapping, geotechnical field instrumentation, laboratory testing, and slope stability analysis. The purpose of this design effort is to provide design-level geotechnical recommendations to stabilize the known unstable slope.

The designer requests a geotechnical report from the HQ Geotechnical Division through the RME. The site data indicated in 510.04(4), as applicable, is provided along with the following information:

- Plan sheet showing the station and location of the proposed unstable slope mitigation project
- If requested, Digital Terrain Model (DTM) files necessary to define the on-ground topography of the project site (the limits of the DTM will have been defined during the Project Definition phase)

It is important that the request for the geotechnical report be made as early as possible in the design phase. Cost and schedule requirements to generate the report are project specific and can vary widely. Unstable slope design investigations might require geotechnical monitoring of ground movement and groundwater over an extended period of time to develop the required field information for the unstable slope mitigation design. The time required to obtain rights of entry and other permits, as well as the long-term monitoring data, must be considered when establishing schedule requirements for the geotechnical report.

In addition to the geotechnical report requirements specified in the *Geotechnical Design Manual*, the HQ Geotechnical Division provides the following information as part of the project geotechnical report (as applicable):

- Unstable slope design analysis and mitigation recommendations
- Constructibility issues associated with the unstable slope mitigation
- Appropriate special provisions for inclusion in the contact plans

The Region Project Office uses the geotechnical report to finalize the design decisions for the project and the completion of the PS&E design.

(c) **PS&E Development**. Adequate geotechnical design information to complete the PS&E is typically obtained during the project design phase. Additional geotechnical work might be needed when right of way cannot be acquired, restrictions are included in permits, or other requirements are added that result in changes to the design.

Special provisions, special project elements, and design details (if not received as part of the design phase geotechnical report) are developed with the assistance of the RME and the HQ Geotechnical Division. The designer uses this information in conjunction with the design phase geotechnical report to complete the PS&E document. The RME and the HQ Geotechnical Division can review the contract plans before the PS&E review begins, if requested. Otherwise, they will review the contract plans during the normal PS&E review process.

(12) Rockslope Design

(a) **Project Definition**. The Region Project Office provides the RME with a description and location of the proposed rock excavation work. For widening of existing rock cuts, the anticipated width and length of the proposed cut in relationship to the existing cut are provided. For new alignments, the approximate location and depth of the cut are provided. Location of the proposed cut(s) can be milepost limits or stationing. The designer meets at the project site with the RME and the HQ Geotechnical Division to conduct a field review, discuss project requirements, and identify any geotechnical issues associated with the proposed rock cuts. The RME requests that the HQ Geotechnical Division participate in the field review and Project Definition reporting.

The level of rock slope design work for the Project Definition phase is conceptual in nature. The geotechnical investigation generally consists of the field review, review of existing records, an assessment of existing rockslope stability, and preliminary geologic structure mapping. The focus of this investigation is to assess the feasibility of the rock cuts for the proposed widening or realignment, not final design. A brief conceptual-level report that summarizes the result of the Project Definition investigation is provided to the designer.

(b) **Project Design**. Detailed rockslope design is done once the roadway geometrics have been established. The rockslope design cannot be finalized until the roadway geometrics have been finalized. Geotechnical information and field data necessary to complete the rockslope design are compiled during this design phase. This work includes rock structure mapping, test borings, laboratory testing, and slope stability analysis. The purpose of this design effort is to determine the maximum stable cut slope angle and any additional rockslope stabilization measures that could be required.

The designer requests a geotechnical report from the HQ Geotechnical Division through the RME. The site data indicated in 510.04(4), as applicable, is provided.

It is important that the request for the geotechnical report be made as early as possible in the design phase. Cost and schedule requirements to generate the report are project specific and can vary widely. The time required to obtain permits and rights of entry must be considered when establishing schedule requirements.

In addition to the geotechnical report requirements specified in the *Geotechnical Design Manual*, the HQ Geotechnical Division provides the following information as part of the project geotechnical report pertaining to rock slope design analysis and recommendations.

- Type of rockslope design analysis conducted and limitation of the analysis (also included will be any agreements with the Region and other customers regarding the definition of "acceptable risk")
- The slope(s) required for stability
- Additional slope stabilization requirements (rock bolts, rock dowels, etc.)
- Rockslope ditch criteria (see Chapter 640)
- Assessment of rippability
- Blasting requirements including limitations on peak ground vibrations and air blast over-pressure (if required)
- Usability of the excavated material (including estimates of shrink and swell)
- Constructibility issues associated with the rock excavation

The Project Office uses the geotechnical report to finalize the design decisions for the project and the completion of the PS&E design for the rockslope elements of the project.

(c) **PS&E Development**. Adequate geotechnical design information to complete the PS&E is typically obtained during the design phase. Additional geotechnical work might be needed when right of way cannot be acquired, restrictions are included in permits, or other requirements are added that result in change to the design.

Special provisions, special blasting requirements, and plan details, if not received as part of the design phase geotechnical report, are developed with the assistance of the RME or the HQ Geotechnical Division. The designer uses this information in conjunction with the design phase geotechnical report to complete the PS&E documents. The RME and the HQ Geotechnical Division review (if requested) the contract plans before the PS&E review begins. Otherwise, they will review the contract plans during the normal PS&E review process.

(13) Bridge Foundations

(a) **Project Definition**. The HQ Geotechnical Division supports the development of reasonably accurate estimates of bridge substructure costs beginning with the Project Definition phase. A field review is recommended for major projects and projects that are located in areas with little or no existing geotechnical information. The Region office responsible for Project Definition coordinates field reviews. Subsurface exploration (drilling) is usually not required at this time, but might be needed if cost estimates cannot be prepared within an acceptable range of certainty.

Once it has received the necessary site data from the Region Project Office, the HQ Bridge and Structures Office is responsible for delivering the following project information to the HQ Geotechnical Division:

- Alternative alignments and/or locations of bridge structures
- A preliminary estimate of channelization (structure width)
- Known environmental constraints

The HQ Geotechnical Division provides the following to the HQ Bridge and Structures and Region offices:

- Summary of existing geotechnical information
- Identification of geotechnical hazards (slides, liquefiable soils, soft soil deposits, etc.)
- Identification of permits that might be required for subsurface exploration (drilling)
- Conceptual foundation types and depths
- If requested, an estimated cost and time to complete a geotechnical foundation report

The HQ Bridge and Structures Office uses this information to refine preliminary bridge costs. The Region Project Office uses the estimated cost and time to complete a geotechnical foundation report to develop the project delivery cost and schedule.

(b) **Project Design**. The HQ Geotechnical Division assists the HQ Bridge and Structures Office with preparation of the bridge preliminary plan. Geotechnical information gathered for Project Definition will normally be adequate for this phase, as test holes for the final bridge design cannot be drilled until accurate pier location information is available. For selected major projects, a type, size, and location (TS&L) report might be prepared, which usually requires some subsurface exploration to provide a more detailed, though not final, estimate of foundation requirements.

The HQ Bridge and Structures Office is responsible for delivering the following project information, based on bridge site data received from the Region Project Office, to the HQ Geotechnical Division:

- Anticipated pier locations
- Approach fill heights
- For TS&L, alternate locations/alignments/structure types

The HQ Bridge and Structures Office can expect to receive the following:

- Conceptual foundation types, depths, and capacities
- Permissible slopes for bridge approaches
- For TS&L, a summary of site geology and subsurface conditions, and more detailed preliminary foundation design parameters and needs
- If applicable or requested, potential impact of erosion or scour potential (determined by the HQ Hydraulics Office) on foundation requirements

The HQ Bridge and Structures Office uses this information to complete the bridge preliminary plan. The Region Project Office confirms right of way needs for approach embankments. For TS&L, the geotechnical information provided is used for cost estimating and preferred alternate selection. The preliminary plans are used by the HQ Geotechnical Division to develop the site subsurface exploration plan.

(c) **PS&E Development**. During this phase, or as soon as a 95% preliminary plan is available, subsurface exploration (drilling) is performed and a geotechnical foundation report is prepared to provide all necessary geotechnical recommendations needed to complete the bridge PS&E.

The HQ Bridge and Structures Office is responsible for delivering the following project information to the HQ Geotechnical Division:

- 95% preliminary plans (concurrent with distribution for Region approval)
- Estimated foundation loads and allowable settlement criteria for the structure, when requested

The HQ Bridge and Structures Office can expect to receive:

- Bridge geotechnical foundation report

The HQ Bridge and Structures Office uses this information to complete the bridge PS&E. The Region Project Office reviews the geotechnical foundation report for construction considerations and recommendations that might affect Region items, estimates, staging, construction schedule, or other items.

Upon receipt of the structure PS&E review set, the HQ Geotechnical Division provides the HQ Bridge and Structures Office with a Summary of Geotechnical Conditions for inclusion in Appendix B of the contract.

(14) Geosynthetics

For geosynthetic design guidance, see Chapter 530.

(15) Washington State Ferries Projects

(a) **Project Design**. The HQ Geotechnical Division assists the Washington State Ferries (WSF) division with determining the geotechnical feasibility of all offshore facilities, terminal facility foundations, and bulkhead walls. For upland retaining walls and grading, utility trenches, and pavement design, the RME assists WSF with determining geotechnical feasibility.

In addition to the site data identified in Section 510.04(4), as applicable, the following information is supplied by WSF to the HQ Geotechnical Division or the RME, as appropriate, with the request for the project geotechnical report:

- A plan showing anticipated structure locations as well as existing structures
- Relevant historical data for the site
- A plan showing utility trench locations
- Anticipated utility trench depths
- Proposed roadway profiles

WSF can expect to receive the following:

- Results of any borings or laboratory tests conducted
- A description of geotechnical site conditions
- Conceptual foundation types, depths, and capacities
- Conceptual wall types
- Assessment of constructibility issues that affect feasibility
- Surfacing depths and/or pavement repair and drainage schemes
- If applicable or requested, potential impact of erosion or scour potential (determined by the HQ Hydraulics Office) on foundation requirements

WSF uses this information to complete the design report, design decisions, and estimated budget and schedule.

WSF is responsible for obtaining any necessary permits or right of entry agreements needed to access structure locations for the purpose of subsurface exploration (for example, test hole drilling). The time required for obtaining permits and rights of entry must be considered when developing project schedules. Possible permits and agreements might include but are not limited to:

- City, county, or local agency use permits.
- Sensitive area ordinance permits.

(b) **PS&E Development**. Subsurface exploration (drilling) is performed and a geotechnical foundation report is prepared to provide all necessary geotechnical recommendations needed to complete the PS&E.

The designer requests a geotechnical report from the HQ Geotechnical Division or the RME, as appropriate. The site data indicated in 510.04(4), as applicable, is provided along with the following information:

- A plan showing final structure locations as well as existing structures
- Proposed structure loadings

WSF can expect to receive the following:

- Results of any borings or laboratory tests conducted
- A description of geotechnical site conditions
- Final foundation types, depths, and capacities
- Final wall types and geotechnical designs/parameters for each wall
- Assessment of constructibility issues to be considered in foundation selection and when assembling the PS&E
- Pile driving information: driving resistance and estimated overdrive
- Surfacing depths and/or pavement repair and drainage schemes

WSF uses this information to complete the PS&E.

Upon receipt of the WSF PS&E review set, the HQ Geotechnical Division provides WSF with a Summary of Geotechnical Conditions for inclusion in Appendix B of the Contract. A Final Geotechnical Project Documentation package is assembled by the HQ Geotechnical Division and sent to WSF or the Plans Branch, as appropriate, for reproduction and sale to prospective bidders.

510.05 Use of Geotechnical Consultants

Prior to authorizing a consultant to conduct the geotechnical investigation for a project, the Region Project Office, the HQ Geotechnical Division, and the RME determine the scope of work and schedule for the project and whether or not the project will go to a geotechnical consultant.

Once the decision has been made to have a consultant conduct the geotechnical investigation for a project, the HQ Geotechnical Division or the RME assists in developing the geotechnical scope and estimate for the project (Consultant Services assists in this process). A team meeting between the consultant team, the Region or Washington State Ferries (depending on whose project it is), and the HQ Geotechnical Division/RME is conducted early in the project to develop technical communication lines and relationships. Good proactive communication between all members of the project team is crucial to the success of the project due to the complex supplier-client relationships.

Additional guidelines on the use of geotechnical consultants and the development of a scope of work for the consultant are provided in the *Geotechnical Design Manual*, Chapter 1.

510.06 Geotechnical Work by Others

Geotechnical design work conducted for the design of structures, or other engineering works by other agencies or private developers within the right of way, is subject to the same geotechnical engineering requirements as for engineering works performed by WSDOT. Therefore, the provisions contained within this chapter also apply in principle to such work. All geotechnical work conducted for engineering works within the WSDOT right of way or that otherwise directly impacts WSDOT facilities must be reviewed and approved by the HQ Geotechnical Division or the RME, depending on the nature of the work.

Additional requirements for geotechnical work by others that impacts WSDOT facilities and land within the WSDOT right of way are set forth in the *Geotechnical Design Manual*, Chapter 1.

510.07 Surfacing Report

Detailed criteria and methods that govern pavement rehabilitation can be found in WSDOT Pavement Policy. The RME provides the surfacing report to the Region Project Office. This report provides recommended pavement types, surfacing depths, pavement drainage recommendations, and pavement repair recommendations.

510.08 Documentation

(1) Design Documentation

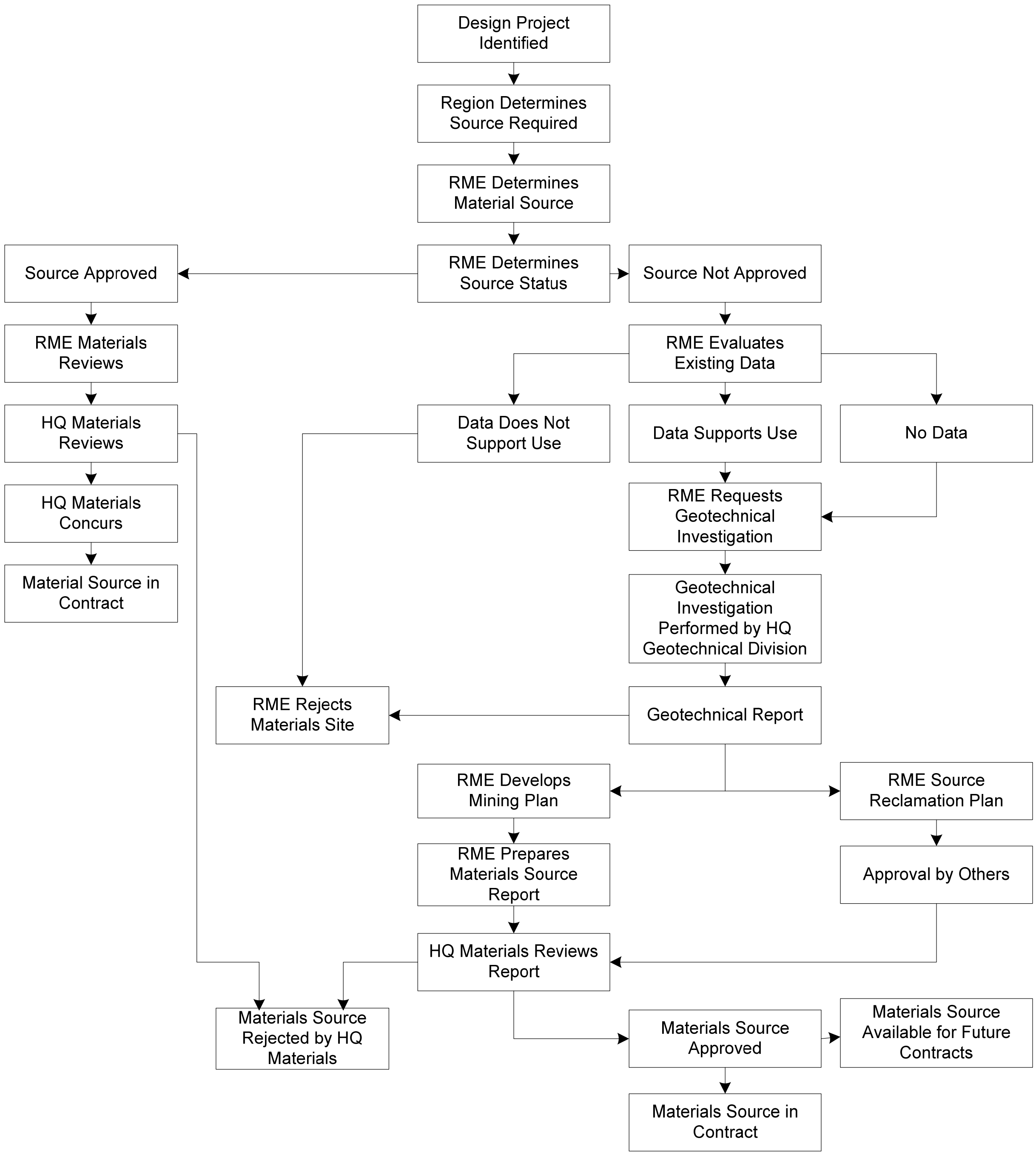
For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

(2) Final Geotechnical Project Documentation and Geotechnical Information Included as Part of the Construction Contract

Once a project PS&E is near completion, all of the geotechnical design memorandums and reports are compiled together to form the Final Geotechnical Project Documentation, to be published for the use of prospective bidders. The detailed process for this is located in the *Plans Preparation Manual*.

Geotechnical information included in the contract consists of the final project boring logs, and, as appropriate for the project, a Summary of Geotechnical Conditions. The boring logs from the geotechnical reports are incorporated into the contract by the Region, WSF, or UCO offices. The Summary of Geotechnical Conditions is provided to the Region, WSF, or UCO by the HQ Geotechnical Division and/or RME.

Additional geotechnical project documentation requirements are set forth in the *Geotechnical Design Manual*.



Material Source Development
Figure 510-1

520.01 Introduction

Detailed criteria and methods that govern pavement design are in the WSDOT Pavement Policy:
www.wsdot.wa.gov/biz/mats/pavement/WSDOT_Pavement_Policy.pdf

Preliminary pavement reports for all design-build project RFPs will be conducted by the State Materials Lab, Pavement Division, with the final report prepared by the design-builder.

520.02 Estimating Tables

Figures 520-1 through 520-5h are to be used when detailed estimates are required. They are for pavement sections, shoulder sections, stockpiles, and asphalt distribution. Prime coats and fog seal are in Figure 520-2a.

Unit Dry Weight				
Type of Material	Truck Measure		Compacted on Roadway	
	lb/cy	T/cy	lb/cy	T/cy
Ballast	3100	1.55	3900	1.95
Crushed Surfacing Top Course	2850	1.43	3700	1.85
Crushed Surfacing Base Course	2950	1.48	3700	1.85
Screened Gravel Surfacing			3700	1.85
**Gravel Base			3400 – 3800	1.70 – 1.90
Shoulder Ballast			2800	1.40
Maintenance Sand ⅜” – 0	2900	1.45		
Mineral Aggregate 2” – 1”	2600	1.30		
Mineral Aggregate 1¾” – ¾”	2600	1.30		
Mineral Aggregate 1½” – ¾”	2550	1.28		
Mineral Aggregate 1” – ¾”	2500	1.25		
Mineral Aggregate ¾” – ½”	2400	1.20		
Mineral Aggregate 1¼” – ¼’”	2600	1.30		
Mineral Aggregate 1” – ¼”	2600	1.30		
Mineral Aggregate ⅞” – ¼”	2550	1.28		
Mineral Aggregate ¾” – ¼”	2500	1.25		
Mineral Aggregate ⅝” – ¼”	2650	1.33		
Mineral Aggregate ½” – ¼” or #4	2600	1.30		
Mineral Aggregate ¼” or #4 – 0	2900	1.45		
Concrete Aggr. No. 2 (1 1/4” - #4)	3000	1.50		
Concrete Sand (Fine Aggregate)	2900	1.45		
Crushed Cover Stone	2850	1.43		

** 3,700 lb/cy (1.85 tons/cy) is recommended as the most suitable factor; however, if the grading approaches the coarseness of ballast, the factor would approach 3,800 lb/cy (1.90 tons/cy), and if the grading contains more than 45% sand, the factor would decrease, approaching 3,400 lb/cy (1.70 tons/cy) for material that is essentially all sand.

General Notes:

Weights shown are dry weights and corrections are required for water contents.

The tabulated weights for the materials are reasonably close; however, apply corrections in the following order:

For specific gravity:

$$\frac{\text{Wt. = tabular wt. x specific gravity on surface report}}{2.65}$$

For water content:

Wt. = tabular wt. x (1 + free water % in decimals)

If they are to be stockpiled, increase required quantities by 10% to allow for waste.

Direct attention to the inclusion of crushed surfacing top course material that may be required for keystone when estimating quantities for projects having ballast course.

Estimating – Miscellaneous Tables

Figure 520-1

General Data[1][2][3]							
Hot Mix Asphalt Pavement							
Complete Mix							
Class of Mix	Depth (ft)	Spread per sy		sy per ton	Tons/Mile Width (ft)		
		lb	ton		10	11	12
HMA	0.10	137	0.0685	14.60	402	442	482

Prime Coats and Fog Seal														
Asphalt							Aggregate							
Application	Type of Asphalt[4]	Application gal[5] per sy	Tons[5] per sy	Tons/Mile Width (ft)			Application lb per sy	Tons/Mile Width (ft)			cy per sy	cy/Mile Width (ft)		
				10	11	12		10	11	12		10	11	12
Prime Coat	MC-250	0.25	0.001004	5.9	6.5	7.1	30	88	97	106	0.0105	62	68	74
Fog Seal	CSS-1	0.04	0.000167	1.0	1.1	1.2								

Specific Data[1][2][3]														
Hot Mix Asphalt Paving Quantities (tons/mile)*														
Width (ft)	Depth of Pavement (ft)													
	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75
4	161	241	321	402	482	563	643	723	804	884	964	1045	1125	1206
6	241	362	482	603	723	844	964	1085	1206	1326	1447	1567	1688	1808
8	321	482	643	804	964	1125	1286	1447	1607	1768	1929	2090	2250	2411
10	402	603	804	1005	1206	1407	1607	1808	2009	2210	2411	2612	2813	3014
11	442	663	884	1105	1326	1547	1768	1989	2210	2431	2652	2873	3094	3315
12	482	723	964	1206	1447	1688	1929	2170	2411	2652	2893	3135	3376	3617
22	884	1326	1768	2210	2652	3094	3536	3978	4421	4863	5305	5747	6189	6631
24	964	1447	1929	2411	2893	3376	3858	4340	4822	5305	5787	6269	6751	7234
* Based on 137 lbs/sy of 0.10 ft compacted depth = 2.05 tons/cy														

Notes:

[1] The specific gravity of the aggregate will affect the weight of aggregate in the completed mix.

[2] The percentage of fine mineral in the coarse aggregate will affect the ratio of coarse to fine. If the coarse aggregate produced contains an excessive amount of fines (¼” to 0), increase the percentage of coarse aggregate and decrease the fines accordingly.

[3] Quantities shown do not provide for widening, waste from stockpile, or thickened edges.

[4] The column “Type of Asphalt” is shown for the purpose of conversion to proper weights for the asphalt being used and does not imply that the particular grade shown is required for the respective treatment.

[5] Quantities shown are retained (residual) asphalt.

Estimating – Hot Mix Asphalt Pavement and Asphalt Distribution Tables
Figure 520-2a

Asphalt Distribution (tons/mile)[1]																						
Asphalt Grade	Gal/ton @ 60° F	Width (ft)	Rate of Application (Gal./cy)																			
			0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00
SC, MC, RC 70	253	10	1.16	2.32	3.48	4.64	5.80	6.96	8.12	9.28	10.46	11.59	12.79	13.91	15.07	16.23	17.39	18.55	19.71	20.87	22.03	23.19
		11	1.28	2.55	3.83	5.10	6.38	7.65	8.93	10.20	11.48	12.75	14.03	15.30	16.58	17.86	19.13	20.41	21.68	22.96	24.23	25.51
		12	1.39	2.78	4.17	5.57	6.96	8.35	9.74	11.13	12.52	13.91	15.30	16.70	18.09	19.48	20.87	22.26	23.65	25.04	26.43	27.83
SC, MC, RC 250	249	10	1.18	2.36	3.53	4.71	5.89	7.07	8.25	9.42	10.60	11.78	12.96	14.14	15.31	16.49	17.67	18.85	20.03	21.20	22.38	23.56
		11	1.30	2.59	3.89	5.18	6.48	7.78	9.07	10.37	11.66	12.96	14.25	15.55	16.85	18.14	19.44	20.73	22.03	23.33	24.62	25.92
		12	1.41	2.83	4.24	5.65	7.07	8.48	9.90	11.31	12.72	14.14	15.55	16.96	18.38	19.79	21.20	22.62	24.03	25.45	26.86	28.27
SC, MC, RC 800	245	10	1.20	2.39	3.59	4.79	5.99	7.18	8.38	9.58	10.78	11.97	13.17	14.37	15.56	16.76	17.96	19.16	20.35	21.55	22.75	23.95
		11	1.30	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.85	13.17	14.49	15.80	17.12	18.44	19.79	21.07	22.39	23.71	25.02	26.34
		12	1.44	2.87	4.31	5.75	7.18	8.62	10.06	11.49	12.93	14.37	15.80	17.24	18.68	20.11	21.55	22.99	24.42	25.86	27.30	28.73
SC, MC, RC 3000	241	10	1.22	2.44	3.66	4.87	6.09	7.31	8.53	9.75	10.97	12.19	13.41	14.62	15.84	17.06	18.28	19.50	20.72	21.94	23.15	24.37
		11	1.34	2.68	4.02	5.36	6.69	8.03	9.37	10.71	12.05	13.39	14.73	16.07	17.41	18.74	20.08	21.42	22.76	24.10	25.44	26.78
		12	1.46	2.92	4.38	5.84	7.30	8.76	10.22	11.68	13.15	14.61	16.07	17.53	18.99	20.45	21.91	23.37	24.83	26.29	27.75	29.21
Paving Asphalt 200-300 PEN.	239	10	1.23	2.45	3.68	4.91	6.14	7.36	8.59	9.82	11.05	12.27	13.50	14.73	15.96	17.18	18.41	19.64	20.86	22.09	23.32	24.55
		11	1.35	2.70	4.05	5.40	6.75	8.10	9.45	10.80	12.15	13.50	14.85	16.20	17.55	18.90	20.25	21.60	22.95	24.30	25.65	27.00
		12	1.47	2.95	4.42	5.89	7.36	8.84	10.31	11.78	13.26	14.73	16.20	17.67	19.15	20.62	22.09	23.56	25.04	26.51	27.98	29.46
Emulsified Asphalt	240	10	1.22	2.44	3.67	4.89	6.11	7.33	8.56	9.77	11.00	12.22	13.44	14.67	15.89	17.11	18.33	19.56	20.78	22.00	23.22	24.44
		11	1.34	2.67	4.03	5.38	6.72	8.07	9.41	10.76	12.10	13.45	14.79	16.13	17.48	18.82	20.17	21.51	22.86	24.20	25.54	26.89
		12	1.47	2.93	4.40	5.87	7.33	8.80	10.27	11.73	13.20	14.67	16.13	17.60	19.07	20.53	22.00	23.47	24.93	26.40	27.87	29.33

Note:

[1] Quantities of asphalt shown are based on 60° F temperature. Recompute to the application temperature for the particular grade.

Estimating – Asphalt Distribution Tables

Figure 520-2b

Bituminous Surface Treatment[1]																	
Class of Mix	Type of Application	Average Application		Mineral Aggregate						Average Spread	Asphalt[2][4][5]						Basic[3] Asphalt Used
				10 ft		11 ft		12 ft			10 ft		11 ft		12 ft		
		lb/sy	cy/sy	T/mi	cy/mi	T/mi	cy/mi	T/mi	cy/mi	gal/sy	gal/mi	T/mi	gal/mi	T/mi	gal/mi	T/mi	
A	Prime Coat									0.48	2787	11.2	3065	12.3	3344	13.4	MC-250
	Crushed Screenings ¾" – ½"	35	0.0146	103	86	113	94	123	103								
	Tack Coat									0.43	2493	10.4	2743	11.4	2992	12.5	CRS-2
	Crushed Screenings ½" – ¼"	28	0.0106	81	62	89	68	97	74								
	Crushed Screenings ¼" – 0"	5	0.0017	15	10	16	11	18	12								
	Totals	68	0.0269	199	158	218	173	238	189	0.91	5280	21.6	5808	23.7	6336	25.9	
B	Seal Coat									0.50	2933	12.2	3227	13.4	3520	14.7	CRS-2
	Crushed Screenings ⅝" – ¼"	33	0.0123	95	72	105	79	114	86								
	Crushed Screenings ¼" – 0"	5	0.0017	15	10	16	11	18	12								
	Totals	38	0.0140	110	82	121	90	132	98	0.50	2933	12.2	3227	13.4	3520	14.7	
C	Seal Coat									0.45	2640	11.0	2904	12.1	3168	13.2	CRS-2
	Crushed Screenings ½" – ¼"	28	0.0106	81	62	89	68	97	74								
	Crushed Screenings ¼" – 0"	5	0.0017	15	10	16	11	18	12								
	Totals	33	0.0123	96	72	105	79	115	86	0.45	2640	11.0	2904	12.1	3168	13.2	
D	Seal Coat									0.43	2493	10.4	2743	11.4	2992	12.5	CRS-2
	Crushed Screenings ⅜" - #10	25	0.0088	73	51	81	57	88	62								
Preseal for B, C & D	Preseal									0.18	1027	4.3	1129	4.7	1232	5.1	CRS-2
	Crushed Screenings ¼" – 0"	12	0.0040	34	23	37	26	40	28								

Notes:

[1] Quantities shown do not provide for widening, waste from stockpile, or thickened edges.

[2] Quantities of asphalt shown are based on 60°F temperature. Recompute to the application temperature for the particular grade.

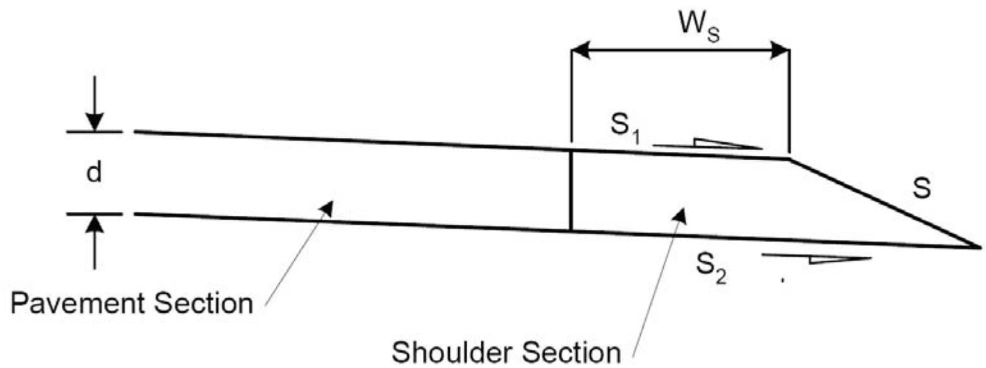
[3] The column "Basic Asphalt Used" is shown for the purpose of conversion to proper weights for the asphalt being used and does not imply that the particular grade shown is required for the respective treatment.

[4] For cutbacks, decrease asphalt by 25%.

[5] For stress absorbing membrane (rubberized asphalt), increase asphalt by 25%.

Estimating – Bituminous Surface Treatment

Figure 520-3



W_S = Shoulder Width (Varies 4 ft, 6 ft, 8 ft, 10 ft, 12 ft)
D = Depth of Section (Varies 0.05 ft to 2 ft)
S = Side Slope (H:V) (Varies 2:1, 3:1, 4:1, and 6:1)
S_1 = Top Shoulder Slope (Varies –0.02 ft/ft or –0.05 ft/ft)
S_2 = Bottom Shoulder Slope (Varies –0.02 ft/ft or –0.05 ft/ft)

Formula for Shoulder Section		
Tons/mile = (A)(K) K=(5280/27)(1.85 tons/cy) $A = \frac{[d + W_S(1/S - S_1)]^2 S}{2(1 - SS_2)} - \frac{W_S^2}{2}(1/S - S_1)$		
Case 1	$S_1 = S_2 = -0.02$ ft/ft	$A = \frac{[d + W_S(1/S - 0.02)]^2 S}{2(1 - 0.02S)} - \frac{W_S^2}{2}(1/S - 0.02)$
Case 2	$S_1 = -0.02$ ft/ft, $S_2 = -0.05$ ft/ft	$A = \frac{[d + W_S(1/S - 0.02)]^2 S}{2(1 - 0.05S)} - \frac{W_S^2}{2}(1/S - 0.02)$
Case 3	$S_1 = -0.05$ ft/ft, $S_2 = -0.02$ ft/ft	$A = \frac{[d + W_S(1/S - 0.05)]^2 S}{2(1 - 0.02S)} - \frac{W_S^2}{2}(1/S - 0.05)$ *
Case 4	$S_1 = S_2 = -0.05$ ft/ft	$A = \frac{[d + W_S(1/S - 0.05)]^2 S}{2(1 - 0.05S)} - \frac{W_S^2}{2}(1/S - 0.05)$
*Limit: Positive Values of A only when $d = W_S(0.03)$		

EXAMPLE: Shoulder Section

Given:

Shoulder Width	8 ft
Top Course	0.25 ft
Base Course	0.80 ft
Total Depth	1.05 ft
Side Slope	3:1
Shoulder Slope	-0.05
Subgrade Slope	-0.02

Depth	1.05 ft (Case 3)	=	3070 tons/mile
Top Course	0.25 ft (Case 4)	=	-763 tons/mile
Base Course		=	2307 tons/mile
Top Course		=	763 tons/mile
Base Course		=	2307 tons/mile

Estimating – Base and Surfacing Typical Section
Formulae and Example
Figure 520-4

Shoulder Section												
Shldr. Width W_s(ft)	Side Slope S:1	Case	Quantity in Tons Per Mile*									
			Surfacing Depth (ft)									
			0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
4	2	1	73	148	226	304	385	468	553	639	728	818
		2	171	251	333	417	504	592	682	774	869	965
		3	N/A	N/A	131	205	281	360	440	522	605	691
		4	73	149	226	306	387	470	556	643	733	824
	3	1	74	150	230	313	398	486	577	671	768	868
		2	178	262	350	442	536	634	734	838	945	1056
		3	N/A	N/A	131	206	285	366	450	537	627	720
		4	74	151	231	315	402	492	585	681	780	883
	4	1	74	153	235	321	411	505	603	705	810	920
		2	185	275	370	469	572	681	793	910	1032	1158
		3	N/A	N/A	131	208	288	373	461	554	650	750
		4	75	154	237	326	418	516	617	724	834	950
	6	1	75	157	245	339	439	545	658	776	901	1032
		2	204	307	417	535	661	794	936	1085	1242	1406
		3	N/A	N/A	131	210	296	387	485	589	699	815
		4	76	160	252	351	459	574	696	827	965	1111
6	2	1	109	221	334	449	566	685	806	929	1053	1180
		2	325	444	565	688	812	939	1068	1199	1332	1467
		3	N/A	N/A	N/A	239	349	461	575	691	809	929
		4	110	221	335	450	568	687	809	933	1058	1186
	3	1	110	223	339	457	579	703	830	961	1094	1230
		2	338	462	590	722	856	994	1134	1278	1426	1576
		3	N/A	N/A	N/A	239	350	464	581	701	824	949
		4	110	223	340	460	583	709	838	970	1106	1245
	4	1	110	225	343	466	592	722	856	994	1136	1282
		2	352	483	619	760	905	1055	1209	1368	1531	1699
		3	N/A	N/A	N/A	239	351	467	587	711	839	971
		4	111	226	346	470	599	733	871	1013	1160	1311
	6	1	112	229	353	483	620	762	911	1066	1227	1394
		2	386	534	690	853	1025	1204	1391	1585	1788	1998
		3	N/A	N/A	N/A	239	353	474	600	733	871	1016
		4	112	233	360	496	640	791	950	1116	1291	1473
8	2	1	146	293	443	594	747	902	1059	1218	1379	1541
		2	526	683	843	1004	1167	1333	1500	1670	1841	2015
		3	N/A	N/A	N/A	N/A	376	522	670	820	972	1125
		4	146	293	443	595	749	904	1062	1222	1384	1548
	3	1	146	295	447	602	760	920	1084	1250	1419	1591
		2	546	711	879	1050	1224	1402	1583	1766	1954	2144
		3	N/A	N/A	N/A	N/A	376	523	673	825	981	1139
		4	146	296	448	604	763	926	1091	1260	1432	1607
	4	1	147	297	452	610	773	939	1109	1284	1462	1644
		2	568	741	919	1101	1288	1479	1675	1875	2080	2290
		3	N/A	N/A	N/A	N/A	376	524	675	831	990	1153
		4	147	298	454	615	780	950	1124	1302	1486	1673
	6	1	148	302	462	628	801	979	1164	1355	1552	1755
		2	622	816	1017	1226	1443	1668	1900	2140	2388	2643
		3	N/A	N/A	N/A	N/A	376	525	681	842	1009	1183
		4	149	305	469	641	820	1008	1203	1406	1616	1835

Estimating – Base and Surfacing Quantities
Figure 520-5a

Shoulder Section												
Shldr. Width W_s(ft)	Side Slope S:1	Case	Quantity in Tons Per Mile*									
			Surfacing Depth (ft)									
			0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00
4	2	1	910	1004	1100	1198	1297	1399	1502	1608	1715	1824
		2	1063	1163	1266	1370	1476	1585	1695	1807	1922	2038
		3	779	868	960	1053	1148	1245	1344	1445	1548	1652
		4	918	1013	1110	1210	1311	1415	1520	1628	1738	1849
	3	1	971	1076	1185	1296	1410	1527	1647	1770	1896	2024
		2	1169	1286	1406	1529	1655	1785	1918	2053	2193	2335
		3	816	914	1016	1120	1228	1338	1451	1567	1686	1807
		4	989	1098	1210	1326	1444	1566	1691	1820	1951	2086
	4	1	1034	1151	1273	1398	1528	1661	1798	1939	2085	2234
		2	1289	1424	1564	1708	1857	2010	2168	2330	2497	2668
		3	855	963	1075	1191	1311	1435	1562	1694	1830	1969
		4	1070	1194	1323	1456	1594	1737	1884	2035	2191	2352
	6	1	1169	1312	1462	1617	1779	1947	2121	2301	2488	2680
		2	1579	1759	1947	2142	2346	2557	2776	3002	3237	3479
		3	937	1066	1200	1341	1488	1641	1800	1966	2138	2315
		4	1265	1426	1596	1773	1957	2150	2350	2558	2774	2998
6	2	1	1308	1438	1570	1704	1840	1978	2117	2259	2402	2548
		2	1603	1742	1883	2026	2171	2318	2467	2618	2771	2926
		3	1050	1174	1299	1426	1555	1686	1819	1954	2090	2229
		4	1315	1447	1581	1716	1854	1994	2135	2279	2425	2573
	3	1	1369	1510	1655	1802	1953	2106	2262	2421	2583	2748
		2	1729	1886	2046	2209	2376	2545	2718	2894	3073	3255
		3	1078	1209	1343	1480	1620	1763	1909	2058	2209	2363
		4	1387	1532	1681	1832	1987	2145	2306	2471	2638	2809
	4	1	1432	1586	1743	1905	2070	2240	2413	2591	2772	2957
		2	1871	2048	2229	2415	2606	2801	3000	3204	3412	3625
		3	1106	1246	1389	1537	1688	1843	2003	2166	2333	2504
		4	1467	1628	1793	1963	2137	2315	2499	2686	2878	3075
	6	1	1567	1746	1932	2124	2322	2526	2736	2953	3175	3404
		2	2215	2441	2674	2916	3164	3421	3685	3957	4237	4525
		3	1167	1325	1488	1658	1833	2015	2203	2398	2598	2805
		4	1663	1861	2066	2279	2500	2729	2965	3209	3461	3721
8	2	1	1706	1872	2040	2211	2383	2557	2732	2910	3090	3271
		2	2190	2367	2547	2728	2912	3097	3285	3475	3666	3860
		3	1281	1438	1597	1758	1921	2086	2253	2422	2592	2765
		4	1713	1881	2051	2223	2397	2573	2751	2930	3112	3296
	3	1	1766	1944	2125	2309	2495	2685	2877	3072	3271	3472
		2	2338	2534	2734	2937	3144	3353	3566	3782	4001	4223
		3	1300	1464	1631	1801	1974	2149	2328	2509	2693	2880
		4	1785	1966	2151	2339	2530	2724	2921	3122	3326	3533
	4	1	1830	2020	2214	2411	2613	2819	3028	3242	3459	3681
		2	2504	2722	2945	3172	3404	3641	3882	4128	4378	4632
		3	1320	1491	1666	1845	2028	2215	2405	2600	2799	3001
		4	1865	2062	2263	2469	2679	2894	3114	3337	3566	3799
	6	1	1965	2181	2402	2630	2864	3105	3351	3604	3863	4128
		2	2907	3178	3457	3743	4038	4340	4650	4967	5292	5626
		3	1363	1549	1741	1940	2144	2355	2572	2795	3024	3259
		4	2061	2295	2536	2786	3043	3308	3580	3861	4149	4445

Estimating – Base and Surfacing Quantities

Figure 520-5b

Shoulder Section												
Shldr. Width W_s(ft)	Side Slope S:1	Case	Quantity in Tons Per Mile*									
			Surfacing Depth (ft)									
			0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
10	2	1	182	366	551	739	928	1119	1312	1507	1704	1903
		2	773	969	1167	1367	1569	1773	1979	2187	2397	2609
		3	N/A	N/A	N/A	N/A	N/A	543	724	908	1094	1281
		4	182	366	552	740	930	1122	1315	1511	1709	1909
	3	1	182	368	556	747	941	1137	1337	1539	1745	1953
		2	802	1007	1215	1426	1640	1858	2079	2303	2530	2760
		3	N/A	N/A	N/A	N/A	N/A	543	725	910	1098	1289
		4	182	368	557	749	944	1143	1344	1549	1757	1968
	4	1	183	370	560	755	954	1156	1363	1573	1787	2006
		2	834	1049	1268	1492	1721	1954	2191	2433	2679	2930
		3	N/A	N/A	N/A	N/A	N/A	543	726	912	1103	1298
		4	183	371	563	760	961	1167	1377	1592	1811	2035
	6	1	184	374	570	773	982	1196	1417	1644	1878	2117
		2	913	1153	1399	1654	1916	2186	2464	2750	3043	3344
		3	N/A	N/A	N/A	N/A	N/A	543	727	917	1113	1316
		4	185	377	578	786	1001	1225	1456	1695	1942	2197
12	2	1	218	438	660	883	1109	1336	1566	1797	2030	2265
		2	1066	1301	1537	1776	2016	2259	2504	2750	2999	3249
		3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	956	1175	1397
		4	218	438	660	884	1110	1339	1569	1801	2035	2271
	3	1	219	440	664	891	1121	1354	1590	1829	2071	2315
		2	1106	1351	1599	1850	2104	2362	2623	2887	3154	3424
		3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	956	1177	1401
		4	219	441	666	894	1125	1360	1598	1839	2083	2330
	4	1	219	442	669	900	1134	1373	1616	1862	2113	2367
		2	1151	1407	1668	1933	2203	2478	2757	3040	3328	3621
		3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	956	1179	1405
		4	219	443	672	904	1142	1384	1630	1881	2137	2397
	6	1	220	446	679	918	1162	1413	1671	1934	2203	2479
		2	1259	1544	1836	2136	2444	2759	3083	3414	3752	4099
		3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	957	1182	1413
		4	221	450	686	930	1182	1442	1709	1985	2268	2558

Pavement Section										
Width W_P (ft)	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
11	199	398	597	796	995	1194	1393	1592	1791	1990
12	217	434	651	868	1085	1302	1519	1737	1954	2171
22	398	796	1194	1592	1990	2388	2786	3184	3582	3980
24	434	868	1302	1737	2171	2605	3039	3473	3907	4341

* Tabulated quantities are based on compacted weight of 1.85 tons/yd^3

Estimating – Base and Surfacing Quantities

Figure 520-5c

Shoulder Section												
Shldr. Width W_s(ft)	Side Slope S:1	Case	Quantity in Tons Per Mile*									
			Surfacing Depth (ft)									
			0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00
10	2	1	2104	2306	2511	2717	2925	3135	3347	3561	3777	3995
		2	2823	3039	3257	3477	3699	3923	4149	4378	4608	4840
		3	1471	1662	1855	2050	2247	2446	2646	2849	3053	3260
		4	2111	2315	2521	2729	2939	3151	3366	3582	3800	4020
	3	1	2164	2378	2595	2815	3038	3264	3492	3724	3958	4195
		2	2994	3230	3470	3714	3960	4209	4462	4718	4977	5239
		3	1483	1680	1880	2082	2288	2496	2707	2921	3138	3358
		4	2183	2401	2621	2845	3072	3303	3536	3773	4013	4256
	4	1	2228	2454	2684	2918	3156	3398	3643	3893	4147	4404
		2	3186	3446	3710	3980	4253	4531	4814	5101	5393	5689
		3	1496	1699	1905	2116	2330	2548	2770	2996	3227	3460
		4	2263	2496	2734	2976	3222	3473	3729	3989	4253	4522
	6	1	2363	2615	2873	3137	3407	3684	3966	4255	4550	4851
		2	3653	3969	4294	4626	4965	5313	5668	6031	6402	6781
		3	1524	1739	1960	2187	2420	2660	2906	3157	3415	3679
		4	2459	2729	3007	3292	3585	3887	4195	4512	4836	5168
12	2	1	2502	2740	2981	3224	3468	3714	3962	4212	4464	4718
		2	3502	3757	4013	4272	4533	4795	5060	5327	5596	5866
		3	1620	1845	2072	2301	2532	2765	2999	3236	3474	3714
		4	2509	2750	2992	3236	3482	3730	3981	4233	4487	4743
	3	1	2562	2813	3066	3322	3581	3843	4107	4375	4645	4919
		2	3698	3975	4255	4538	4824	5114	5406	5702	6001	6304
		3	1627	1857	2089	2324	2562	2803	3047	3294	3544	3796
		4	2581	2835	3092	3352	3615	3882	4151	4424	4700	4980
	4	1	2626	2888	3154	3424	3698	3976	4258	4544	4834	5128
		2	3918	4220	4526	4837	5152	5472	5796	6125	6458	6796
		3	1635	1869	2107	2348	2594	2844	3098	3355	3617	3882
		4	2661	2930	3204	3482	3765	4052	4344	4640	4941	5246
	6	1	2761	3049	3343	3643	3950	4262	4581	4906	5237	5575
		2	4453	4815	5185	5562	5948	6341	6742	7150	7566	7991
		3	1651	1894	2144	2400	2662	2930	3205	3485	3772	4065
		4	2857	3163	3477	3799	4128	4465	4810	5163	5524	5892

Pavement Section										
Width W_P (ft)	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00
11	2189	2388	2587	2786	2985	3184	3383	3582	3781	3980
12	2388	2605	2822	3039	3256	3473	3690	3907	4124	4341
22	4378	4775	5173	5571	5969	6367	6765	7163	7561	7959
24	4775	5210	5644	6078	6512	6946	7380	7814	8249	8683

* Tabulated quantities are based on compacted weight of 1.85 tons/yd^3

Estimating – Base and Surfacing Quantities
Figure 520-5d

Shoulder Section												
Shldr. Width W_s(ft)	Side Slope S:1	Case	Quantity in Tons Per Mile*									
			Surfacing Depth (ft)									
			1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50
4	2	1	1935	2048	2163	2279	2398	2518	2640	2765	2891	3019
		2	2157	2277	2399	2524	2650	2779	2909	3042	3176	3312
		3	1759	1867	1977	2089	2203	2319	2437	2557	2678	2802
		4	1963	2078	2196	2315	2437	2561	2686	2814	2943	3075
	3	1	2156	2290	2428	2568	2711	2857	3006	3157	3312	3470
		2	2480	2629	2781	2936	3094	3255	3420	3588	3759	3933
		3	1932	2059	2190	2323	2459	2598	2740	2885	3033	3183
		4	2223	2364	2509	2656	2806	2960	3117	3277	3441	3607
	4	1	2387	2543	2704	2869	3038	3210	3387	3567	3752	3940
		2	2844	3025	3210	3399	3593	3792	3995	4202	4415	4631
		3	2113	2260	2412	2567	2726	2890	3057	3228	3403	3582
		4	2517	2686	2860	3039	3222	3410	3602	3799	4000	4206
	6	1	2879	3084	3295	3513	3736	3966	4201	4443	4691	4946
		2	3729	3986	4252	4525	4806	5094	5391	5695	6007	6327
		3	2499	2689	2886	3088	3297	3512	3733	3960	4193	4433
		4	3229	3468	3715	3969	4232	4502	4779	5065	5358	5659
6	2	1	2695	2844	2995	3147	3302	3459	3617	3778	3940	4104
		2	3083	3242	3403	3566	3731	3898	4067	4238	4411	4586
		3	2369	2511	2655	2802	2949	3099	3251	3404	3560	3717
		4	2722	2874	3028	3184	3341	3501	3663	3827	3993	4160
	3	1	2916	3086	3260	3436	3615	3798	3983	4170	4361	4555
		2	3440	3629	3821	4016	4214	4416	4620	4828	5039	5253
		3	2521	2681	2844	3010	3179	3351	3525	3703	3883	4067
		4	2983	3160	3341	3524	3711	3901	4094	4290	4490	4692
	4	1	3146	3339	3536	3737	3942	4151	4364	4580	4801	5026
		2	3843	4065	4291	4523	4758	4998	5243	5492	5746	6004
		3	2679	2858	3041	3228	3418	3613	3812	4014	4221	4431
		4	3276	3482	3692	3907	4127	4350	4579	4812	5049	5291
	6	1	3639	3880	4127	4381	4640	4906	5178	5456	5741	6031
		2	4820	5123	5434	5753	6079	6413	6755	7105	7462	7827
		3	3017	3236	3461	3693	3930	4174	4423	4679	4941	5210
		4	3989	4264	4547	4837	5136	5442	5756	6078	6407	6745
8	2	1	3454	3640	3827	4016	4207	4399	4594	4791	4989	5189
		2	4055	4253	4452	4654	4858	5063	5271	5480	5692	5906
		3	2939	3115	3293	3473	3655	3839	4024	4212	4401	4592
		4	3482	3670	3860	4052	4246	4442	4640	4840	5042	5246
	3	1	3675	3882	4092	4304	4520	4738	4959	5183	5410	5640
		2	4449	4677	4909	5144	5382	5624	5869	6116	6367	6622
		3	3070	3263	3459	3658	3859	4064	4271	4481	4695	4911
		4	3743	3956	4173	4392	4615	4841	5071	5303	5539	5778
	4	1	3906	4135	4368	4606	4847	5092	5341	5593	5850	6111
		2	4891	5155	5423	5696	5973	6255	6541	6832	7127	7427
		3	3208	3418	3632	3851	4073	4299	4529	4763	5001	5243
		4	4036	4278	4524	4775	5031	5291	5556	5825	6098	6376
	6	1	4399	4676	4959	5249	5545	5847	6155	6469	6790	7116
		2	5966	6315	6671	7035	7407	7787	8174	8569	8972	9383
		3	3501	3749	4002	4262	4529	4801	5079	5364	5655	5952
		4	4748	5060	5379	5706	6040	6383	6733	7091	7456	7830

Estimating – Base and Surfacing Quantities

Figure 520-5e

Shoulder Section												
Shldr. Width W_s(ft)	Side Slope S:1	Case	Quantity in Tons Per Mile*									
			Surfacing Depth (ft)									
			1.55	**1.60**	**1.65**	**1.70**	**1.75**	**1.80**	**1.85**	**1.90**	**1.95**	**2.00**
4	2	1	3148	3280	3414	3549	3687	3826	3967	4110	4255	4402
		2	3451	3591	3734	3878	4025	4173	4324	4477	4631	4788
		3	2927	3054	3183	3314	3447	3582	3718	3857	3997	4139
		4	3209	3344	3482	3622	3763	3907	4053	4201	4350	4502
	3	1	3630	3793	3959	4129	4300	4475	4653	4834	5017	5203
		2	4110	4291	4475	4662	4852	5045	5242	5441	5644	5850
		3	3337	3493	3652	3814	3979	4147	4318	4492	4668	4848
		4	3777	3950	4126	4305	4488	4673	4862	5054	5250	5448
	4	1	4133	4329	4529	4733	4941	5153	5369	5589	5812	6040
		2	4852	5078	5308	5543	5782	6026	6274	6527	6784	7046
		3	3764	3951	4142	4337	4535	4738	4944	5155	5369	5587
		4	4416	4631	4850	5074	5302	5535	5773	6015	6261	6512
	6	1	5206	5473	5745	6024	6310	6601	6898	7202	7512	7828
		2	6654	6989	7332	7683	8041	8407	8781	9163	9552	9950
		3	4678	4930	5188	5452	5722	5999	6282	6570	6865	7166
		4	5968	6285	6609	6941	7281	7628	7984	8347	8718	9096
6	2	1	4270	4438	4608	4779	4953	5128	5306	5485	5666	5849
		2	4763	4942	5123	5306	5491	5678	5868	6059	6252	6447
		3	3876	4038	4201	4365	4532	4701	4871	5044	5218	5394
		4	4330	4502	4676	4852	5030	5210	5391	5575	5761	5949
	3	1	4752	4951	5153	5359	5567	5778	5992	6208	6428	6651
		2	5471	5691	5915	6142	6372	6605	6842	7082	7325	7571
		3	4253	4442	4634	4829	5026	5227	5430	5637	5846	6058
		4	4898	5107	5320	5535	5754	5976	6201	6429	6660	6895
	4	1	5254	5486	5723	5963	6207	6455	6707	6963	7223	7487
		2	6267	6534	6806	7082	7363	7648	7938	8233	8532	8835
		3	4645	4864	5086	5312	5542	5776	6014	6256	6501	6751
		4	5537	5788	6044	6304	6569	6838	7111	7389	7672	7959
	6	1	6328	6630	6939	7254	7576	7903	8237	8577	8923	9275
		2	8200	8581	8969	9365	9769	10181	10600	11028	11463	11905
		3	5484	5765	6051	6344	6643	6949	7260	7578	7901	8231
		4	7090	7442	7803	8171	8547	8931	9322	9721	10128	10543
8	2	1	5391	5595	5801	6009	6219	6431	6644	6859	7077	7296
		2	6121	6339	6559	6780	7004	7230	7457	7687	7919	8153
		3	4785	4980	5177	5376	5577	5779	5984	6190	6398	6608
		4	5452	5660	5870	6082	6296	6512	6730	6950	7172	7396
	3	1	5873	6109	6347	6589	6833	7080	7330	7583	7839	8098
		2	6879	7140	7403	7670	7940	8214	8490	8770	9053	9339
		3	5129	5351	5576	5803	6034	6267	6503	6743	6985	7229
		4	6020	6265	6514	6765	7020	7278	7539	7804	8071	8342
	4	1	6376	6644	6917	7193	7473	7758	8046	8338	8634	8934
		2	7731	8040	8354	8671	8994	9321	9652	9988	10329	10674
		3	5488	5738	5992	6249	6511	6776	7046	7319	7596	7877
		4	6659	6946	7238	7534	7835	8140	8450	8764	9083	9406
	6	1	7449	7788	8133	8485	8842	9206	9575	9951	10333	10722
		2	9801	10227	10661	11103	11552	12009	12474	12947	13427	13915
		3	6255	6565	6880	7202	7530	7864	8204	8550	8903	9262
		4	8211	8600	8997	9401	9813	10233	10661	11096	11539	11990

Estimating – Base and Surfacing Quantities
Figure 520-5f

Shoulder Section												
Shldr. Width W_s(ft)	Side Slope S:1	Case	Quantity in Tons Per Mile*									
			Surfacing Depth (ft)									
			1.05	**1.10**	**1.15**	**1.20**	**1.25**	**1.30**	**1.35**	**1.40**	**1.45**	**1.50**
10	2	1	4214	4436	4659	4884	5111	5340	5571	5804	6038	6275
		2	5074	5310	5548	5788	6031	6275	6521	6769	7019	7272
		3	3468	3678	3890	4104	4320	4537	4757	4978	5201	5427
		4	4242	4466	4692	4920	5150	5382	5617	5853	6091	6331
	3	1	4435	4678	4924	5173	5424	5679	5936	6196	6460	6726
		2	5505	5774	6045	6320	6599	6880	7165	7453	7744	8038
		3	3581	3806	4035	4266	4501	4738	4978	5221	5467	5715
		4	4503	4752	5005	5261	5520	5782	6048	6316	6588	6863
	4	1	4666	4931	5201	5474	5751	6032	6317	6606	6899	7196
		2	5990	6295	6605	6919	7238	7561	7889	8221	8558	8900
		3	3698	3940	4186	4436	4689	4947	5208	5474	5743	6017
		4	4796	5074	5357	5644	5935	6232	6532	6838	7147	7462
	6	1	5158	5472	5792	6117	6449	6787	7132	7482	7839	8202
		2	7167	7561	7963	8373	8790	9215	9648	10088	10537	10993
		3	3950	4226	4509	4798	5093	5394	5701	6015	6334	6660
		4	5508	5856	6211	6574	6945	7323	7710	8104	8506	8915
12	2	1	4974	5231	5491	5752	6015	6281	6548	6816	7087	7360
		2	6139	6414	6691	6969	7250	7533	7818	8104	8393	8684
		3	3956	4200	4446	4694	4944	5195	5449	5704	5961	6220
		4	5002	5262	5524	5788	6055	6323	6593	6866	7140	7416
	3	1	5195	5474	5756	6041	6329	6619	6913	7209	7509	7811
		2	6609	6918	7230	7545	7863	8184	8509	8837	9168	9502
		3	4052	4310	4571	4836	5103	5372	5645	5921	6199	6481
		4	5262	5548	5837	6129	6424	6723	7024	7329	7637	7948
	4	1	5425	5727	6033	6342	6656	6973	7294	7619	7948	8282
		2	7138	7485	7836	8192	8553	8917	9287	9661	10039	10422
		3	4151	4425	4702	4983	5268	5557	5850	6147	6448	6753
		4	5556	5870	6189	6512	6840	7172	7509	7851	8197	8547
	6	1	5918	6268	6624	6986	7354	7728	8109	8495	8888	9287
		2	8422	8862	9309	9764	10227	10698	11176	11662	12156	12657
		3	4364	4669	4981	5298	5622	5952	6288	6630	6979	7333
		4	6268	6652	7043	7442	7849	8264	8687	9117	9555	10001
Pavement Section												
Width W_P (ft)			**1.05**	**1.10**	**1.15**	**1.20**	**1.25**	**1.30**	**1.35**	**1.40**	**1.45**	**1.50**
11			4179	4378	4576	4775	4974	5173	5372	5571	5770	5969
12			4558	4775	4993	5210	5427	5644	5861	6078	6295	6512
22			8357	8755	9153	9551	9949	10347	10745	11143	11541	11939
24			9117	9551	9985	10419	10853	11287	11722	12156	12590	13024

* Tabulated quantities are based on compacted weight of 1.85 tons/yd^3

Estimating – Base and Surfacing Quantities
Figure 520-5g

Shoulder Section												
Shldr. Width W_s(ft)	**Side Slope S:1**	**Case**	**Quantity in Tons Per Mile***									
			Surfacing Depth (ft)									
			1.55	**1.60**	**1.65**	**1.70**	**1.75**	**1.80**	**1.85**	**1.90**	**1.95**	**2.00**
10	2	1	6513	6753	6995	7239	7485	7733	7983	8234	8488	8743
		2	7526	7782	8041	8301	8563	8827	9094	9362	9632	9905
		3	5654	5883	6113	6346	6581	6817	7056	7296	7538	7782
		4	6573	6818	7064	7312	7562	7814	8069	8325	8583	8843
	3	1	6995	7266	7541	7819	8099	8382	8669	8958	9250	9545
		2	8335	8636	8940	9247	9557	9870	10187	10506	10829	11156
		3	5967	6221	6479	6739	7002	7268	7537	7809	8084	8361
		4	7141	7423	7707	7995	8286	8581	8878	9179	9482	9789
	4	1	7497	7802	8111	8423	8740	9060	9385	9713	10045	10381
		2	9246	9596	9951	10311	10675	11043	11416	11794	12176	12563
		3	6294	6575	6860	7149	7442	7739	8040	8344	8653	8966
		4	7780	8104	8432	8764	9101	9442	9788	10139	10494	10853
	6	1	8571	8946	9327	9715	10108	10508	10914	11326	11744	12169
		2	11457	11928	12408	12895	13390	13892	14403	14921	15447	15980
		3	6992	7330	7674	8025	8382	8744	9113	9488	9870	10257
		4	9333	9758	10191	10631	11079	11536	11999	12471	12950	13437
12	2	1	7634	7911	8189	8469	8751	9035	9321	9609	9899	10190
		2	8977	9272	9569	9868	10168	10471	10776	11083	11392	11703
		3	6481	6744	7009	7276	7544	7814	8087	8361	8637	8915
		4	7695	7975	8258	8542	8828	9117	9407	9700	9994	10291
	3	1	8116	8424	8735	9049	9365	9685	10007	10333	10661	10992
		2	9840	10180	10524	10871	11221	11575	11931	12291	12654	13020
		3	6765	7052	7342	7635	7931	8230	8532	8836	9144	9454
		4	8263	8581	8901	9225	9553	9883	10216	10553	10893	11236
	4	1	8619	8960	9304	9653	10006	10363	10723	11088	11456	11829
		2	10810	11202	11599	12000	12405	12816	13230	13650	14073	14502
		3	7061	7374	7691	8011	8335	8664	8996	9332	9672	10017
		4	8902	9262	9626	9994	10367	10745	11127	11514	11905	12300
	6	1	9692	10103	10521	10945	11374	11810	12253	12701	13155	13616
		2	13167	13684	14209	14741	15282	15830	16386	16949	17521	18100
		3	7694	8061	8434	8813	9199	9590	9988	10392	10802	11218
		4	10454	10915	11384	11861	12346	12838	13338	13846	14361	14885

Pavement Section										
Width W_P (ft)	**1.55**	**1.60**	**1.65**	**1.70**	**1.75**	**1.80**	**1.85**	**1.90**	**1.95**	**2.00**
11	6168	6367	6566	6765	6964	7163	7362	7561	7760	7959
12	6729	6946	7163	7380	7597	7814	8031	8249	8466	8683
22	12337	12735	13133	13530	13928	14326	14724	14122	15520	15918
24	13458	13892	14326	14761	15195	15629	16063	16497	16931	17365

* Tabulated quantities are based on compacted weight of 1.85 tons/yd^3

Estimating – Base and Surfacing Quantities
Figure 520-5h

530.01 General

Geosynthetics include a variety of manufactured products that are used in drainage, earthwork, erosion control, and soil reinforcement applications.

Several geosynthetic applications are addressed in the *Standard Specifications for Road, Bridge, and Municipal Construction* (Standard Specifications). These applications are as follows:

- Low survivability underground drainage
- Moderate survivability underground drainage
- Separation
- Soil stabilization
- Moderate survivability permanent erosion control
- High survivability permanent erosion control
- Ditch lining
- Temporary silt fence

The Standard Specifications address geosynthetic properties as well as installation requirements and are not site specific. Geosynthetic properties provided in the Standard Specifications are based on the range of soil conditions likely to be encountered in the state of Washington for the applications defined. Other applications, such as prefabricated edge drains, pond liners, and geotextile retaining walls, are currently handled by special provision.

Design responsibilities are discussed in 530.05 below and illustrated in Figures 530-4 and 5.

This chapter does not address applications where geosynthetics are used to help establish vegetation through temporary prevention of erosion (vegetation mats).

530.02 References

Highway Runoff Manual, M 31-15, WSDOT

Hydraulics Manual, M 23-03, WSDOT

<u>*WSDOT*</u> *Pavement* <u>*Policy*</u>

Plans Preparation Manual, M 22-31, WSDOT

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

530.03 Geosynthetic Types and Characteristics

Geosynthetics include woven and nonwoven geotextiles, geogrids, geonets, geomembranes, and geocomposites. Terms used in the past for these construction materials include *fabrics*, *filter fabric*, or *filter cloth* which are for the most part synonymous with the newer term *geotextile*.

Photographs of the various types of geosynthetics are provided in Figure 530-6.

Woven geotextiles consist of slit polymer tapes, monofilament fibers, fibrillated yarns, or multifilament yarns simply woven into a mat. Woven geotextiles generally have relatively high strength and stiffness and, except for the monofilament wovens, relatively poor drainage characteristics.

Nonwoven geotextiles consist of a sheet of continuous or staple fibers entangled randomly into a felt in the case of needle-punched nonwovens, and pressed and melted together at the fiber contact points in the case of heat-bonded nonwovens. Nonwoven geotextiles tend to have low to medium strength and stiffness with high elongation at failure, and relatively good drainage characteristics. The high elongation characteristic gives them superior ability to deform around stones and sticks.

Geogrids consist of a polymer grid mat constructed either of coated yarns or punched and stretched polymer sheet and usually have high strength and stiffness. They are used primarily for soil reinforcement.

Geonets are similar to geogrids but are typically lighter weight, weaker, and have smaller mesh openings. They are used in light reinforcement applications or are combined with drainage geotextiles to form a drainage structure.

Geomembranes consist of impervious polymer sheets that are typically used to line ponds or landfills, or in some cases are placed over moisture sensitive swelling clays to control moisture.

Geocomposites include prefabricated edge drains, wall drains, and sheet drains, that consist typically of a cuspated or dimpled polyethylene drainage core wrapped in a geotextile. The geotextile wrap keeps the core clean so that water can freely flow through the drainage core. The drainage core acts as a conduit. Prefabricated edge drains are used in place of shallow geotextile wrapped trench drains at the edges of the roadway to provide subgrade and base drainage. Wall drains and sheet drains are typically placed between the back of the wall and the soil to drain the soil retained by the wall.

530.04 Geosynthetic Function Definitions and Applications

The function of the geosynthetic varies with the application. See Figure 530-7 for pictorial representations of the various applications. The geosynthetic must be designed with its function(s) in the given application in mind. Typical geosynthetic functions include filtration, drainage, separation, reinforcement, and erosion control. Definitions of these functions and examples of applications where these functions are dominant are as follows:

Geosynthetic filtration is defined as the passage of water through the geosynthetic relatively unimpeded (permeability or permittivity) without allowing passage of soil through the geosynthetic (retention). This is the primary function of geotextiles in underground drainage applications.

Drainage is defined as the carrying of water in the plane of the geosynthetic as a conduit (transmissivity). This is a primary function of geocomposite drains and in some cases thick nonwoven needle-punched geotextiles placed in underground drainage applications where water must be transported away from a given location by the geosynthetic itself.

Separation is defined as the prevention of the mixing of two dissimilar materials. This is a primary function of geotextiles placed between a fine-grained subgrade and a granular base course beneath a roadway.

Reinforcement is defined as the strengthening of a soil mass by the inclusion of elements (geosynthetics) that have tensile strength. This is the primary function of high strength geotextiles and geogrids in geosynthetic reinforced wall or slope applications, or in roadways placed over very soft subgrade soils that are inadequate to support the weight of the construction equipment or even the embankment itself.

Geosynthetic erosion control is defined as the minimizing of surficial soil particle movement due to the flow of water over the surface of bare soil or due to the disturbance of soil caused by construction activities under or near bodies of water. This is the primary function of geotextiles used as silt fences or placed beneath riprap or other stones on soil slopes. Silt fences keep eroded soil particles on the construction site, whereas geotextiles placed beneath riprap or other stones on soil slopes prevent erosion from taking place at all. In general, the permanent erosion control methods described in this chapter are only used where more natural means (such as the use of biodegradable vegetation mats to establish vegetation to prevent erosion) are not feasible.

These functions control some of the geosynthetic properties, such as apparent opening size (AOS) and permittivity, and in some cases load-strain characteristics.

The application will also affect the geosynthetic installation conditions. These installation conditions influence the remaining geosynthetic properties needed, based on the *survivability* level required.

Geosynthetic survivability is defined as the ability of the geosynthetic to resist installation conditions without significant damage, such that the geosynthetic can function as intended. Survivability affects the strength properties of the geosynthetic required.

530.05 Design Approach for Geosynthetics

Four questions must be answered to complete a geosynthetic design:

- Is a geosynthetic really needed?
- What geosynthetic properties will ensure that the geosynthetic functions as intended?
- Where should the geosynthetic be located?
- Will maintenance of the geosynthetic, or the structure of which it is a part, be needed? And, if so, how will it be maintained?

The site conditions and purpose for the geotextile are reviewed to determine whether or not a geotextile is needed.

- For most drainage, separation, soil stabilization, permanent erosion control, and silt fence applications, if a geotextile is needed the geotextile properties in the Standard Specifications can be used.
- In some situations where soil conditions are especially troublesome or in critical or high risk applications, a project specific design may be needed.
- The location of the geosynthetic will depend on how it is intended to function. (See Figure 530-7 for examples.)
- Consider the flow path of any ground water or surface water when locating the geotextile as well as selecting the geotextile to be used. For example, in permanent erosion control applications, water may flow to the geotextile from the existing ground as well as from the surface through wave action, stream flow, or overland sheet flow. For saturated fine sandy or silty subgrades, water must be able to flow from the subgrade through the geotextile soil stabilization layer during the pumping action caused by traffic loads.

Background information and the answers to each of these questions, or at least guidance to obtaining the answers to these questions, are provided for each Standard Specification application as follows:

(1) Underground Drainage, Low and Moderate Survivability

Geotextile used for underground drainage must provide filtration to allow water to reach the drain aggregate without allowing the aggregate to be contaminated by finer soil particles.

Geotextile filtration properties are a function of the soil type. For underground drainage applications, if the subgrade soil is relatively clean gravel or coarse sand, a geotextile is probably not required. At issue is whether or not there are enough fines in the surrounding soil to eventually clog the drain rock or drain pipe if unrestricted flow toward the drain is allowed.

To approximately match the geotextile filtration properties to various soil types, specifications for three classes of Construction Geotextile for Underground Drainage are available in the Standard Specifications. For underground drainage applications, use the gradation of the soil, specifically the percent by weight passing the #200 sieve, to select the drainage geotextile class required. Base selection of the appropriate class of geotextile on the following table:

Percent Passing the #200 Sieve	Geotextile Class
Less than 15%	A
15% to 50%	B
Greater than 50%	C

Selection Criteria for Geotextile Class
Figure 530-1

Obtain soil samples for geotextile underdrain design every 300 ft along the roadway alignment, using hand holes, and at major soil type transitions. This may be spread to every 1,000 ft if the soil conditions appear to be uniform. Use existing soil data where feasible instead of taking new soil samples.

If soil conditions vary widely along the alignment where underground drainage geotextile is anticipated, different classes of drainage geotextile may be required for specific sections of a continuous system.

Strength properties for the underground drainage geotextile depend on the survivability level required to resist installation stresses.

Low survivability designates that the installation stresses placed on the geotextile will be relatively low, requiring only moderate geotextile strength to resist potentially damaging installation conditions. Examples of low survivability level underground drainage applications include:

- Trench drains
- Drains placed behind walls or other structures to drain the backfill
- A geotextile filter sheet placed behind a gabion wall to prevent fines from being washed through the gabion wall face. Trench depths, or the height of the geotextile filter sheet behind gabion walls, must be less than or equal to 6 ft for the low survivability level.

In moderate survivability applications, significant installation stresses may occur, requiring higher geotextile strength. Examples of the moderate survivability application include:

- Trench drains with a depth of greater than 6 ft
- A geotextile filter sheet behind a gabion wall with a height greater than 6 ft
- Any area drain

An area drain is defined as a geotextile placed over or under a horizontal to moderately sloping (1.5H:1V or flatter slope) layer of drainage aggregate. Examples of area drains include:

- Drainage layers over cut-and-cover tunnels
- Rock buttress drainage
- Permeable base beneath highway pavement (see the *WSDOT Pavement Policy* for additional information on permeable bases)
- A parking lot drainage layer

Note that pipe wrapping (the geotextile is wrapped around the surface of the pipe) is not included as an underground drainage application.

Locate the geotextile such that it will function as intended. For example, if the objective is to keep the drainage aggregate surrounding a drain pipe clean, locate the geotextile such that it completely separates the drainage aggregate from more silty surrounding soils, which may include native soils as well as relatively silty roadway base or fill materials.

Consider the flow path of any ground water or surface water when locating the geotextile.

The flow path from the geotextile, as part of the ground water drainage, is typically directed to a surface water conveyance system. Design of surface water conveyance is guided by the *Hydraulics Manual*. The surface water conveyance must be low enough to prevent backflow and charging of the ground water drainage; typically by matching inverts of ground water drainage to crowns of surface water conveyance pipes. A 1 ft allowance is usually applied when connecting to open water or ditches.

(2) Separation

Geotextile used for separation must prevent penetration of relatively fine grained subgrade soil into the ballast or other roadway or parking lot surfacing material to prevent contamination of the surfacing material (the separation function). This application may also apply to situations other than beneath roadway or parking lot surfacing where it is not necessary for water to drain through the geotextile unimpeded (filtration), but where separation of two dissimilar materials is required.

640.01 General

Geometric cross sections for state highways are governed by functional classification criteria, traffic volume, and whether the highway is in a rural or an urban area. (See Chapter 440 for information on functional class.)

High Occupancy Vehicle (HOV) lanes must be considered when continuous through lanes are to be added within the limits of an urban area with a population over 200,000. (See Chapter 1050.)

When a state highway within an incorporated city or town is a portion of a city street, the design features must be developed in cooperation with the local agency. (See Chapter 440 for guidance on geometric design data when a state highway within an incorporated city or town is a portion of a city street.)

For additional information, see the following chapters:

Chapter	Subject
430	Roadway widths and cross slopes for modified design level
440	Minimum lane and shoulder widths for full design level
440	Shoulder widths at curbs
510	Geotechnical investigation
520	Pavement type
641	Turning roadway width
642	Superelevation
910	Requirements for islands
940	Lane and shoulder widths for ramps
960	Median crossovers

640.02 References

Design Guidance

Highway Runoff Manual, M 31-16, WSDOT

Local Agency Guidelines (LAG), M 36-63, WSDOT

Plans Preparation Manual, M 22-31, WSDOT

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

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

640.03 Definitions

auxiliary lane The portion of the roadway adjoining the through lanes for parking, speed change, turning, storage for turning, weaving, truck climbing, and other purposes supplementary to through-traffic movement.

divided multilane A roadway with two or more through lanes in each direction and a median that physically or legally prohibits left turns, except at designated locations.

freeway A divided highway that has a minimum of two lanes in each direction, for the exclusive use of traffic, and with full control of access.

high pavement type Portland cement concrete pavement or hot mix asphalt (HMA) pavement on a treated base.

intermediate pavement type Hot mix asphalt pavement on an untreated base.

lane A strip of roadway used for a single line of vehicles.

lane width The lateral design width for a single lane, striped as shown in the Standard Plans and the Standard Specifications.

low pavement type Bituminous surface treatment (BST).

median The portion of a highway separating the traveled ways for traffic in opposite directions.

outer separation The area between the outside edge of the traveled way for through traffic and the nearest edge of the traveled way of a frontage road or a collector-distributor road.

roadway The portion of a highway, including shoulders, for vehicular use.

rural design area An area that meets none of the conditions to be an urban design area.

shoulder The portion of the roadway contiguous with the traveled way, primarily for accommodation of stopped vehicles, emergency use, lateral support of the traveled way, and use by pedestrians.

shoulder width The lateral width of the shoulder, measured from the outside edge of the outside lane to the edge of the roadway.

superelevation The rotation of the roadway cross section in such a manner as to overcome part of the centrifugal force that acts on a vehicle traversing a curve.

traveled way The portion of the roadway intended for the movement of vehicles, exclusive of shoulders and lanes for parking, turning, and storage for turning.

turning roadway A curve on an open highway, a ramp, or the connecting portion of the roadway between two intersecting legs of an intersection.

undivided multilane A roadway with two or more through lanes in each direction on which left turns are not controlled.

urban area An area designated by the Washington State Department of Transportation (WSDOT) in cooperation with the Transportation Improvement Board and regional transportation planning organizations, subject to the approval of the FHWA.

urban design area An area where urban design criteria is appropriate, that is defined by one or more of the following:

- An urban area.
- An area within the limits of an incorporated city or town.
- An area characterized by intensive use of the land for the location of structures, that receives such urban services as sewer, water, and other public utilities, as well as services normally associated with an incorporated city or town. This may include an urban growth area defined under the Growth Management Act (see Chapter 36.70A RCW, Growth management – planning by selected counties and cities), but outside the city limits.
- An area with not more than 25% undeveloped land.

640.04 Roadways

The cross sections shown in Figures 640-1, 2, 3, 4a, and 4b represent minimum values for full design level. (See Chapter 440 for additional design information for full design level and Chapter 430 for cross sections and design information for modified design level.)

(1) Traveled Way Cross Slope

The cross slope on tangents and curves is a main element in roadway design. The cross slope or crown on tangent sections and large radius curves is complicated by two contradicting controls. Reasonably steep cross slopes are desirable to aid in water runoff and to minimize ponding as a result of pavement imperfections and unequal settlement. However, steep cross slopes are undesirable on tangents because of the tendency for vehicles to drift to the low side of the roadway. Steeper cross slopes are noticeable in steering, and they increase susceptibility to sliding to the side on icy or wet pavements.

A 2% cross slope is normally used for tangents and large radius curves on high and intermediate pavement types. With justification, cross slopes may vary by ± 0.5% from the target 2% cross slope. Do not design cross slopes flatter than 1.5%.

On low pavement types, the cross slope may be increased to 3% to allow for reduced construction control and greater settlement.

Superelevation on curves is a function of the design speed and the radius of the curve. (See Chapter 642 for guidance on superelevation design.)

Chapter 642 Superelevation

642.01 General

To maintain the desired design speed, highway and ramp curves are usually superelevated to overcome part of the centrifugal force that acts on a vehicle.

For additional information, see the following chapters:

Chapter	**Subject**
430	Roadway widths and cross slopes for modified design level
440	Minimum lane and shoulder widths for full design level
940	Lane and shoulder widths for ramps

642.02 References

(1) Design Guidance

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

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

(2) Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

642.03 Definitions

lane A strip of roadway used for a single line of vehicles.

lane width The lateral design width for a single lane, striped as shown in the *Standard Plans* and the *Standard Specifications*.

median The portion of a highway separating the traveled ways for traffic in opposite directions.

roadway The portion of a highway, including shoulders, for vehicular use.

superelevation (super) The rotation of the roadway cross section in such a manner as to overcome part of the centrifugal force that acts on a vehicle traversing a curve.

superelevation runoff The length of highway needed to accomplish the change in cross slope from a section with adverse crown removed (level) to a fully superelevated section, or vice versa.

superelevation transition length The length of highway needed to change the cross slope from normal crown or normal pavement slope to full superelevation.

tangent runout The length of highway needed to change the cross slope from normal crown to a section with adverse crown removed (level).

traveled way The portion of the roadway intended for the movement of vehicles, exclusive of shoulders and lanes for parking, turning, and storage for turning.

turning roadway A curve on an open highway, a ramp, or the connecting portion of roadway between two intersecting legs of an intersection.

642.04 Superelevation Rate Selection

The maximum superelevation rate allowed is 10%.

Depending on design speed, construct large-radius curves with a normal crown section. The minimum radii for normal crown sections are shown in Figure 642-1. Superelevate curves with smaller radii as follows:

- Figure 642-4a (e_{max}=10%) is preferred for all open highways, ramps, and long-term detours (especially when associated with a main line detour).
- Figure 642-4b (e_{max}=8%) may be used for freeways in urban design areas and areas where the e_{max}=6% rate is allowed but e_{max}=8% is preferred.
- Figure 642-4c (e_{max}=6% Max) may be used, with justification, for nonfreeways in urban design areas, in mountainous areas, and for short-term detours (generally implemented and removed in one construction season).
- Figure 642-5 may be used for turning roadways at intersections, for urban managed access highways with a design speed of 40 mph or less, and, with justification, for ramps in urban areas with a design speed of 40 mph or less.

When selecting superelevation for a curve, consider the existing curves on the corridor. To maintain route continuity and driver expectance on open highways, select the chart (see Figure 643-4a, 4b, or 4c) that best matches the superelevation on the existing curves.

In locations that experience regular accumulations of snow and ice, limit superelevation from the selected chart to 6% or less. In these areas, justification is required for superelevation rates greater than 6%. Vehicles moving at slow speeds or stopped on curves with supers greater than 6% tend to slide inward on the radius (downslope).

Round the selected superelevation rate to the nearest full percent.

Design Speed (mph)	Minimum Radius for Normal Crown Section (ft)
15	945
20	1,680
25	2,430
30	3,325
35	4,360
40	5,545
45	6,860
50	8,315
55	9,920
60	11,675
65	13,130
70	14,675
75	16,325
80	18,065

Minimum Radius for Normal Crown Section
Figure 642-1

642.05 Existing Curves

Evaluate the superelevation on an existing curve to determine its adequacy. Use the equation in Figure 642-2 to determine the minimum radius for a given superelevation and design speed. Superelevation is deficient when the existing radius is less than the minimum from the equation.

$$R = \frac{6.68V^2}{e+f}$$

Where:

R = The minimum allowable radius of the curve (ft)
V = Design speed (mph)
e = Superelevation rate (%)
f = Side friction factor from Figure 642-3

Minimum Radius for Existing Curves
Figure 642-2

For Preservation projects where the existing pavement is to remain in place, the superelevation on existing curves may be evaluated with a ball banking analysis.

Corrective action is required to address deficient superelevation when the existing radius is less than the minimum radius calculated using the equation or when the maximum speed determined by a ball banking analysis is less than the design speed. Provide superelevation as given in 642.04.

Design Speed (mph)	Side Friction Factor (f)
15	32
20	27
25	23
30	20
35	18
40	16
45	15
50	14
55	13
60	12
65	11
70	10
75	9
80	8

Side Friction Factor
Figure 642-3

642.06 Turning Movements at Intersections

Curves associated with the turning movements at intersections are superelevated using the rates for low-speed urban roadway curves. Use superelevation rates as high as feasible, consistent with curve length and climatic conditions. Figure 642-5 shows the minimum superelevation for the given design speed and radius. Use judgment in considering local conditions such as snow and ice. When using high superelevation rates on short curves, provide smooth transitions with merging ramps or roadways.

642.07 Runoff for Highway Curves

For added comfort and safety, provide uniform superelevation runoff over a length adequate for the likely operating speeds. The length of the runoff is based on a maximum allowable difference between the grades on the pivot point and the outer edge of traveled way for one 12-foot lane.

Provide transitions for all superelevated highway curves as specified in Figures 642-6a through 6e. Which transition to use depends on the location of the pivot point, the direction of the curve, and the roadway cross slope.

Pay close attention to the profile of the edge of traveled way created by the superelevation runoff; do not let it appear distorted. The combination of superelevation transition and grade may result in a hump or dip in the profile of the edge of traveled way. When this happens, the transition may be lengthened to eliminate the hump or dip. If the hump and dip cannot be eliminated this way, pay special attention to drainage in the low areas to prevent ponding. Locating the pivot point at the centerline of the roadway will also help to minimize humps and dips at the edge of the traveled lane and will reduce the required superelevation runoff length.

When reverse curves are necessary, provide sufficient tangent length for complete superelevation runoff for both curves (that is, from full superelevation of the first curve to level to full superelevation of the second curve). If tangent length is longer than this but not sufficient to provide full super transitions (that is, from full superelevation of the first curve to normal crown to full superelevation of the second curve), increase the superelevation runoff lengths until they abut. This provides one continuous transition, without a normal crown section, similar to Designs C^2 and D^2 in Figures 642-6c and 6d, except that full super will be attained rather than the normal pavement slope as shown.

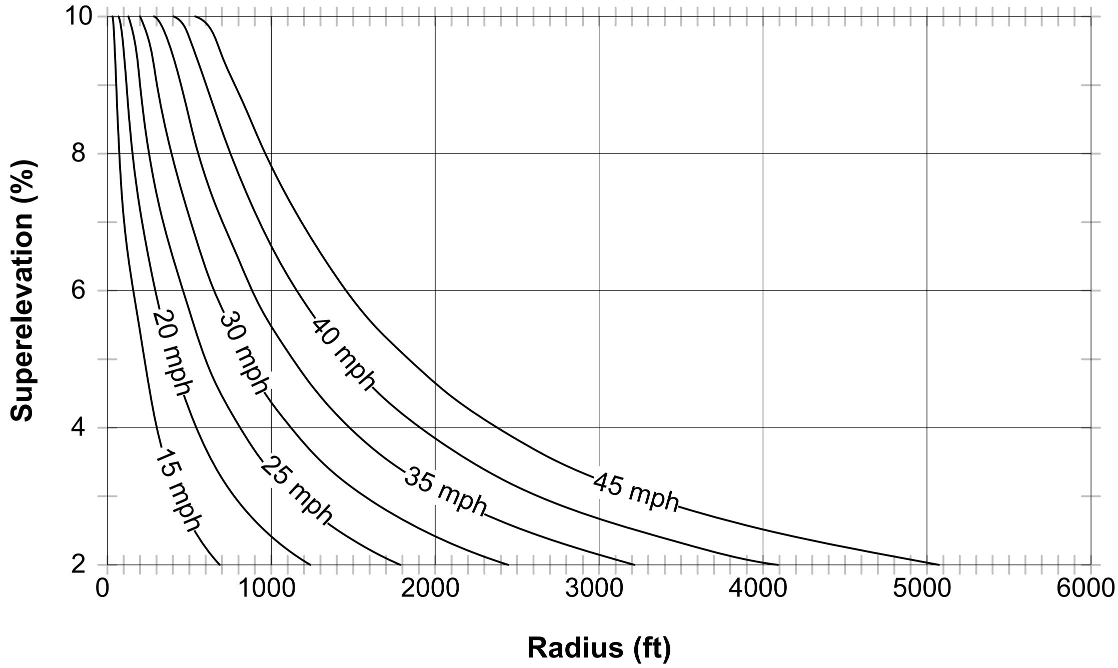
Superelevation runoff is permissible on structures but not desirable. Whenever feasible, strive for full super or normal crown slopes on structures.

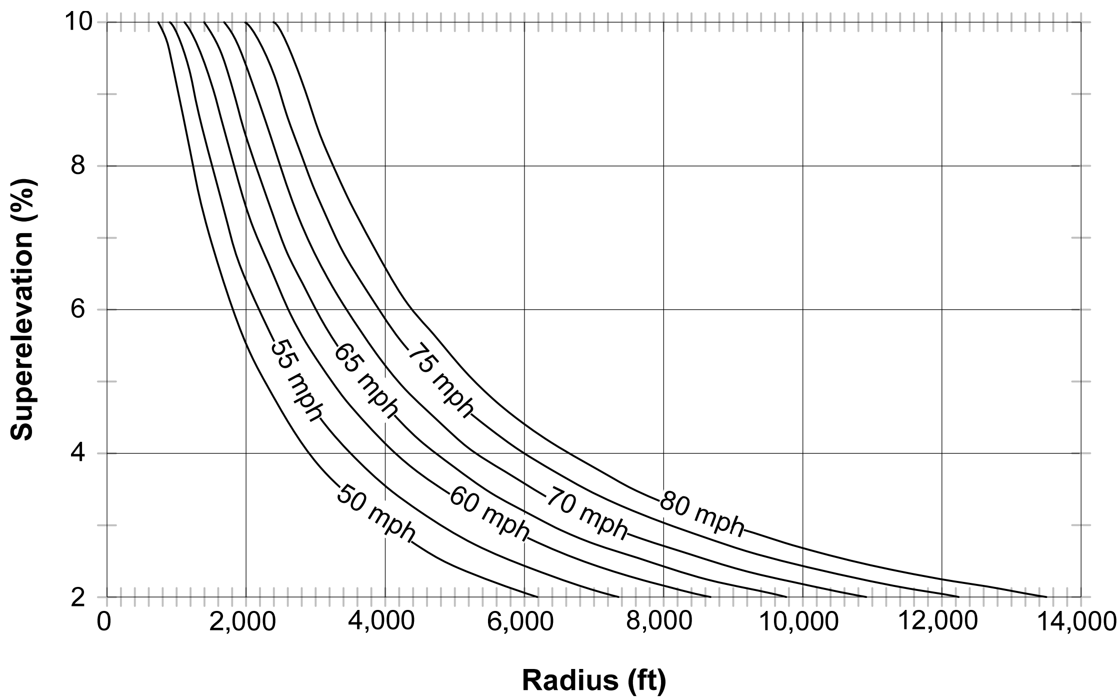
642.08 Runoff for Ramp Curves

Superelevation runoff for ramps use the same maximum relative slopes as the specific design speeds used for highway curves. Multilane ramps have a width similar to the width for highway lanes; therefore, Figures 642-6a through 6e are used to determine the superelevation runoff for ramps. Single-lane ramps have a lane width of 15 feet in curves, requiring the runoff length to be adjusted. Superelevation transition lengths (L_T) for single-lane ramps are given in Figures 642-7a and 7b. Additional runoff length for turning roadway widening is not required.

642.09 Documentation

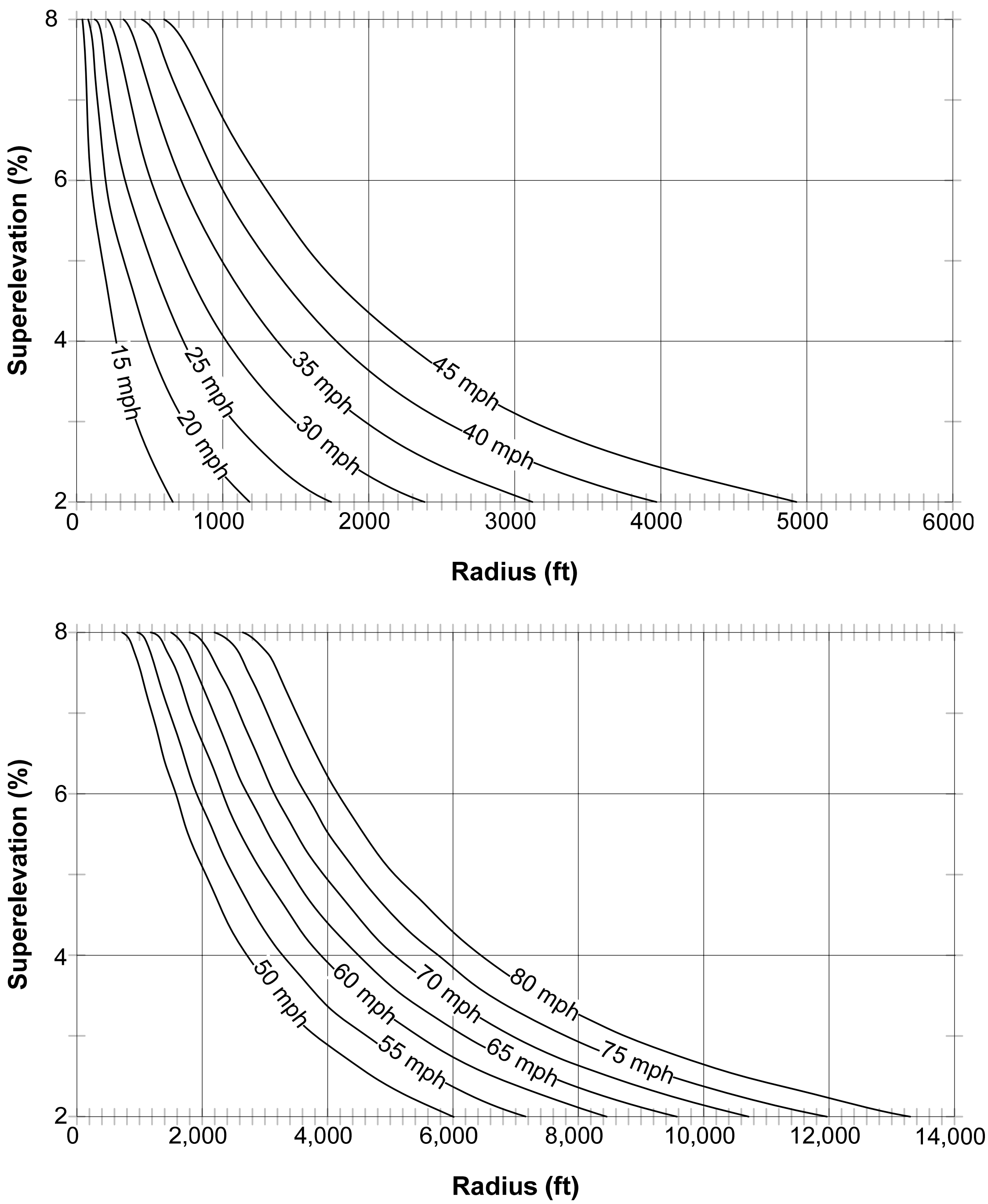
For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/





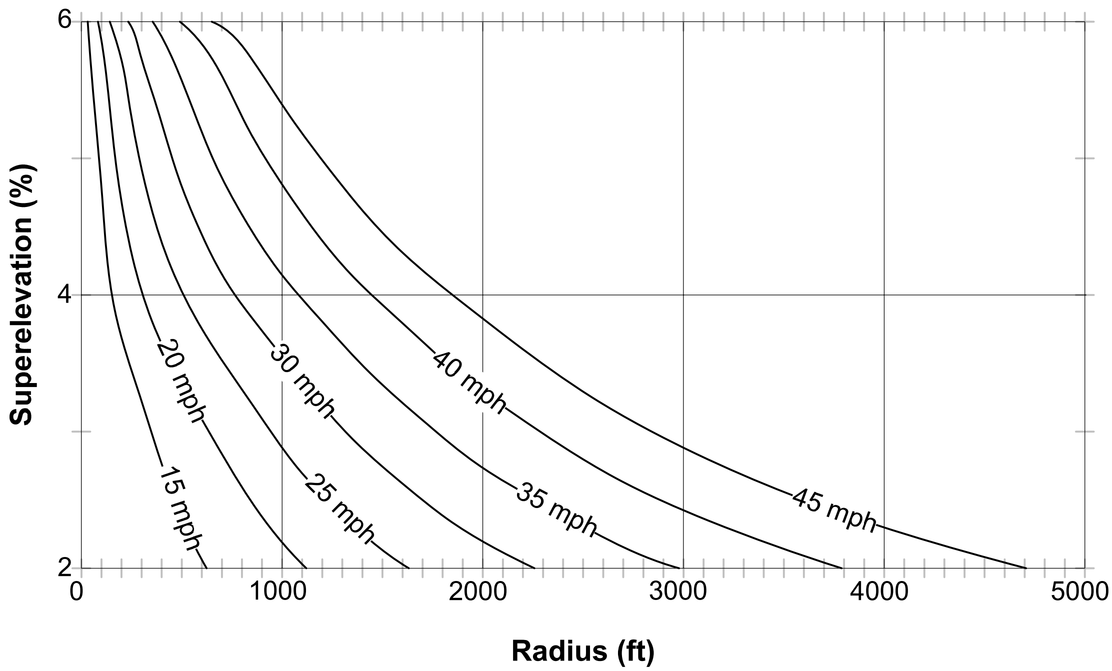
Design Speed (mph)	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Minimum Radius (ft)	40	75	130	205	295	415	545	700	880	1095	1345	1640	1980	2380

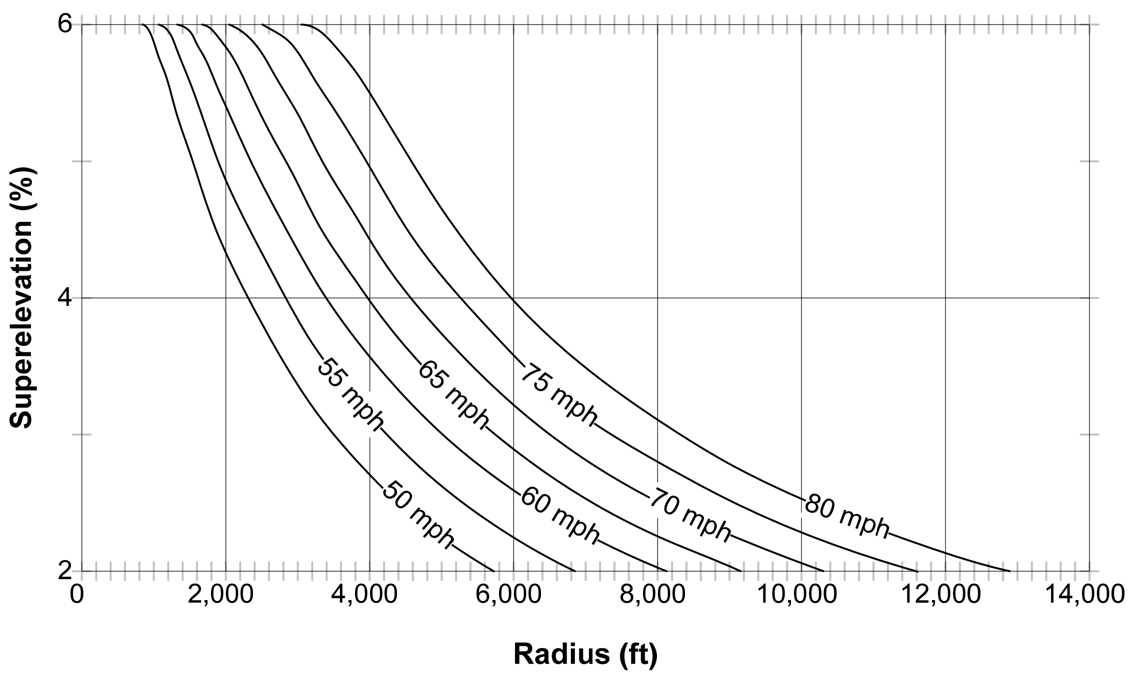
Superelevation Rates (10% max)
Figure 642-4a



Design Speed (mph)	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Minimum Radius (ft)	40	80	135	215	315	450	590	760	965	1205	1490	1820	2215	2675

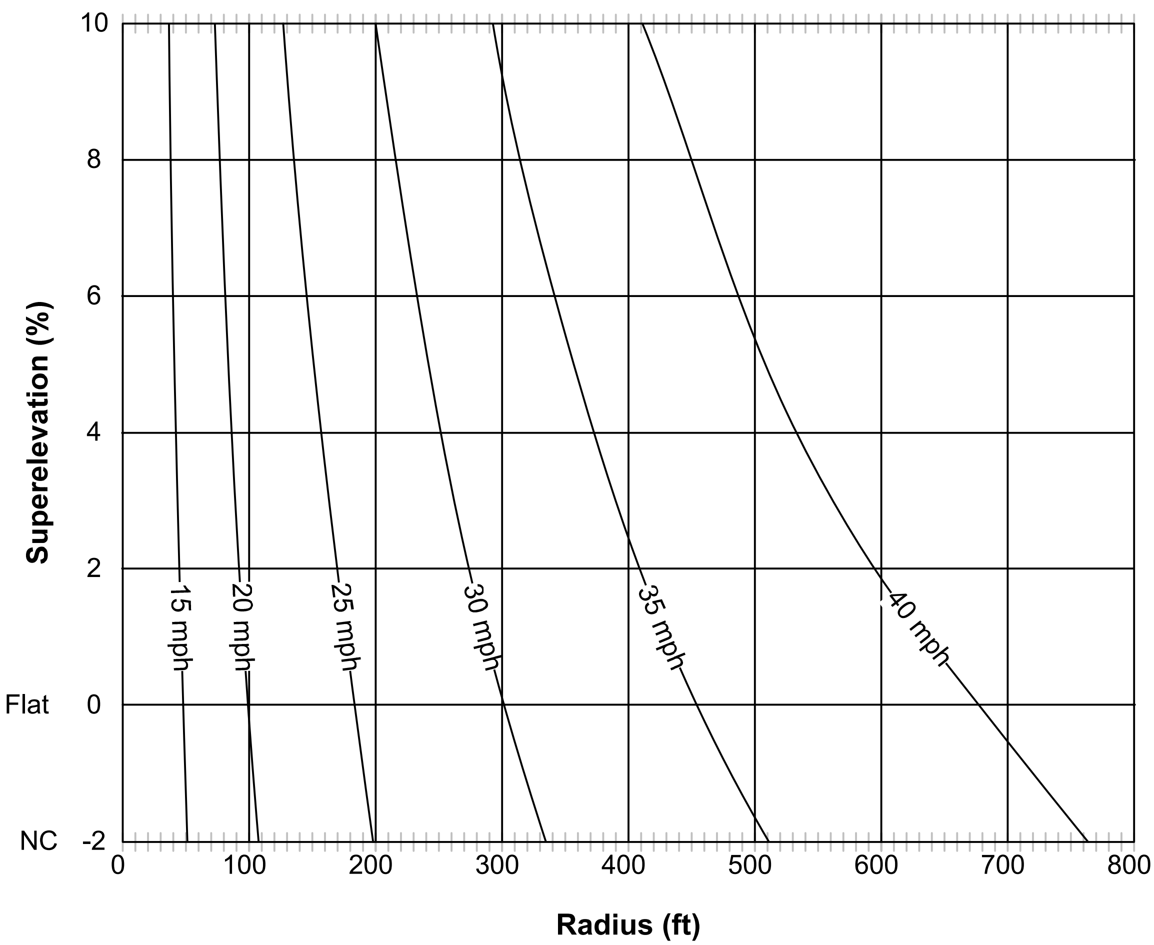
Superelevation Rates (8% max)
Figure 642-4b





Design Speed (mph)	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Minimum Radius (ft)	40	85	145	235	345	490	645	840	1065	1340	1665	2050	2510	3055

Superelevation Rates (6% max)
Figure 642-4c



NC = Normal crown

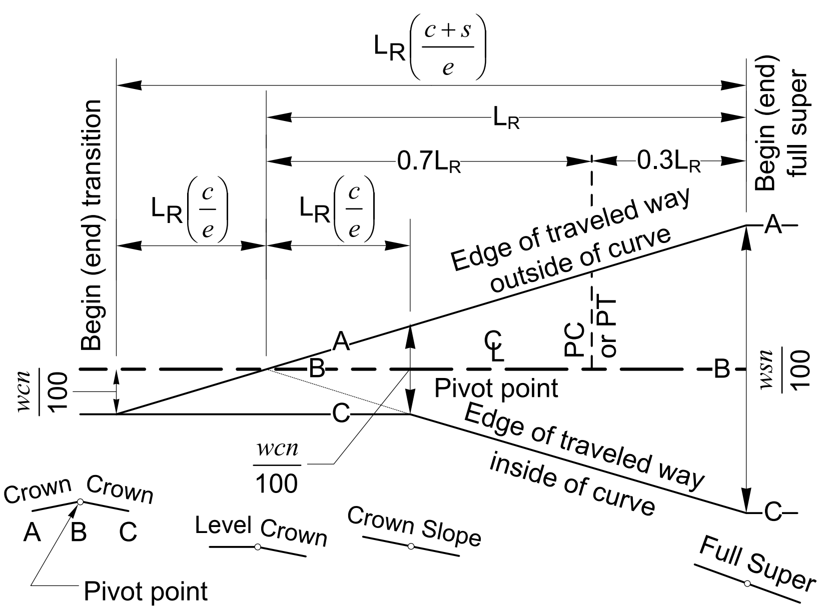
Superelevation Rates for Intersections and Low-Speed Urban Roadways
Figure 642-5

e (%)	LB=Basic Runoff in Feet for Design Speed													
	15 mph	**20 mph**	**25 mph**	**30 mph**	**35 mph**	**40 mph**	**45 mph**	**50 mph**	**55 mph**	**60 mph**	**65 mph**	**70 mph**	**75 mph**	**80 mph**
2	30	30	35	35	40	40	45	50	50	55	55	60	65	70
3	45	50	50	55	60	60	65	70	75	80	85	90	95	105
4	60	65	70	75	75	85	90	95	100	105	110	120	125	135
5	75	80	85	90	95	105	110	120	130	135	140	150	160	170
6	90	95	105	110	115	125	135	145	155	160	170	180	190	205
7	110	115	120	130	135	145	155	170	180	185	195	210	220	240
8	125	130	135	145	155	165	180	190	205	215	225	240	250	275
9	140	145	155	165	175	185	200	215	230	240	250	270	285	310
10	155	160	170	180	195	205	220	240	255	265	280	300	315	345

* Based on one 12-ft lane between the pivot point and the edge of traveled way. When the distance exceeds 12 ft, use the following equation to obtain L_R: $L_R=L_B(1+0.04167X)$

Where:

X = The distance in excess of 12 ft between the pivot point and the farthest edge of traveled way, in ft



Design A – Pivot Point on Centerline Crown Section

c = Normal crown (%)

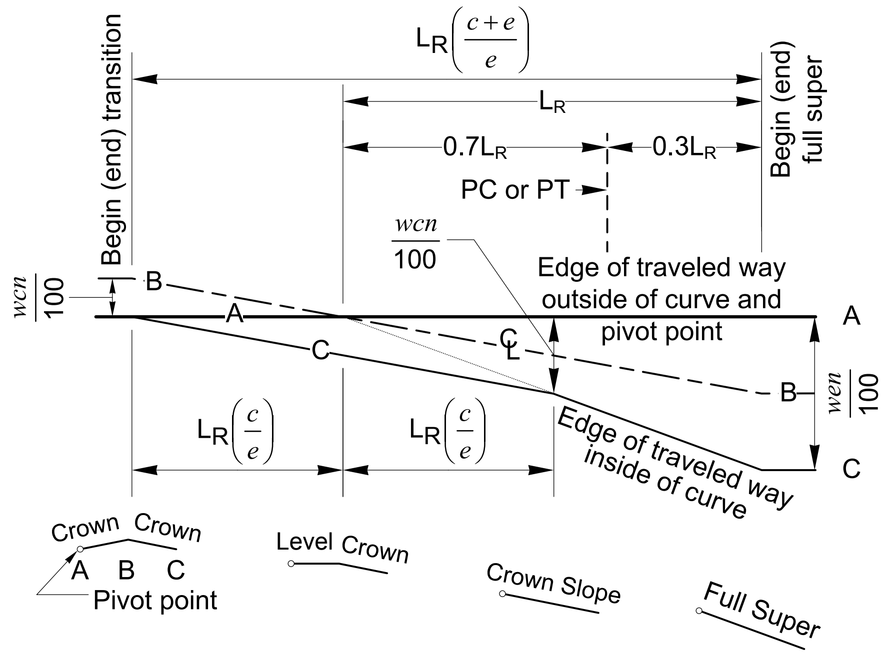
e = Superelevation rate (%)

n = Number of lanes between points

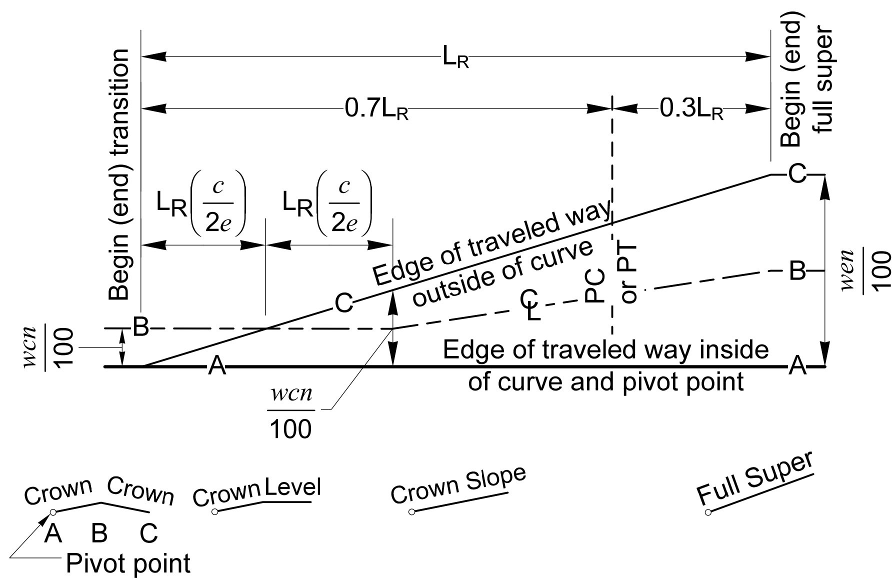
w = Width of lane

Superelevation Transitions for Highway Curves

Figure 642-6a



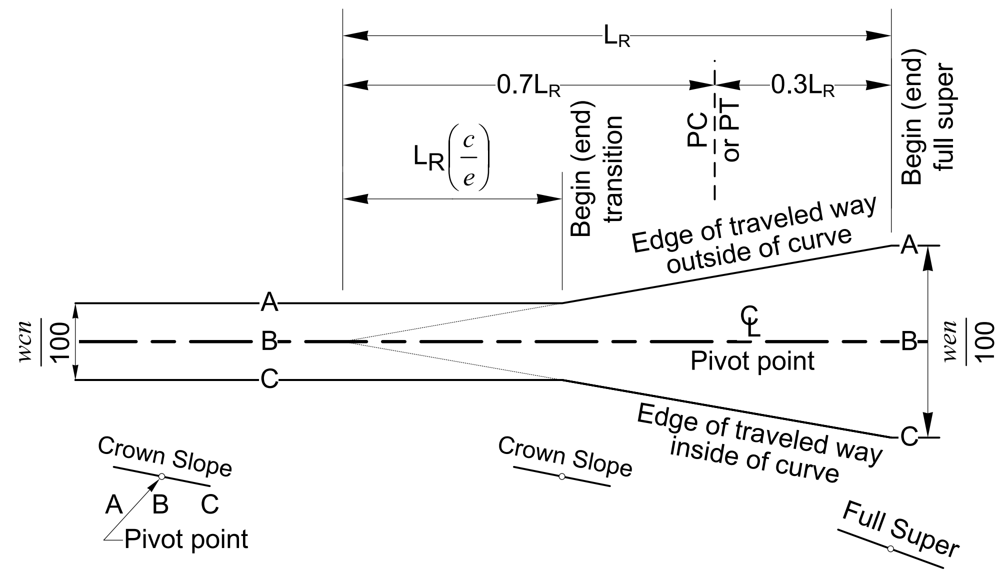
Design B[1] – Pivot Point on Edge of Traveled Way: Outside of Curve Crowned Section



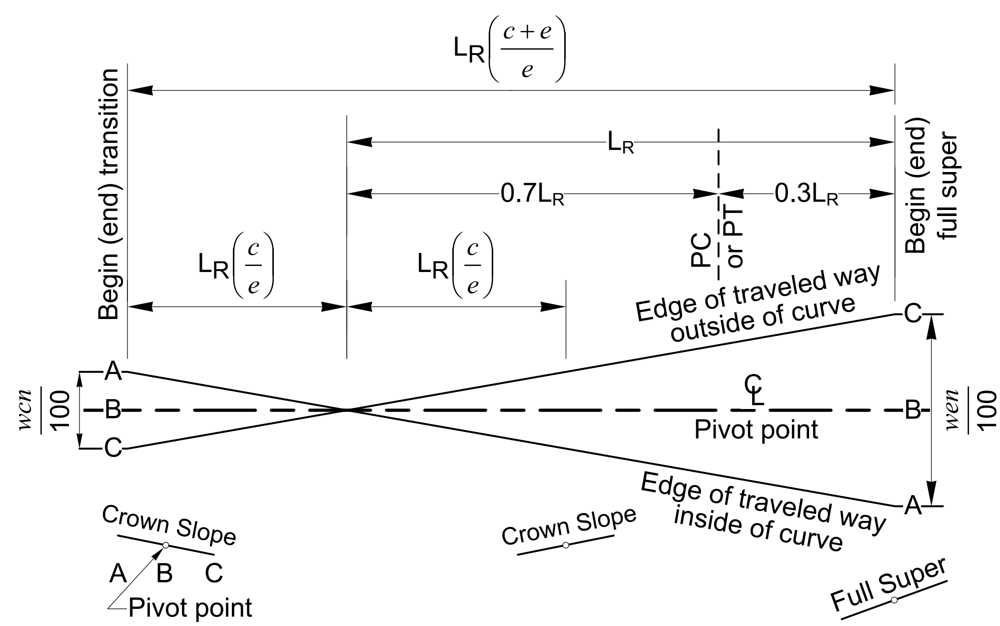
Design B[2] – Pivot Point on Edge of Traveled Way: Inside of Curve Crowned Section

c = Normal crown (%)
e = Superelevation rate (%)
n = Number of lanes between points
w = Width of lane

Superelevation Transitions for Highway Curves
Figure 642-6b



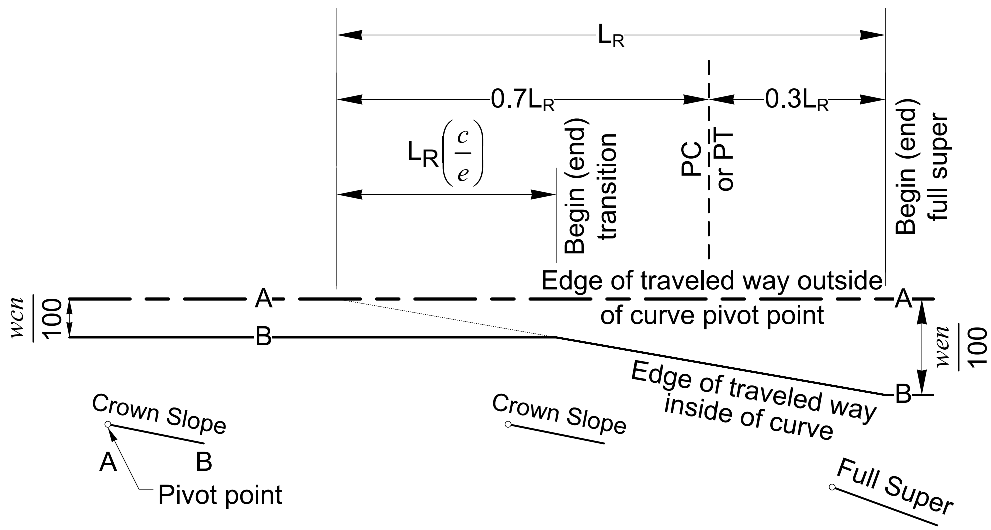
Design C[1] – Pivot Point on Centerline Curve in Direction of Normal Pavement Slope: Plane Section



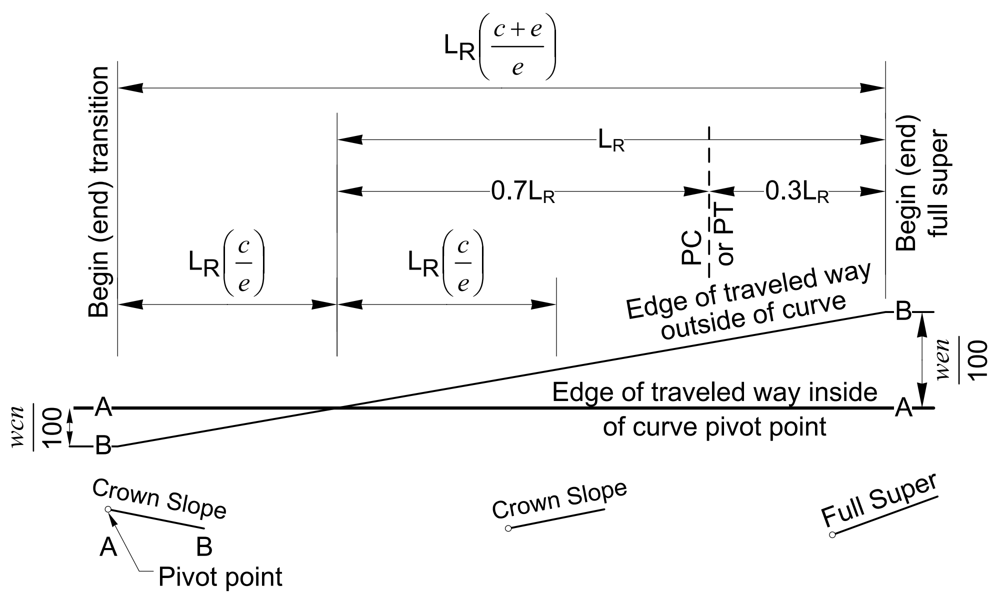
Design C[2] – Pivot Point on Centerline Curve Opposite to Normal Pavement Slope: Plane Section

c = Normal crown (%)
e = Superelevation rate (%)
n = Number of lanes between points
w = Width of lane

Superelevation Transitions for Highway Curves
Figure 642-6c



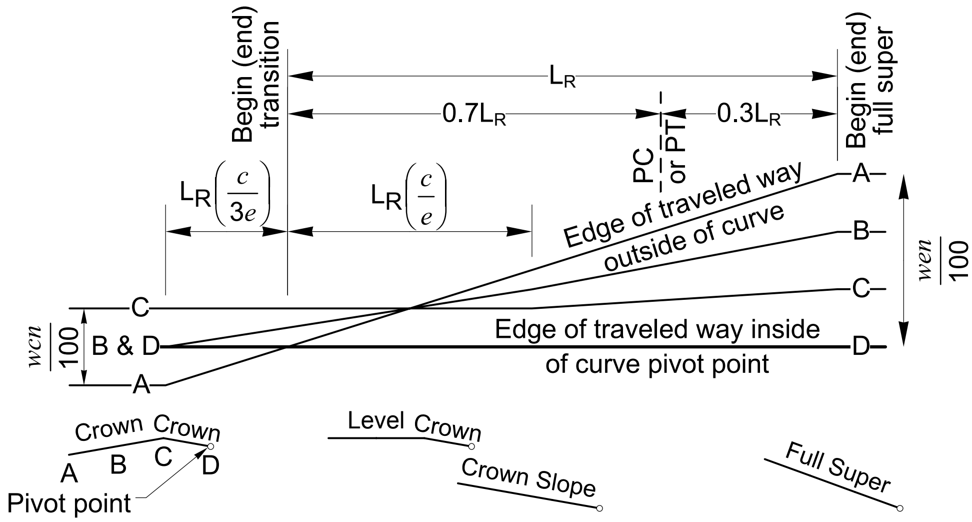
Design D[1] – Pivot Point on Edge of Traveled Way Curve in Direction of Normal Pavement Slope: Plane Section



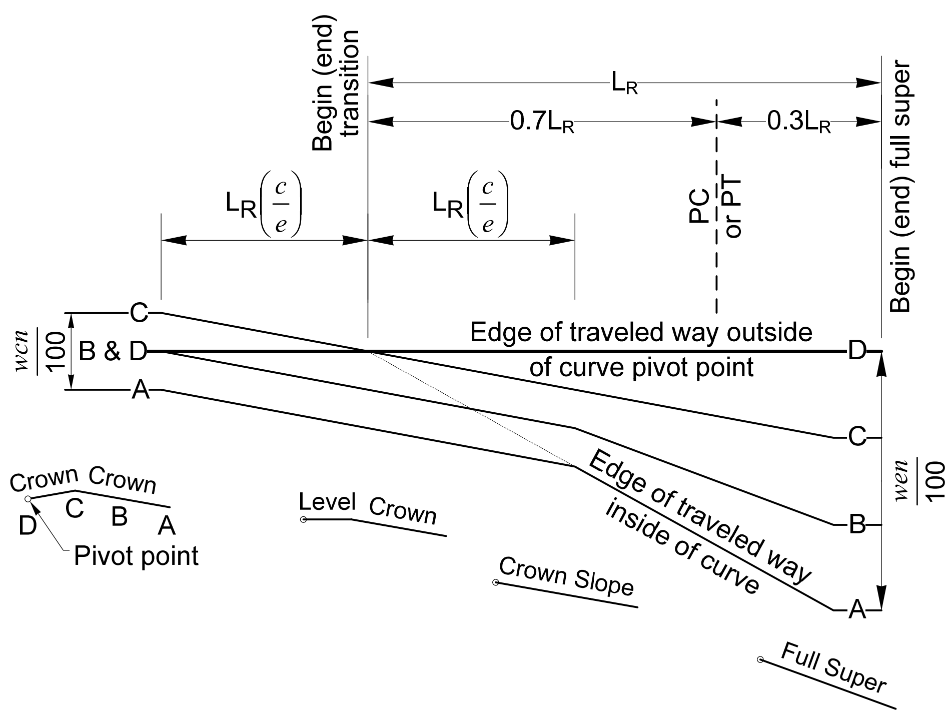
Design D[2] – Pivot Point on Edge of Traveled Way Curve Opposite to Normal Pavement Slope: Plane Section

c = Normal crown (%)
e = Superelevation rate (%)
n = Number of lanes between points
w = Width of lane

Superelevation Transitions for Highway Curves
Figure 642-6d



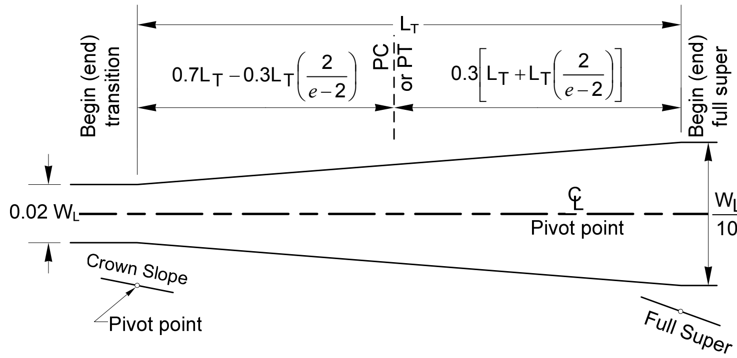
Design E[1] – Six Lane With Median, Pivot Point on Edge of Traveled Way: Inside of Curve Crown Section



Design E[2] – Six Lane With Median, Pivot Point on Edge of Traveled Way: Outside of Curve Crown Section

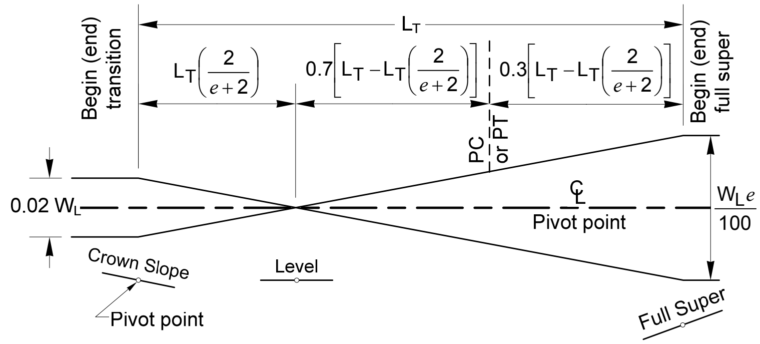
c = Normal crown (%)
e = Superelevation rate (%)
n = Number of lanes between points
w = Width of lane

Superelevation Transitions for Highway Curves
Figure 642-6e



e (%)	Length of Transition in Feet for Design Speed							
	20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph
	L_T	L_T	L_T	L_T	L_T	L_T	L_T	L_T
3	10	15	15	15	15	15	15	15
4	20	25	25	25	25	30	30	35
5	30	35	35	35	40	45	45	50
6	40	45	45	50	55	55	60	65
7	50	55	55	60	65	70	75	80
8	60	65	70	75	80	85	90	95
9	70	75	80	85	95	100	105	110
10	80	85	90	100	105	115	120	130

Table 1 Pivot Point on Centerline – Curve in Direction of Normal Pavement Slope



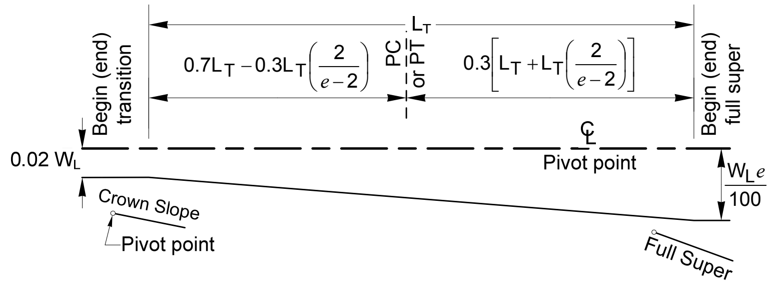
e (%)	Length of Transition in Feet for Design Speed							
	20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph
	L_T	L_T	L_T	L_T	L_T	L_T	L_T	L_T
2	40	40	45	50	55	55	60	65
3	50	55	55	60	65	70	75	80
4	60	65	70	75	80	85	90	95
5	70	75	80	85	90	100	105	110
6	80	85	90	95	105	115	120	130
7	90	95	100	110	120	125	135	145
8	100	105	115	120	130	140	150	160
9	110	120	125	135	145	155	165	175
10	120	130	135	145	160	170	180	190

Table 2 Pivot Point on Centerline – Curve in Direction Opposite to Normal Pavement Slope

W_L = width of ramp lane

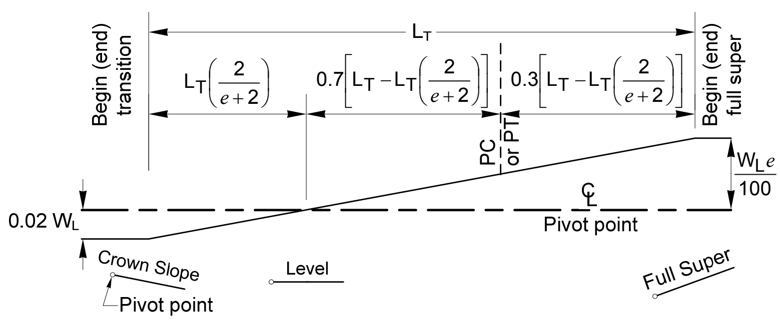
Superelevation Transitions for Ramp Curves

Figure 642-7a



e (%)	Length of Transition in Feet for Design Speed							
	20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph
	L_T	L_T	L_T	L_T	L_T	L_T	L_T	L_T
3	20	25	25	25	25	30	30	35
4	40	45	45	50	55	55	60	65
5	60	65	70	75	80	85	90	95
6	80	85	90	100	105	115	120	130
7	100	105	115	120	130	140	150	160
8	120	130	135	145	160	170	180	190
9	140	150	160	170	185	195	210	225
10	160	170	180	195	210	225	240	255

Table 3 Pivot point on edge of traveled way – Curve in direction of normal pavement slope



e (%)	Length of Transition in Feet for Design Speed							
	20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph
	L_T	L_T	L_T	L_T	L_T	L_T	L_T	L_T
2	80	85	90	100	105	115	120	130
3	100	105	115	120	130	140	150	160
4	120	130	135	145	160	170	180	190
5	140	150	160	170	185	195	210	225
6	160	170	180	195	210	225	240	255
7	180	190	205	220	235	255	270	290
8	200	210	225	245	265	280	300	320
9	220	235	250	265	290	310	330	350
10	240	255	270	290	315	340	360	385

Table 4 Pivot point on edge of traveled way – Curve in direction opposite to normal pavement slope
W_L = width of ramp lane

Superelevation Transitions for Ramp Curves

Figure 642-7b

Chapter 820 Signing

820.01 General

Signing is a primary mechanism for regulating, warning, and guiding traffic. Signing must be in place when any section of highway is open to the motoring public. Each highway project has unique and specific signing requirements. For statewide signing uniformity and continuity, it is sometimes necessary to provide signing beyond the project limits. Design characteristics of the facility determine the size and legend for a sign. As the design speed increases, larger sign sizes are necessary to provide adequate message comprehension time. The MUTCD, the *Traffic Manual*, and the *Sign Fabrication Manual* contain standard sign dimensions, specific legends, and reflective sheeting types for all new signs.

Guide signing provides the motorist with directional information to destinations. This information is always presented in a consistent manner. In some cases, there are specific laws, regulations, and policies governing the content of the messages on these signs. All proposed guide signs for a project require the approval of the Region Traffic Engineer. The use of nonstandard signs is strongly discouraged and their use requires the approval of the State Traffic Engineer.

The design matrices in Chapter 325 identify the design levels for signing on all Preservation and Improvement projects. These levels are indicated in the column "Signing" for Interstate main line and the column "Signing, Delineation, and Illumination" for all other routes.

Review and update existing signing within the limits of all Preservation and Improvement projects as indicated in the matrices. Provide standard signing on projects with either a "B" (basic design level) or "EU" (evaluate upgrade) matrix designation. Apply the following criteria when determining whether to replace or modify existing signs:

- Lack of nighttime retroreflectivity
- Substantial damage, vandalism, or deterioration
- Age of signs (seven to ten years old)
- A change in sign use policy
- Improper location
- Message or destination changes necessary to satisfy commitments to public or local agencies
- Substandard mounting height
- Change in jurisdiction (for example, a county road becomes a state route)

Address sign support breakaway features when identified in the "Clear Zone" columns of the matrices. When the "F" (full design level) matrix designation is present, the preceding criteria are still applicable and all existing signing is required to conform to the current policy for reflective sign sheeting requirements. Remove or replace signing not conforming to this policy.

820.02 References

(1) Federal/State Laws and Codes

23 CFR 655, Traffic Operations to Section 820.02(1)

Directive D 32-20, "State Route Mileposts," WSDOT

RCW 47.36, Traffic control devices

(2) Design Guidance

Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), 2003 Edition, FHWA, 2003, including the Washington State Modifications to the MUTCD, M 24-01, 2003

Plans Preparation Manual, M 22-31, WSDOT

Sign Fabrication Manual, M 55-05, WSDOT

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

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 4th Edition, Washington DC, AASHTO, 2001

Traffic Manual, M 51-02, WSDOT

820.03 Design Components

(1) Location

The MUTCD contains the guidelines for positioning signs. Check sign locations to ensure that the motorist's view of the sign is not obscured by other roadside appurtenances. Also, determine whether the proposed sign will obstruct the view of other signs or limit the motorist's sight distance of the roadway. Reposition existing signs, when necessary, to satisfy these visibility requirements. Where possible, locate signs behind existing traffic barriers, on grade separation structures, or where terrain features will minimize their exposure to errant vehicles.

(2) Longitudinal Placement

The MUTCD and the *Traffic Manual* provide guidelines for the longitudinal placement of signs that are dependent on the type of sign. Select a location to fit the existing conditions to ensure visibility and adequate response time. In most cases, signs can be shifted longitudinally to enhance safety without compromising their intended purpose.

(3) Lateral Clearance

The *Standard Plans* and the MUTCD contain minimum requirements for the lateral placement of signs. Where possible, position the signs at the maximum feasible lateral clearance for safety and reduced maintenance costs. Locate large guide signs and motorist information signs beyond the Design Clear Zone (see Chapter 700) when limited right of way or other physical constraints are not a factor. On steep fill slopes, an errant vehicle is likely to be partially airborne from the slope break near the edge of shoulder to a point 12 feet down the slope. When signs are placed on fill slopes steeper than 6H:1V, locate the support at least 12 feet beyond the slope break.

Use breakaway sign support features, when required, for signs located within the Design Clear Zone and for signs located beyond this zone where there is a possibility they might be struck by an errant vehicle. Breakaway features are not necessary on signposts located behind traffic barriers. Install longitudinal barriers to shield signs without breakaway features located within the Design Clear Zone when no other options are available.

Sign bridges and cantilever sign structures have limited span lengths. Locate the vertical components of these structures as far from the traveled way as possible and, where appropriate, install traffic barriers (see Chapter 710).

Do not locate signposts in the bottom of a ditch or where the posts will straddle the ditch. The preferred location is beyond the ditch or on the ditch backslope (see the *Standard Plans*). In high fill areas, where conditions require placement of a sign behind a traffic barrier, consider adding embankment material to reduce the length of the sign supports.

(4) Sign Heights

For ground-mounted signs installed at the side of the road, provide a mounting height of at least 7 feet, measured from the bottom of the sign to the edge of traveled way. Supplemental plaques, when used, are mounted directly below the primary sign. At these locations, the minimum mounting height of the plaque is 5 feet.

Do not attach supplemental guide signs to the posts below the hinge mechanism or the saw cut notch on multiple-post installations. The location of these hinges or saw cuts on the sign supports are shown in the *Standard Plans*.

A minimum 7-foot vertical height from the bottom of the sign to the ground directly below the sign is necessary for the breakaway features of the sign support to function properly when struck by a vehicle. The minimum mounting height for new signs located behind longitudinal barriers is 7 feet, measured from the bottom of the sign to the edge of traveled way. A lower mounting height of 5 feet may be used when replacing a sign panel on an existing sign assembly located behind the longitudinal barrier. The *Standard Plans* shows typical sign installations.

For ground-mounted signs installed on multiple posts that are a minimum of 12 feet from the edge of traveled way in cut sections, the minimum height clearance between the sign and the ground for the post farther from the edge of traveled way is as follows:

- For slopes 2H:1V and steeper, the minimum height clearance is 2 feet
- For slopes 3H:1V or flatter, the minimum height clearance is 7 feet

Signs used to reserve parking for people with disabilities are installed at each designated parking stall and are mounted 7 feet above the surface at the sign location.

(5) Foundations

Foundation details for timber and steel ground-mounted sign supports are shown in the *Standard Plans*, which also contains foundation designs for truss-type sign bridges and cantilever sign structures. Three designs, Types 1, 2, and 3, are shown for each structure.

An investigation of the foundation material is necessary to determine the appropriate foundation design. Use the data obtained from the geotechnical report to select the foundation type.

- The Type 1 foundation design uses a large concrete shaft and is the preferred installation when the lateral bearing pressure of the soil is 2500 psf or greater.
- The Type 2 foundation design has a large rectangular footing design and is an alternative to the Type 1 foundation when the concrete shaft is not suitable.
- The Type 3 foundation design is used in poorer soil conditions where the lateral bearing pressure of the soil is between 1500 psf and 2500 psf.

If a nonstandard foundation or monotube structure design is planned, forward the report to the Headquarters (HQ) Bridge and Structures Office for use in developing a suitable foundation design (see Chapter 510).

(6) Signposts

Ground-mounted signs are installed on either timber posts, laminated wood box posts, or steel posts. The size and number of posts required for a sign installation are based on the height and surface area of the sign, or signs, being supported. Use the information in Figures 820-2, 820-3, and 820-4 and the *Standard Plans* to determine the posts required for each installation. Coordinate with the Region Maintenance Office concerning signpost installation.

Use steel posts with breakaway supports that are multidirectional if the support is likely to be hit from more than one direction. For any wide flange multiple-steel post installations located within the Design Clear Zone, the total weight of all the posts in a 7-foot-wide path shall not exceed a combined post weight of 34 lbs/foot. Use the Wide Flange Beam Weights table in Figure 820-3 to determine wide flange steel post weights. If the proposed sign configuration does not meet the weight criterion, relocate, resize, or provide barrier protection for the proposed installation.

All signposts are to be designed to 90 mph wind loads. Design features of breakaway supports are shown in the *Standard Plans*. Steel signposts commonly used are: Perforated Square Steel Tube (PSST); Square Steel Tube (SST); Round Pipe (RP); and Wide Flange "H-Beam." Steel posts with Type TP-A, TP-B, PL, PL-T, PL-U, AS, AP, SB-1, and SB-2 bases have multidirectional breakaway features.

820.04 Overhead Installation

Conditions justifying the use of overhead sign installations are noted in the MUTCD. Where possible, mount overhead signs on grade separation structures rather than sign bridges or cantilever supports.

Details for the construction of truss-type sign bridges and cantilever sign supports are shown in the *Standard Plans*.

The HQ Bridge and Structures Office designs structure-mounted sign mountings, monotube sign bridges, and monotube cantilever sign supports. For overhead sign installation designs, provide sign dimensions, horizontal location in relation to the roadway, and location of the lighting fixtures to facilitate design of the mounting components by the HQ Bridge and Structures Office.

(1) Illumination

The retroreflectivity of currently approved sign sheeting removes the need to provide illumination for most sign installations. Ground-mounted signing, regardless of sign type or message content, does not require sign lighting for nighttime legibility. Only overhead-mounted signs with "EXIT ONLY" panels in noncontinuous illumination areas or overhead-mounted guide signs for left side exits in all areas are illuminated.

The sign lights for existing illuminated overhead and ground-mounted signs can only be de-energized and removed if the retroreflective sheeting is adequate for nighttime legibility. A nighttime assessment of all nonilluminated overhead signs within the project limits is required. Replace all signs that have inadequate retroreflectivity (contact the Region Traffic Office). In situations where a nonhighway light source interferes with a sign's legibility, consider relocating the sign or providing sign lights.

Flashing beacon signs are used to alert a motorist of an unusual or unexpected driving condition ahead. Sign lights are unnecessary on flashing beacon signs when appropriate sign sheeting, full circle or tunnel signal head visors, and automatic dimmer devices are used.

All other overhead signs are illuminated only when one of the following conditions is present:

- Sign visibility is less than 800 feet due to intervening sight obstructions such as highway structures or roadside features
- Signs directly adjacent to other overhead signs have sign lights

Overhead Sign Type	Continuous or Noncontinuous Illumination	Sign Lighting Required	Sheeting Type (Background)	Sheeting Type (Legend & Border)
EXIT ONLY guide sign	Continuous	No	IV*	VIII or IX
EXIT ONLY guide sign	Noncontinuous	Yes	II	III or IV
Guide signs for left side exits	Both	Yes	II	III or IV
Other guide signs	Both	No	III or IV	VIII or IX
Regulatory signs	Both	No	IV	n/a
Warning signs	Both	No	VIII or IX	n/a

Note:
Full (Continuous) Illumination is when light standards (luminaires) exist between interchanges.
* For Yellow Background Sheeting, use Type VIII or IX Fluorescent Sheeting.

Reflective Sheeting Requirements for Overhead Signs
Figure 820-1

(2) Vertical Clearance

The minimum vertical clearance from the roadway surface to the lowest point of an overhead sign assembly is 17 feet 6 inches. The minimum vertical clearance from the roadway surface to the lowest point of an overhead sign assembly without sign light(s) is 19 feet 6 inches. The maximum clearance is 21 feet. Contact the HQ Traffic Office regarding signs under bridges and in tunnels.

(3) Horizontal Placement

Consider roadway geometrics and anticipated traffic characteristics when locating signs above the lane, or lanes, to which they apply. Install advance guide signs and exit direction signs that require an EXIT ONLY and “down arrow” panel directly above the drop lanes. To reduce driver confusion about which lane is being dropped, avoid locating a sign with an EXIT ONLY panel on a horizontal curve.

(4) Service Walkways

Walkways are provided on structure-mounted signs, truss-type sign bridges, and truss-type cantilever sign supports where roadway and traffic conditions prohibit normal sign maintenance activities. Monotube sign bridges and cantilever sign supports normally do not have service walkways.

Vandalism of signs, particularly in the form of graffiti, can be a major problem in some areas. Vandals sometimes use the service walkways. Maintenance costs for cleaning or replacing vandalized signs at these locations can exceed the benefit of providing the service walkway.

820.05 State Highway Route Numbers

For state routes, RCW 47.36.095 authorizes WSDOT to sign state highways using a system of state route numbers assigned to eliminate duplication of numbers. This numbering system follows the system employed by the federal government in the assignment of interstate and U.S. routes: odd numbers indicate general north-south routes and even numbers indicate general east-west routes.

820.06 Mileposts

Milepost markers are a part of a statewide system for all state highways and are installed in accordance with Directive D 32-20, State Route Mileposts.

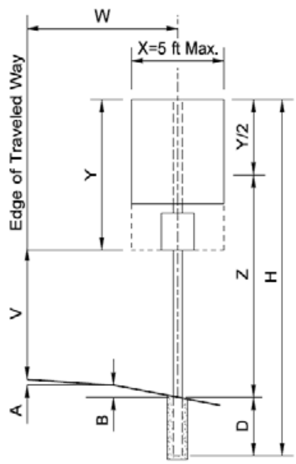
820.07 Guide Sign Plan

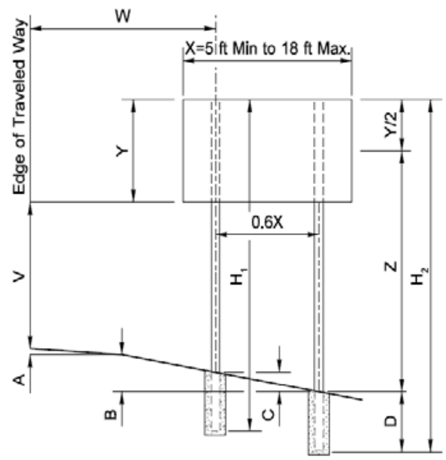
A preliminary guide sign plan is developed to identify existing and proposed guide signing on state highways and is reviewed by the Region Traffic Engineer. Preliminary guide signs for interstate routes are to be furnished to the HQ Traffic Operations Office for review and concurrence. The plan provides an easily understood graphic representation of the signing and its continuity to motorist destinations, activities, and services. It is also used to identify deficiencies or poorly defined routes of travel. A guide sign plan for safety and mobility improvement projects is desirable. When proposed highway work affects signing to a city or town, the guide sign plan can be furnished to the official governing body for review and consideration. The guide sign plan is reviewed and approved by the Region Traffic Engineer.

820.08 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:

www.wsdot.wa.gov/design/projectdev/





Notes:

The following designs are *not permitted* when a sign is to be located in or outside the design clear zone in an area where it is likely to be struck by an errant vehicle:

1. A sign with any post larger than 6x8 inches
2. A 2-post, 3-post, or 4-post sign that uses 6-inch or larger posts and has two posts spaced less than 7 ft apart on center.

Table 1 Timber Post Selection

Post Size (in)	$(X)(Y)(Z)$ (ft^3)				D (ft)
	Number of Posts				
	1	2	3	4	
4 x 4	60	115	175	235	3
4 x 6	125	335	500	675	4
6 x 6	200	415	620	815	4
6 x 8	330	695	1150	1515	5
6 x 10	670	1355	2030	2700	6
8 x 10	835	1685	2515	3360	6
6 x 12	985	2005	2965	3945	7

Values shown are the maximum permitted.

For timber grade requirements, see the *Standard Specifications*, 9-09.2.

Foundation depths are based on allowable lateral bearing pressure in excess of 2500 psf.

If the value (X)(Y)(Z) amount exceeds the limit for 6x12 post(s), use steel post(s) for sign installation.

A = Vertical distance from edge of traveled way to edge of shoulder

B = Vertical distance from slope catch point to centerline of longest post

C = Vertical distance between adjacent posts

X & Y = Single sign or back-to-back signs: overall dimensions of the sign – Multiple signs: dimensions of the area within the perimeter of a rectangle enclosing the extremities of the sign

Z = Height from ground line to midheight of sign at the centerline of the longest post

D = Embedment depth

H = Total post height

V = Vertical clearance from edge of traveled way

W = Distance from edge of traveled way to the centerline of the post nearest the roadway

Design Example – Single Post

Given:

Sign 3 ft wide, 3.5 ft high; a secondary sign 1.5 ft wide, 2 ft high, mounted 3 inches (0.25 ft) below; 8-ft shoulder with 2% slope; 6H:1V embankment; W = 15 ft; V = 5 ft

Solution:

X = 3 ft
Y = 3.5 + 2 + 0.25 = 5.75 ft
A = (0.02)(8) = 0.16
B = (W-8)/6 = (15-8)/6 = 1.17
Z = Y/2 + V + A + B
= (5.75/2) + 5 + 0.16 + 1.17 = 9.2 ft
(X)(Y)(Z) = (3)(5.75)(9.2) = 158.7 ft^3
Since 159 ft^3< 200 ft^3, from Table 1, select 6x6 post

H = 9.2 + (5.75/2) + 4 = 16.1 ft

Design Example – Double Post

Given:

Sign 12 ft wide, 4 ft high; 10-ft shoulder with 2% slope; 6H:1V embankment; W = 25 ft; V = 7 ft

Solution:

X = 12 ft; Y = 4 ft
A = (0.02)(10) = 0.2
B = [(W-10) + (0.6X)]/6 = [(25-10) + (0.6)(12)]/6 = 3.7
C = (0.6)(12)/6 = 1.2
Z = Y/2 + V + A + B = 4/2+7 + 0.2 + 3.7 12.9 ft
(X)(Y)(Z) = (12)(4)(12.9) = 619 ft^3

Since 619 ft^3 < 695 ft^3, select two 6x8 posts.

H_2 = Y/2 + Z + D = 4/2 + 12.9 + 5 = 19.9 ft

H_1 = H_2-C = 19.9-1.2 = 18.7 ft

Note: 6x6 and larger posts require 7-ft spacing. Sign may be installed within the Design Clear Zone.

Timber Posts

Figure 820-2

X & Y = Single sign or back-to-back signs: overall dimensions of the sign – Multiple signs: dimensions of the area within the perimeter of a rectangle enclosing the extremities of the signs

Z = Height from the base connection (2½ inches above the post foundation for wide flange beams) to the midheight of the sign at the centerline of the longest post

H = Post length

V = Vertical clearance from the edge of traveled way

W = Distance from the edge of traveled way to the centerline of the longest post nearest the roadway

Design Example – Steel Post Selection

Given:

Sign 22 ft wide, 12 ft high; 10-ft shoulder with 2% slope; 3H:1V embankment; W = 32 ft; V = 7ft.

Solution:

X = 22
Y = 12
A = (0.02)(10) = 0.2
B = [(W-10)+(0.7)(X/3)] = [(32-10)+(0.7x22)]/3 = 12.5
C = (0.35)(22)/3 = 2.6
Z = Y/2 + V + A + B-0.21
= 12/2 + 7 + 0.2 + 12.5-0.21 = 25.5 ft
(X)(Y)(Z) = (22)(12)(25.5) = 6729 ft^3
Since 6729 ft^3 < 9480 ft^3, select three W10x26 (ASTM A36) or W10x22 (ASTM A992) (See the *Standard Plans*.)

H3 = 12/2 + 25.5 = 31.5 ft

H2 = H3-C = 31.5-2.6 = 28.9 ft

H1 = H2-C = 28.9-2.6 = 26.3 ft

Table 1 Wide Flange Steel Post Selection

Wide Flange Beam			
Post Size		(X)(Y)(Z) (ft^3) Number of Posts	
ASTM A992	ASTM A36	2	3
W6x9	W6x12	1570	2355
W6x12	W6x16	2340	3510
W8x18	W8x21	4120	6180
W10x22	W10x26	6320	9480
W12x26	W12x30	8700	- - -

Table 2 Wide Flange Beam Weights

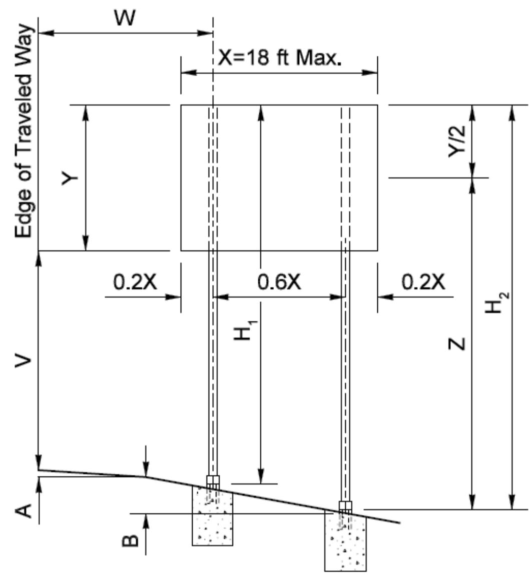
Beam Size	Weight lbs/ft	Beam Size	Weight lbs/ft
W6x9	9	W8x21	21
W6x12	12	W10x22	22
W6x16	16	W10x26	26
W6x18	18	W12x26	26
		W10x30	30

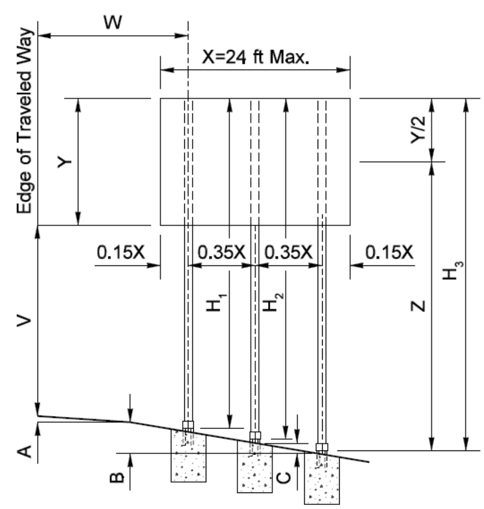
Notes:

Values shown in Table 1 are the maximum permitted. A single-wide flange post installation is not allowed.

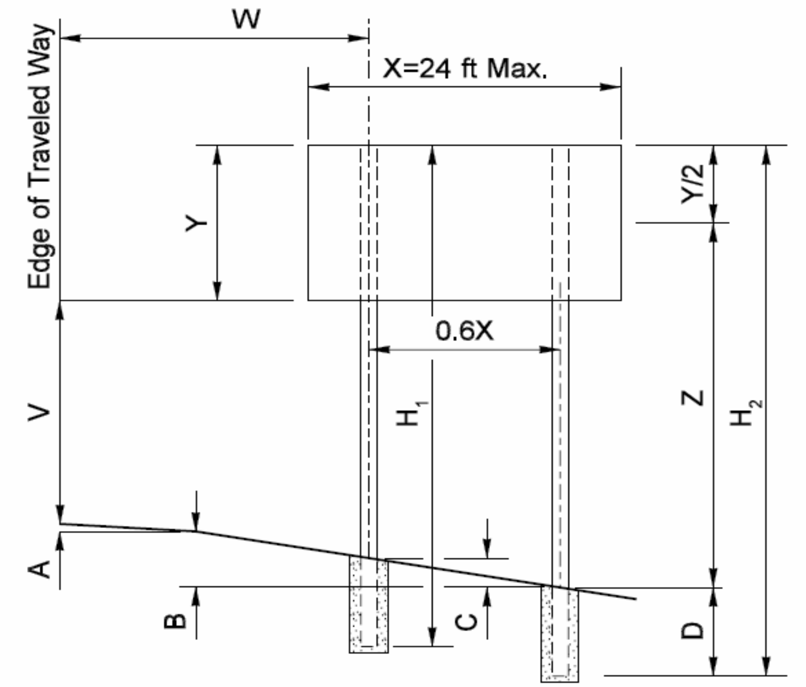
Consider using one of the following: perforated square steel tube posts, solid steel tube posts, or round steel posts.

For post selection for other than wide flange beam supports and a single-post assembly, see the *Standard Plans*. To determine post sizes for these types of posts, use the wind load charts at:
www.wsdot.wa.gov/design/traffic/signing
(See the *Standard Plans* for additional information.)





Wide Flange Steel Posts
Figure 820-3



X & Y = Single sign or back-to-back signs: overall dimensions of the sign – Multiple signs: dimensions of the area within the perimeter of a rectangle enclosing the extremities of the signs

Z = Height from ground line to the midheight of the sign at the centerline of the longest post

D = Embedment depth

H = Post length

V = Vertical clearance from edge of traveled way

W = Distance from edge of traveled way to the centerline of the post nearest the roadway. (See the *Standard Plans*.)

Design Example – M Post Selection

Given:

Two-post assembly sign 16 ft wide, 6 ft high; 10-ft shld with 2% slope; 6H:1V embankment; W = 25 ft.; V = 7 ft.

Solution:

X = 16
Y = 6
A = (0.02)(10) = 0.2
B = [(W-10) + 0.6X]/6
= [(25-10) + (0.6)(16)]/6 = 4.1
C = (0.6X)/6 = (0.6)(16)/6 = 1.6
Z = Y/2 + V + A + B = 6/2 + 7 + 0.2+4.1 = 14.3 ft
(X)(Y)(Z) = (16)(6)(14.3) = 1373 ft^3
Since 1373 ft^3 < 1661 ft^3 from Table 1, select a post type M.

H2 = Y/2 + Z + D = 6/2 + 14.3 + 6 = 23.3 ft

H1 = H2-C = 23.3-1.6 = 21.7 ft

Table 1 Laminated Wood Box Post Selection

Post Type	Size (in)	Z (ft)	(X)(Y)(Z) ft^3
M	7⅞ x 7⅞	15 < Z≤ 26	1329
M	7⅞ x 7⅞	Z ≤ 15	1661
L	7⅞ x 14⅞	15 < Z ≤ 26	3502
L	7⅞ x 14⅞	Z ≤ 15	4378

Table 2 Embedment Depth (D)

Z (ft)	Sign Area Feet ^{2}					
	Up to 50	51 to 100	101 to 150	151 to 200	201 to 250	251 to 290
9 to 12	6	6	7	8	9	10
13 to 15	6	6	7.5	9	10	
16 to 18	7	7.5	9			
19 to 22	7	8	10			
23 to 26	7.5	8.5				

Design Example – L Post Selection

Given:

Two-post assembly sign 18 ft wide, 8 ft high;10-ft shld with 2% slope; 6H:1V embankment W = 25 ft; V = 7 ft.

Solution:

X = 18
Y = 8
A = (0.02)(10) = 0.2
B = [(W-10)+(0.6X)]/6 = [(25-10)+(0.6)(18)]/6 = 4.3
C = 0.6X/6 = (0.618)/6 = 1.8
Z = Y/2 + V + A + B = 8/2 + 7 + 0.2 + 4.3 = 15.5 ft
(X)(Y)(Z) = (18)(8)(15.5) = 2232 ft^3
Since 2232 ft^3 < 3502 ft^3 from Table 1, select a post type L.

H2 = Y/2 + Z + D = 8/2 + 15.5 + 9 = 28.5 ft

H1 = H2-C = 28.5 – 1.8 = 26.7 ft

Laminated Wood Box Posts
Figure 820-4

Chapter 840 Illumination

840.01 General

Illumination is provided along highways, in parking lots, and at other facilities to enhance the visual perception of conditions or features that require additional motorist, cyclist, or pedestrian alertness during the hours of darkness.

WSDOT is responsible for illumination on state highways and crossroads (per WAC 468-18-050 and WAC 468-18-040) with partial limited access control, modified limited access control, or full limited access control, regardless of the location. WSDOT is responsible for illumination on state highways and crossroads (per WAC 468-18-050) with managed access control that are located outside the corporate limits of cities. Cities are responsible for illumination on managed access state highways within their corporate limits.

For the definitions of limited access control and managed access control, see Chapter 1420. For a listing (by milepost) of the limited access or managed access status of all state highways, see the "Access Control Tracking System, Limited Access and Managed Access Master Plan," under the RELATED SITES heading: 🖰 www.wsdot.wa.gov/eesc/design/access/. Refer to the WSDOT/Association of Washington Cities agreement "City Streets as Part of State Highways" (🖰 www.wsdot.wa.gov/TA/Operations/LAG/CityStreets.html) for further information.

840.02 References

(1) Federal/State Laws and Codes

National Electrical Code, NFPA, Quincy, MA

RCW 47.24.020, Jurisdiction, control

WAC 296-24-960, Working on or near exposed energized parts

WAC 468-18-040, Design standards for rearranged county roads, frontage roads, access roads, intersections, ramps and crossings

WAC 468-18-050, Policy on the construction, improvement and maintenance of intersections of state highways and city streets

(2) Design Guidance

American National Standard Practice for Roadway Lighting, IES RP-8-00, New York, NY 2000

Directive D 22-21, "Truck Weigh Stations and Vehicle Inspection Facilities on State Highways"

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

NFPA 502: Standard for Road Tunnels, Bridges, and Other Limited Access Highways, NFPA, Quincy, MA 2008

Roadway Lighting Design Guide, AASHTO, October 2005

Roadway Lighting Handbook, Addendum to Chapter Six: Designing the Lighting System Using Pavement Luminance, Federal Highway Administration, Addendum to Implementation Package 78-15, Washington, DC 1983

Roadway Lighting Handbook, Federal Highway Administration, Implementation Package 78-15, Washington, DC 1978 (Reprinted April 1984)

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

(3) Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

An Informational Guide for Roadway Lighting, AASHTO, Washington, DC 1984

City Streets as a Part of State Highways, Final Report, WSDOT, 1997

Light Trespass: Research Results and Recommendations, IES TM-11-00, New York, NY 2000

Recommended Practice for Tunnel Lighting, IESNA RP-22-05, New York, NY 2005

840.03 Definitions

average light level The average of all light intensities within the design area.

complex ramp alignment and grade The exit advisory speed is mph or lower than the posted main line speed, or there is a 6% or greater change in grade from existing main line grade to the ramp grade.

continuous load The electrical load on a circuit that lasts for a duration of three or more hours on any day.

footcandle (fc) The illumination of a surface one square foot in area on which a flux of one lumen is uniformly distributed. One footcandle equals one lumen per square foot.

lamp lumens The total light output from a lamp, measured in lumens.

lumen The unit used to measure luminous flux.

luminaire A complete lighting unit comprised of a light bulb, wiring, and a housing unit.

luminance The quotient of the luminous flux at an element of the surface surrounding the point and propagated in directions defined by an elementary cone containing the given direction, by the product of the solid angle of the cone and area of the orthogonal projection of the element of the surface on a plane perpendicular to the given direction. The luminous flux may be leaving, passing through, and/or arriving at the surface.

luminous flux The time rate of the flow of light.

maximum uniformity ratio The average light level within the design area divided by the minimum light level within the design area (see Figure 840-25).

maximum veiling luminance ratio This ratio is the maximum veiling luminance divided by the average luminance over a given design area for an observer traveling parallel to the roadway centerline (see Figure 840-25).

minimum average light level The average of all light intensities within the design area, measured just prior to relamping the system (see Figure 840-25, Note 1).

minimum light level The minimum light intensity of illumination at any single point within the design area measured just prior to relamping the system (see Figure 840-25, Note 1).

mounting height – luminaire The vertical distance between the surface of the design area and the center of the light source of the luminaire. Note: This is not to be confused with pole height (H1), but is the actual distance that the luminaire is located above the roadway edge line.

multimodal connection The point where multiple types of transportation activities occur; for example, where transit buses and van pools drop off or pick up passengers (including passengers with bicycles).

nighttime The period of time from one-half hour after sunset to one-half hour before sunrise and any other time when persons or objects may not be clearly discernable at a distance of 500 feet (RCW 46.04.200).

pedestrian crossing For the purpose of lighting design, the number of pedestrian movements that cross through the design area.

pole height (H1) The vertical distance from the light source to the pole base. This distance is specified in contracts and used by the pole manufacturers to fabricate the light standard.

roadway luminance The light projected from a luminaire that travels toward a given area, represented by a point on the pavement surface, and then back toward the observer, opposite to the direction of travel. The units of roadway luminance are footcandles.

security lighting A minimal amount of lighting used to illuminate areas for public safety or theft reduction. Security lighting for walkways is the lighting of areas where shadows and horizontal and vertical geometry obstruct a pedestrian's view.

SIgnal Maintenance Management System (SIMMS) A database system to help the Signal Maintenance department manage work and inventory data. SIMMS is used to enter work reports for maintenance jobs, print timesheets, and maintain location records for Signals inventory.

slip base A mechanical base designed to allow the light standard to break away from the fixed foundation when hit by a vehicle traveling at the design speed.

spacing The distance in feet measured on centerline between adjacent luminaires.

transit flyer stop A multimodal connection located within the boundaries of a limited access facility.

transit stop A connection on the highway where the transit bus stops to pick up or drop off passengers.

uniformity ratio The ratio of the minimum average light level on the design area to the minimum light level of the same area (see Figure 840-25).

veiling luminance The stray light produced within the eye by light sources produces a veiling luminance that is superimposed on the retinal image of the objects being observed. This stray light alters the apparent brightness of an object within the visual field and the background against which it is viewed, thereby impairing the ability of the driver to perform visual tasks. Conceptually, veiling luminance is the light that travels directly from the luminaire to the observer's eye.

840.04 Design Considerations

An illumination system is built from many separate components. The simplest illumination system contains the following:

- A power feed from the local utility company
- An electrical service cabinet containing a photocell and circuit breaker for each illumination circuit
- Runs of conduit with associated junction boxes leading to each luminaire
- Conductors routed from the service cabinet breaker to each luminaire
- A concrete light standard foundation
- A light standard with a slip base or a fixed base
- A luminaire (light) over or near the roadway edge line

There are design considerations that need to be addressed when performing even the most minimal work on an existing illumination system. An existing electrical system is acceptable for use under the design requirements and National Electric Code (NEC) rules that were in effect at the time of installation. When modifying an existing electrical system, the designer is responsible for bringing the whole system up to current NEC design standards. Retrofitting an existing fixed base light standard with a slip base feature requires the installation of quick disconnect fittings and fuses in the circuit, at the luminaire. The existing conductor configuration for a fixed base luminaire is not acceptable for use on a breakaway (slip base) installation. Existing conductors and components that no longer meet current NEC requirements are to be replaced and the whole circuit is to be designed to current standards. This may mean replacing the whole circuit back to the nearest overcurrent protection device (circuit breaker). Design considerations to be addressed when modifying an existing illumination system include the following:

- Whether the existing circuit is in compliance with current NEC standards (deficient electrical component)
- Whether existing luminaire system components, such as conductors, conduit, junction boxes, foundation, and pole comply with current standards
- Whether conductors meet NEC requirements for temperature rating (deficient electrical component)
- Conductor material: aluminum conductors or copper conductors (deficient electrical component)
- The condition and adequacy of the existing conduit running between the luminaire and the nearest junction box (deficient electrical component)
- The condition of the junction box next to the luminaire (deficient electrical component)
- The suitability of the existing foundation to meet current design requirements
- The suitability of the location to meet current design standards for illumination
- The location and bolt pattern of the existing foundation to meet current design standards
- The design life remaining for the existing light standard (deficient electrical component)
- The condition of the existing light standard (deficient electrical component)
- Maintenance personnel assessment of the electrical safety of the installation

Involve appropriate Headquarters (HQ) and Region Traffic Office design personnel early in the process. Ensure that potential system deficiencies are reflected in the estimate of work.

Another consideration is the need to maintain illumination during construction. Site preparation, widening, drainage, guardrail installation, or other work can easily impact existing conduit runs or luminaire locations. Also, changed conditions such as merging, weaving, or unusual alignment due to traffic control often require additional temporary illumination. Note: The same lighting requirements apply whether a condition is temporary or permanent.

840.05 Required Illumination

The design matrices identify the design levels for illumination on all Preservation and Improvement projects (see Chapter 325).

- **Basic Design Level**. At the basic design level for minor safety or preservation work, providing slip base features on existing light standards (when in the Design Clear Zone or recovery area) and bringing electrical components to current standards is required. Consider other minor safety work as necessary. Providing additional lighting or relocating light standards on Preservation projects may be considered spot safety enhancements. When the Illumination column has an EU (evaluate upgrade to full design level), consider providing illumination if it would be beneficial to the specific project, and document accordingly.

  For Minor Operational Enhancement projects using the design matrices in Chapter 340, illumination is not required.

- **Evaluate Upgrade**. Review the age of the equipment as listed in SIMMS and consider replacing components that have reached their design life. Where items will not be upgraded, document why it will not be done. Components should be located so that they can be safely accessed from the right of way. Poles, foundations, heads, etc., that have reached their design life should be replaced. Slip base features should be per current design standards. Uniformity should be evaluated in the design areas (see 840.07(2)). Locations that are illuminated per this section should be brought to full standards or documented regarding why they are not (deferred to another project, etc.). Consider additional illumination per 840.06, if warranted, or design additional illumination if it is called for in the Project Definition.

  When it is necessary to relocate existing light standard foundations, evaluate the entire conduit run serving those light standards and replace deficient components to current (NEC) standards.
- **Full Standards**. For full design level, the illumination specified in this chapter is required when constructing a new system and/or bringing the entire existing system to full standards (such as slip base features, grounding, conduit, light levels, and uniformity). On existing systems, this includes all components not otherwise affected by the project. Review all conduit runs, not just the one affected by relocating light standards on that run.

Figures 840-1 through 840-24 show examples of illumination for roadway, transit flyer stops, parking lots, truck weigh stations, tunnels, bridges, work zones, and detour applications. Illumination is required in these examples, which are further discussed in the remainder of this section.

A minimum of two light standards of standard pole height are required at all design areas, with the exception of ramp terminals and entrance/exit points at minor parking lots.

(1) Freeway Off-Ramps and On-Ramps

Provide the necessary illumination for the design area of all freeway off-ramp gore areas and on-ramp acceleration tapers (see 840.07(2) and Figures 840-1a, 1b, and 1c).

(2) Freeway Ramp Terminals

Provide the necessary illumination for the design area (see Figure 840-2). Additional illumination is required if the intersection has left-turn channelization or a traffic signal.

(3) Freeway On-Ramps With Ramp Meter Signals

Provide the necessary number of light standards to illuminate freeway on-ramps with ramp meters, from the beginning of the on-ramp to the ramp meter stop bar. When there is an HOV bypass lane or a two-lane merge beyond the ramp meter, then provide illumination for the entire ramp from the beginning of the on-ramp to the ramp merge point with the main line (see Figure 840-3).

(4) Freeway-to-Freeway Ramp Connections

Provide the necessary number of light standards to illuminate freeway-to-freeway ramps that connect full limited access freeway systems from the exit ramp gore area to the main line merge area (see Figure 840-4).

(5) HOT (High Occupancy Toll) Lane Enter/Exit Zones

Provide the necessary number of luminaires to illuminate the design area of the enter/exit zones of the HOT Lane (see Figure 840-5).

(6) Lane Reduction

Provide the necessary number of light standards to illuminate the design area of all highway lane reduction areas within the urban boundary (see Figure 840-6). This requirement does not apply to:

- The end of slow-moving vehicle turnouts.
- The end of the area where driving on shoulders is allowed.

(7) Add Lane Channelization

Provide the necessary number of light standards to illuminate the design area of highway add lanes on high-volume roadways within the urban boundary (see Figure 840-7). This requirement does not apply to the following:

- The beginning of an add lane on a low-volume roadway in a rural area beyond the urban boundary
- The beginning of a slow-moving vehicle turnout
- The beginning of an area where driving on shoulders is allowed

(8) Intersections With Left-Turn Lane Channelization

Illumination of the intersection area and the left-turn storage area is required for intersections with painted or other low-profile pavement markings such as raised pavement markings. When the channelization is delineated with curbs, raised medians, or islands, illuminate the raised channelization from the beginning of the left-turn approach taper (see Figures 840-8a and 8b). Illumination of the secondary road intersecting the state highway can be beneficial to the motoring public. Funding and design, however, are the local agency's responsibility. Contact that agency to see whether it is interested in participating.

(9) Intersection With Drop Lane/Right-Turn Lane Channelization

Illumination of the intersection area and the right-turn storage area is required for intersections with painted or other low-profile pavement markings such as raised pavement markings. Raised channelization such as curbs, raised medians, and islands are to be illuminated from the beginning of the right-turn taper. For concurrent left-turn and right-turn channelization, where the left-turn lane and the left-turn taper are longer than the right-turn lane and taper, illuminate the roadway as described in 840.05(8), and include the right-turn lane area in the design area (see Figure 840-9). Illumination of the secondary road intersecting the state highway can be beneficial to the motoring public. Funding and design, however, are the local agency's responsibility. Contact that agency to see whether it is interested in participating

(10) Intersections With Traffic Signals

Illuminate all intersections with traffic signals on state highways (see Figure 840-10). Illumination of the crossroad is beneficial and the participation of the local agency is desirable. In cities with a population under 22,500, the state may assume responsibility for illumination installed on signal standards.

(11) Roundabouts

Provide the necessary number of light standards to illuminate the design area of roundabouts (see Chapter 915 and Figure 840-12).

(12) Railroad Crossings With Gates or Signals

Railroad crossings with automated gates or signals on state highways are illuminated if there is nighttime train traffic. Within the corporate limits of a city, and outside limited access control, illumination is the responsibility of the city. Install luminaires beyond the railroad crossing, on the side of the roadway opposite the approaching traffic, to back light the train (see Figure 840-13).

(13) Midblock Pedestrian Crossings

Illuminate the entire midblock pedestrian crossing, including the crosswalks, the refuge area in the roadway, and the sidewalks or shoulders adjacent to the crosswalk. When a raised median pedestrian refuge design is used, illuminate the raised channelization (see Figure 840-14).

(14) Transit Flyer Stops

Illuminate the pedestrian-loading areas of transit flyer stops located within the limited access boundaries (see Figure 840-15).

(15) Major Parking Lots

All parking lots with usage exceeding 50 vehicles during the nighttime peak hour are considered major parking lots. Provide an illumination design that will produce the light levels shown in Figure 840-25. (See Figure 840-16 for the parking design area and bus loading zone design area.) During periods of low usage at night, security lighting is required only in the parking area and bus loading zone. Provide an electrical circuitry design that allows the illumination system to be reduced to approximately 25% of the required light level.

(16) Minor Parking Lots

Minor parking lots have a nighttime peak hour usage of 50 or fewer vehicles. Provide security-level lighting for those lots owned and maintained by the state. Security lighting for a minor parking lot consists of lighting the entrance and exit to the lot (see Figure 840-17).

(17) Truck Weigh Sites

Provide illumination of the roadway diverge and merge sections, scale platforms, parking areas, and inspection areas of weigh sites (see Figure 840-18).

(18) Safety Rest Areas

Provide illumination within rest areas at the roadway diverge and merge sections, the walkways between parking areas and rest room buildings, and the parking areas as for a major parking lot (see Figure 840-19).

(19) Chain-Up/Chain-Off Parking Areas

Provide the necessary number of luminaires to illuminate the design area of the chain-up/chain-off parking area (see Figure 840-20).

(20) Tunnels

Long tunnels have a portal-to-portal length greater than the stopping sight distance. Provide both nighttime and daytime illumination for long tunnels. Consider illumination for short tunnels if the horizontal-to-vertical ratio is ≥ 10:1 (see Chapter 650 and Figure 840-21). Provide daytime security lighting in pedestrian tunnels.

(21) Bridge Inspection Lighting

Provide the necessary number of light fixtures to illuminate the interior inspection areas of floating bridges and steel box girder bridges (see Figure 840-22). Coordinate bridge illumination requirements with the HQ Bridge and Structures Office.

(22) Same Direction Traffic Split Around an Obstruction

Provide the necessary number of light standards to illuminate the design area where traffic is split around an obstruction. This requirement applies to permanent and temporary same-direction split channelization. For temporary work zones, illuminate the obstruction for the duration of the traffic split (see Figure 840-23).

(23) Overhead Sign Illumination

Provide sign lighting on overhead signs as discussed in Chapter 820. Sign illumination is provided with sign lighting fixtures mounted directly below the sign. The light source of the fixture is a 175 watt mercury vapor lamp or an 85 watt induction lamp. Provide one sign with a width of 16 feet or less. For wider signs, provide two or more sign lights with a spacing not exceeding 16 feet. If two or more closely spaced signs are in the same vertical plane on the structure, consider the signs as one unit and use a uniform light fixture spacing for the entire width. Voltage drops can be significant when the electrical service is not nearby. In areas where an electrical power source is more than ½ mile away, utility company installation costs can be prohibitive. With justification, overhead sign illumination is not required where the power source is more than ½ mile away.

840.06 Additional Illumination

At certain locations, additional illumination is desirable to provide better definition of nighttime driving conditions or to provide consistency with local agency goals and enhancement projects. For improvement projects on state highways, additional illumination is considered under certain circumstances, which are listed in this section. Justify the additional illumination in the Design Documentation Package (DDP).

Some conditions used in making the decision to provide additional illumination are:

- **Diminished Level of Service**. A mobility condition where the nighttime peak hour level of service is D or lower. To determine the level of service, use traffic volume counts taken during the evening peak hour. Peaking characteristics in urban areas are related to the time of day. Traffic counts taken in the summer between 4:30 p.m. and 7:30 a.m. may be used as nighttime volumes if adjustment factors for differences in seasonal traffic volumes are applied for November, December, and January.
- **Nighttime Collision Frequency**. When the number of nighttime collisions equals or exceeds the number of daytime collisions. An engineering study indicating that illumination will result in a reduction in nighttime collisions is required as justification. Consider the seasonal variations in lighting conditions when reviewing reported collisions. Collision reporting forms, using a specific time period to distinguish between "day" and "night," might not indicate the actual lighting conditions at the time of a collision. Consider the time of year when determining whether a collision occurred at nighttime. A collision occurring at 5:00 p.m. in July would be a daytime collision, but a collision occurring at the same time in December would be during the hours of darkness.
- **Nighttime Pedestrian Accident Locations (PALs)**. The mitigation of nighttime PALS requires different lighting strategies than vehicular accident locations. Provide light levels to emphasize crosswalks and adjacent sidewalks. Multilane highways with two-way left-turn lanes, in areas transitioning from rural land use to urban land use or areas experiencing commercial growth or commercial redevelopment, are typically high-speed facilities with numerous road approaches and driveways. These approaches allow numerous vehicle entry and exit points and provide few crossing opportunities for pedestrians; consider additional illumination.

(1) Highways

Proposals to provide full (continuous) illumination require the approval of the State Traffic Engineer. Regions may choose to develop (regional or corridor-specific) system plans for providing full (continuous) illumination. The State Traffic Engineer's approval of a system plan will eliminate the need for a project-specific approval from the State Traffic Engineer.

The decision whether to provide full (continuous) illumination is to be made during the scoping stage and communicated to the designers as soon as possible.

(a) On the main line of full limited access highways, consider full (continuous) illumination if a diminished level of service exists and any two of the following conditions are satisfied:

- There are three or more successive interchanges with an average spacing of 1½ miles or less, measured from the center of each interchange or a common point such as a major crossroad
- The segment is in an urban area
- A nighttime collision frequency condition exists
- A benefit/cost analysis between the required and full (continuous) illumination indicates a value added condition with the addition of continuous illumination

(b) On the main line of highways without full limited access control, consider full (continuous) illumination if the segment of highway is in a commercial area and either a diminished level of service exists or a nighttime collision frequency exists and an engineering study indicates that nighttime driving conditions will be improved.

(2) Ramps

At ramps, consider additional illumination when a diminished level of service exists for the ramps and any of the following conditions are present:

- The ramp alignment and grade are complex
- There are routine queues of five or more vehicles per lane at the ramp terminal during the nighttime peak hour due to traffic control features
- A nighttime collision frequency condition exists
- The criteria for continuous main line illumination have been satisfied

(3) Highway-to-Highway Ramp Connections

Provide the necessary number of light standards to illuminate highway-to-highway ramps that connect partial or modified limited access freeway systems or managed access highway systems, from the exit ramp gore area to the main line merge area. For an example of the ramp connection, see Figure 840-4.

(4) Crossroads

At crossroads, consider additional illumination when a diminished level of service exists and a nighttime collision frequency exists. Also, consider additional illumination if the crossroad is in a short tunnel, an underpass, or a lid.

(5) Intersections Without Turn-Lane Channelization

Consider illumination of intersections without turn-lane channelization if a nighttime collision frequency requirement is satisfied or the intersection meets warrants for left-turn channelization (see Figure 840-11).

(6) Short Tunnels, Underpasses, or Lids

Consider illumination of short tunnels, underpasses, or lids if portal conditions result in brightness that is less than the measured daytime brightness of the approach roadway divided by 15 and the length to vertical clearance ratio is 10:1 or greater.

(7) Work Zones and Detours

Consider temporary illumination of the highway through work zones and detours when changes to the highway alignment or grade remain in place during nighttime hours, and when the following conditions may be present (see Figure 840-24):

- Nonstandard roadway features such as narrow lanes, narrow shoulders, or substandard shy distance to barriers or structures
- The temporary alignment includes abrupt changes in highway direction or lane shifts with substandard lane shift tapers
- Other unusual highway features such as abrupt lane edge drop-offs, sudden changes in pavement conditions, or temporary excavation or trenching covers
- There is an anticipation of heavy construction truck traffic, possibly requiring flaggers, entering and exiting the highway during nighttime hours

For further information, see Chapter 810.

(8) Transit Stops

The responsibility for lighting at transit stops is shared with the transit agency. Consider illuminating transit stops with shelters, as they usually indicate greater passenger usage. Negotiation with the transit agencies is required for the funding and maintenance of this illumination. Negotiating a memorandum of understanding (MOU) with each transit agency is preferred over spot negotiations. If the transit agency is unable or unwilling to participate in the funding and maintenance of the illumination, consider a single light standard positioned to illuminate both the transit pullout area and the loading area.

(9) Bridges

Justification for illuminating the roadway/sidewalk portion of bridges is the same as that for highways on either end of the bridge with or without full limited access control, as applicable. Justification for illuminating the architectural features of a bridge structure requires the approval of the State Traffic Engineer. For justification for illuminating pedestrian walkways or bicycle trails under a bridge, see 840.06(11).

(10) Railroad Crossing Without Gates or Signals

Consider the illumination of railroad crossings without gates or signals when:

- The collision history indicates that motorists experience difficulty in seeing trains or control devices.
- There are a substantial number of rail operations conducted during nighttime hours.
- The crossing is blocked for long periods due to low train speeds.
- The crossing is blocked for long periods during the nighttime.

For further information, see the MUTCD.

(11) Walkways and Bicycle Trails

Consider illumination of a pedestrian walkway if the walkway is a connection between two highway facilities. This could be between parking areas and rest room buildings at rest areas; between drop-off/pick-up points and bus loading areas at flyer stops; or between parking areas and bus loading areas or ferry loading zones. Consider illuminating existing walkways and bicycle trails if security problems have been reported. Also, consider illumination if security problems are anticipated. Under these conditions, the walkways and bicycle trails are illuminated to the level shown in Figure 840-25.

840.07 Design Criteria

(1) Light Levels

Light levels vary with the functional classification of the highway, the development of the adjacent area, and the level of nighttime activity. Light level requirements for highways and other facilities are shown in Figure 840-25. These levels are the minimum average light levels required for a design area at the end of rated lamp life for applications requiring a spacing calculation. Light level requirements *are not applicable* for single light standards or security lighting installations where:

- The light level is reduced to approximately 25% of the required light level in parking lots and parking lot loading areas during periods of low usage at night.
- Walkway or path illumination is installed only at areas where shadows and horizontal and vertical geometry obstruct a pedestrian's view.

Light level requirements *are applicable* when:

- The complete walkway or path is to be illuminated for public safety.

For design-level classifications of highways, see Chapters 325, 410, 430, and 440.

(a) **Activity Areas**. The types of activity areas (shown below) are related to the number of pedestrian crossings through the design area. These crossings need not occur within a single crosswalk and can be at several locations along the roadway in an area with pedestrian generators. Land use and activity classifications are as follows:

- **High Activity**. Areas with over 100 pedestrian crossings during nighttime peak hour pedestrian usage. Examples include downtown retail areas; near outdoor stage theaters, concert halls, stadiums, and transit terminals; and parking areas adjacent to these facilities.
- **Medium Activity**. Areas with pedestrian crossings that number between 11 and 100 during nighttime peak hour pedestrian usage. Examples include downtown office areas; blocks with libraries, movie theaters, apartments, neighborhood shopping, industrial buildings, and older city areas; and streets with transit lines.
- **Low Activity**. Areas with pedestrian crossings that number less than 11 during the nighttime peak hour pedestrian usage. Examples include suburban single-family areas, low-density residential developments, and rural or semirural areas.

(2) Design Areas

The design area is that portion of the roadway, parking lot, or other facility subject to the minimum light level, minimum average light level, uniformity ratio, and maximum veiling luminance ratio design requirements. This encompasses the area between the edges of the traveled way along the roadway; the outer edges of the stopping points at intersections; and, when present, a bike lane adjacent to the traveled way. When the roadway has adjacent sidewalks, the design area includes these features, except that sidewalks adjacent to the traveled way are exempt from maximum veiling luminance ratio requirements. The access areas used for interior inspection of a floating bridge or steel box girder bridge are exempt from lighting level and lighting ratio design requirements.

Design area requirements for various applications are shown in Figures 840-1 through 840-24 and the following:

- **Single-Lane Off-Ramp**. Two main line through lanes and the ramp lane, including gore area, from the gore point (beginning of wide line) to a point 200 feet (minimum) downstream of the gore point. A 100-foot longitudinal tolerance either way from the gore point is allowed.
- **Two-Lane Off-Ramp**. Two main line through lanes and both ramp lanes, including gore area, from a point 200 feet upstream of the gore point (beginning of wide line) to a point 200 feet downstream of the gore point. A 100-foot longitudinal tolerance either way from the gore point is allowed.
- **Single-Lane On-Ramp**. Two main line through lanes and the ramp lane, from a point where the ramp lane is 10 feet wide to a point 200 feet downstream. A 100-foot longitudinal tolerance either way is allowed (this includes auxiliary lane on-connections and lane reductions).
- **Two-Lane On-Ramp**. Two main line through lanes and the ramp lanes from a point where the ramp width is 22 feet wide to a point 200 feet upstream and 200 feet downstream. A 100-foot longitudinal tolerance either way is allowed.
- **Intersections Channelized With Pavement Markings**. The design area has two components: the intersection area and the approach areas. The intersection area is the area between the stopping points on both the main road and the minor road, including marked or unmarked crosswalks. The approach areas are the areas on the main roadway between the stopping point and where the left-turn lane is full width.
- **Intersections With Raised Channelization**. The design area has two components: the intersection area and the approach areas. The intersection area is the area between the stopping points on both the main road and the minor road, including marked or unmarked crosswalks. The approach areas are the areas on the main roadway between the stopping point and where the left-turn taper begins.
- **Unchannelized Intersection**. The area between the stopping points on both the main road and the minor road, including marked or unmarked crosswalks.
- **Railroad Crossing**. The roadway width from a point 50 feet on either side of the track (the approach side only for one-way roadways).
- **Transit Loading Area**. The lane width and length designated for loading.
- **Major Parking Lot**. The entire area designated for parking, including internal access lanes.

- **Scale Platform at Weigh Site**. The approach width from the beginning of the scale platform to the end of the platform.
- **Inspection Area at Weigh Site**. The area dedicated to inspection as agreed upon with the Washington State Patrol.
- **Bridge Inspection Lighting System**. Fixtures are to be ceiling mounted with a maximum spacing of 25 feet. Illumination is to consists of a 100 watt incandescent (or fluorescent equivalent) fixture. Each fixture is to be designed with a 20 amp rated ground fault circuit interrupt (GFCI) receptacle. A light switch is needed at each entrance to any common inspection area. For inspection areas with two or more entrances, three-way or four-way switches are required.

(3) Daytime Light Levels for Tunnels and Underpasses

It is important to provide sufficient illumination inside a tunnel. When driving into and through a tunnel during the day, a driver's eyes have to adjust from a high light level (daylight) to a lower lighting level inside the tunnel. Motorists require sufficient time for their eyes to adapt to the lower light level of the tunnel itself. When sufficient lighting is not provided in the threshold, transition, or interior zones of a tunnel, a motorist's eyes may not have enough time to adapt and may experience a "black hole" or "blackout" effect. This "black hole" effect may cause a motorist to slow down, reducing the efficiency of the roadway. When leaving the tunnel, the driver's eyes have to adjust from a low lighting level back to daytime conditions. The full design considerations for tunnel lighting are covered in 840.02 in the Supporting Information section. All designs for illuminating tunnels are to be reviewed and approved by the State Traffic Engineer.

- Long tunnels are divided into zones for the determination of daytime light levels. Each zone is equal in length to the pavement stopping sight distance. The entrance zone beginning point is a point outside the portal where the motorist's view is confined to the predominance of the darkened tunnel structure.
- The daytime entrance zone light level is dependent upon the brightness of the features within the motorists' view on the portal approach. The brightness level is defined as the average brightness measured over a 20° cone at a point 500 feet in advance of the portal. The entrance zone light level produced within the tunnel must be sufficient to provide a brightness level of approximately 5% of the measured portal brightness, after adjustment for the reflectivity of the roadway, walls, and ceiling. Design successive zones for a daytime light level of 5% of the previous zone light level to a minimum value of five footcandles. Requirements for nighttime light levels for long tunnels on continuously illuminated roadways are the same as the light level required on a roadway outside the tunnel. Provide illumination of fire protection equipment, alarm pull boxes, phones, and emergency exits in long tunnels. (See NFPA 502 for additional information.)
- A short tunnel or underpass has a length-to-vertical clearance ratio of 10:1 or less. Short tunnels and underpasses in rural areas or with low pedestrian usage normally do not have daytime illumination. Short tunnels and underpasses in urban areas with high pedestrian usage may require daytime and nighttime illumination. Consultation with the affected local agency is recommended. Short tunnels and underpasses with length-to-vertical clearance ratios greater than 10:1 are treated the same as an entrance zone on a long tunnel to establish daytime light levels. Short tunnels and underpasses where the exit portal is not visible from the entrance portal due to curvature of the roadway are to be considered

long tunnels. Nighttime light level requirements for short tunnels on continuously illuminated roadways are the same as the light level required on the roadway outside the tunnel.

(4) Light Standards

(a) **Light Standards**. Light standards are the most common supports used to provide illumination for highway facilities. The 40-foot and 50-foot-high light standards with slip bases and Type 1 mast arms are predominantly used on state highways. The angular Type 2 mast arms are allowed only to match existing systems. Use Type 1 mast arms on all new systems. Cities and counties may elect to use different mounting heights to address factors unique to their environments. On state highways, alternative light standards may be considered if requested by the city or county, provided they agree to pay any additional costs associated with this change.

The typical location for a light standard is on the right shoulder. When considering designs for light standards mounted on concrete barrier in the median, consider the total life cycle cost of the system, including the user costs resulting from lane closures required for relamping and repair operations. Light standards located in the vicinity of overhead power lines require a minimum 10-foot circumferential clearance from the power line (including the neutral conductor) to any portion of the light standard or luminaire. Depending on the line voltage, a distance greater than 10 feet may be required (WAC 296-24-960). Consult the HQ Bridge and Structures Office when mounting light standards on structures such as retaining walls and bridge railings.

It is preferable to locate a light standard as far from the traveled way as possible to reduce the potential for impacts from errant vehicles. The preferred position for the luminaire is directly over the edge line. However, some flexibility is acceptable with the luminaire position to allow for placement of the light standard. On Type III signal standards, luminaires may be placed more than 4 feet from the edge line. Standard mast arm lengths are available in 2-foot increments between 6 and 16 feet. The preferred design for a single-arm light standard is a 16-foot mast arm installed on a 40-foot or 50-foot standard. The maximum allowable mast arm length for a single-arm light standard is 16 feet. The preferred design for a double mast arm light standard has mast arms between 6 feet and 12 feet in length, installed on a 40-foot or 50-foot standard. The maximum allowable mast arm length for a double luminaire light standard is 12 feet.

When light standards are located within the Design Clear Zone, breakaway and slip base features are used to reduce the severity of an impact. (See Chapter 700 for additional guidance on clear zone issues.)

In curb and sidewalk sections, locate the light standard behind the sidewalk. Slip bases on light standards are a safety requirement for roadways where the posted speed is 35 mph or higher. They are not always desirable at other locations. Fixed bases are installed in the following locations:

- Parking lots
- Medians where the light standard is mounted on median barrier

- Behind traffic barrier, beyond the barrier's deflection design value (see Chapter 710)
- Along pedestrian walkways, bike paths, and shared-use paths

(b) **Light Standard Heights**. Standard pole heights (20-foot, 30-foot, 40-foot, or 50-foot) are readily available from local distributors and manufacturers. Light standards can also be supplied with other lengths. However, WSDOT maintenance offices cannot stock poles with nonstandard lengths for use as replacements in the event of a knockdown. Nonstandard lengths in 5-foot increments (25-foot, 35-foot, or 45-foot) will require a longer delivery time. Other nonstandard lengths (for example, 27-foot, 33-foot, 43-foot, or 47-foot) will not only require a longer delivery time, they will also be more expensive.

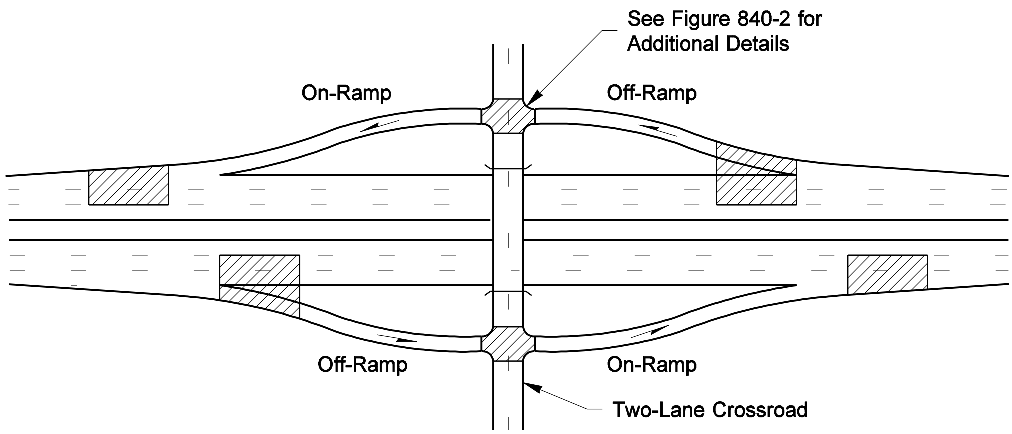
In almost all cases, use standard pole heights of 40 feet and 50 feet for roadway illumination. Structure-mounted light standards may need to be shorter than the standard 40-foot or 50-foot grade-mounted pole. It is acceptable to use 20-foot or 30-foot light standards on bridges, retaining walls, or other structures to compensate for top-of-structure elevation above the roadway surface. Use of these standard pole heights will result in variable mounting heights for the luminaires. Luminaire mounting height is defined as the actual distance from the roadway surface directly under the luminaire to the luminaire itself. Use the actual mounting height at each location when calculating light standard spacing. High mast light supports may be considered for complex interchanges where continuous lighting is justified. High mast lighting may be considered for temporary illumination areas during construction. Initial construction costs, long-term maintenance, clear zone mitigation, spillover light onto adjacent properties, and negative visual impacts are important factors when considering high mast illumination. Shorter light standards of 30 feet or less may be used for minor parking lots, trails, pedestrian walkways, and locations with restricted vertical clearance.

(c) **Standard Luminaire**. The cobra head-style, high-pressure sodium vapor luminaire with Type III, medium cut-off light distribution is the normal light source used for state highway lighting. A Type III distribution projects an oval pattern of light on the roadway, and a Type V distribution projects a circular pattern of light on the roadway. Post top-mounted luminaires and other decorative light fixtures with Type V patterns are more effective for area lighting in parking lots and other locations where more symmetrical light distribution patterns are used.

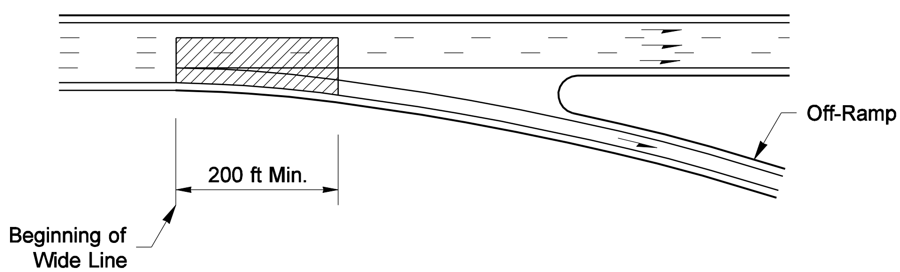
(d) **Electrical Design**. For an example of circuit layout, conductor sizing, conduit sizing, overcurrent protection device sizing, and other electrical design calculations, see the *Traffic Manual*, Chapter 4.

840.08 Documentation

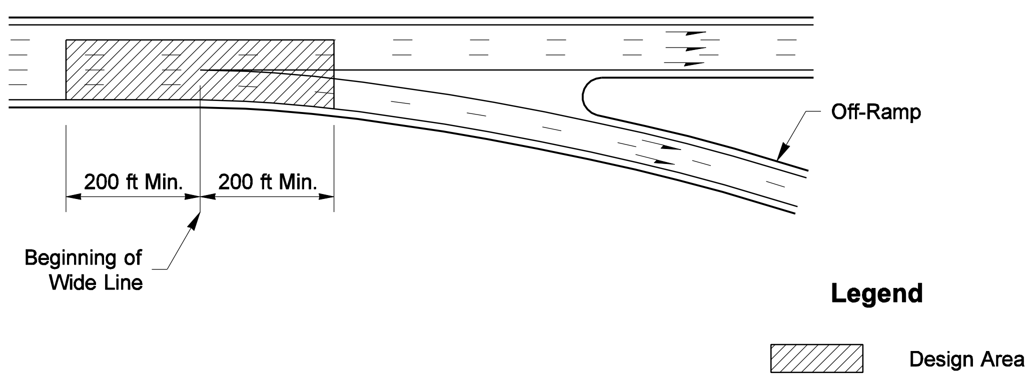
For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/



Required Illumination for a Typical Diamond Interchange
(Shown for single-lane ramp connection and a two-lane crossroad without channelization.)

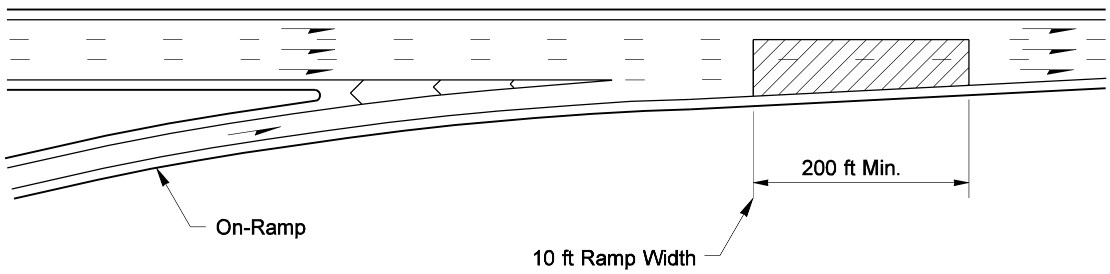


Single-Lane Off-Connection
(The design area may be shifted up to 100 ft from the beginning of the wide line;
a minimum of two light standards of standard pole height required for design area.)

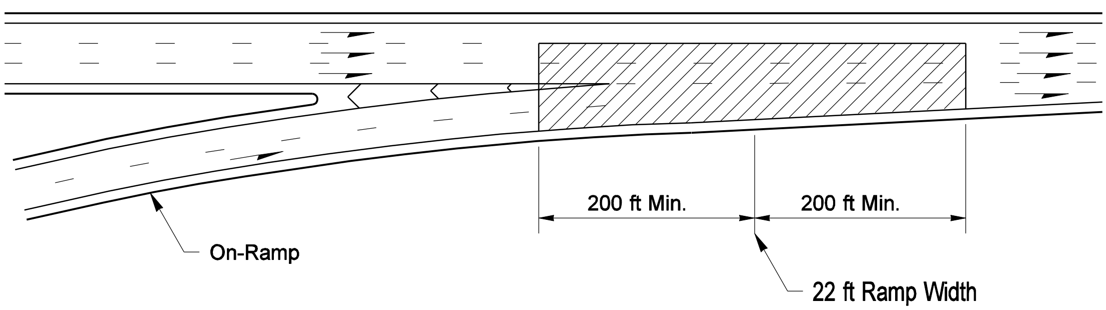


Two-Lane Off-Connection
(The design area may be shifted up to 100 ft from the beginning of the wide line;
a minimum of three light standards of standard pole height required for design area.)

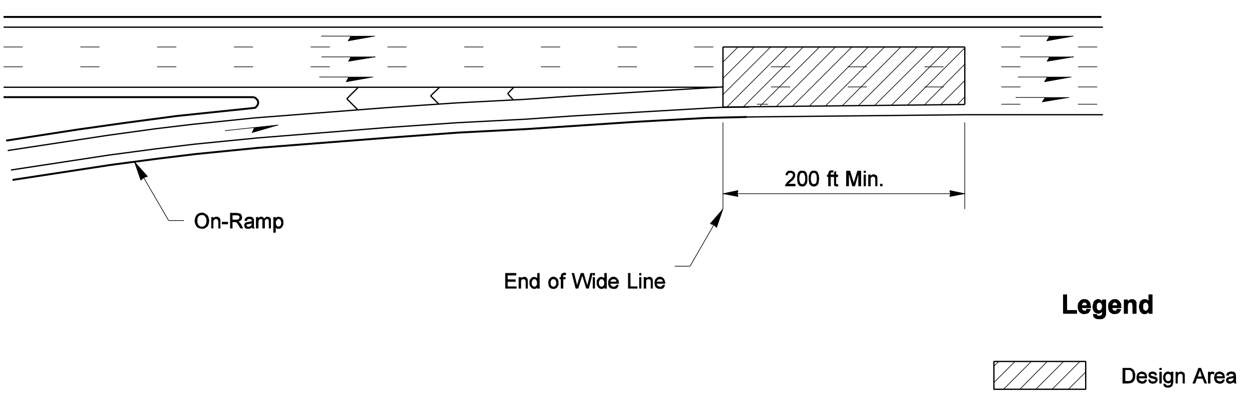
Freeway Lighting Applications
Figure 840-1a



Single-Lane On-Connection
(The design area may be shifted up to 100 ft from the 10-ft-wide ramp point;
a minimum of two light standards of standard pole height required for design area.)

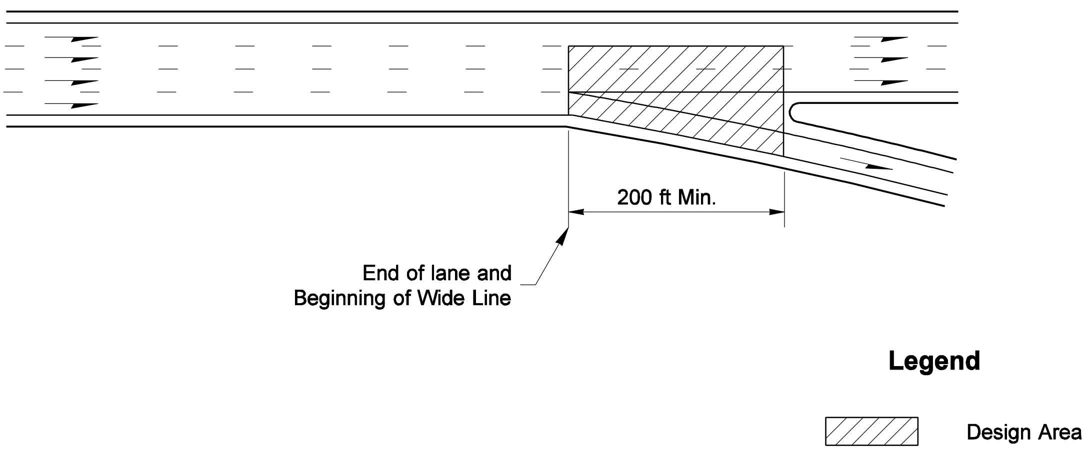


Two-Lane On-Connection
(The design area may be shifted up to 100 ft from the 22-ft-wide ramp point;
a minimum of three light standards of standard pole height required for design area.)



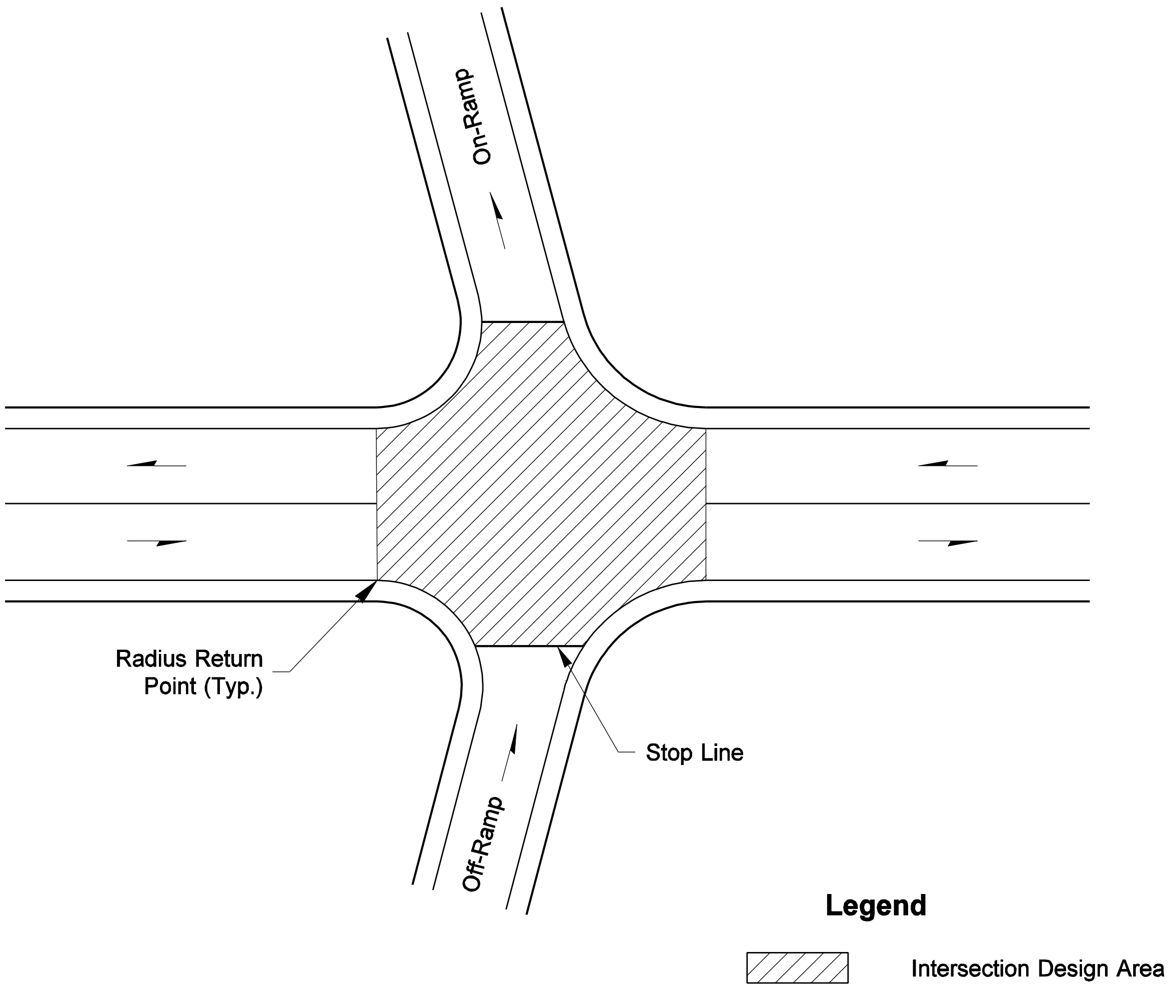
Auxiliary-Lane at On-Connection
(The design area may be shifted up to 100 ft from the 10-ft-wide ramp point;
a minimum of two light standards of standard pole height required for design area.)

Freeway Lighting Applications
Figure 840-1b

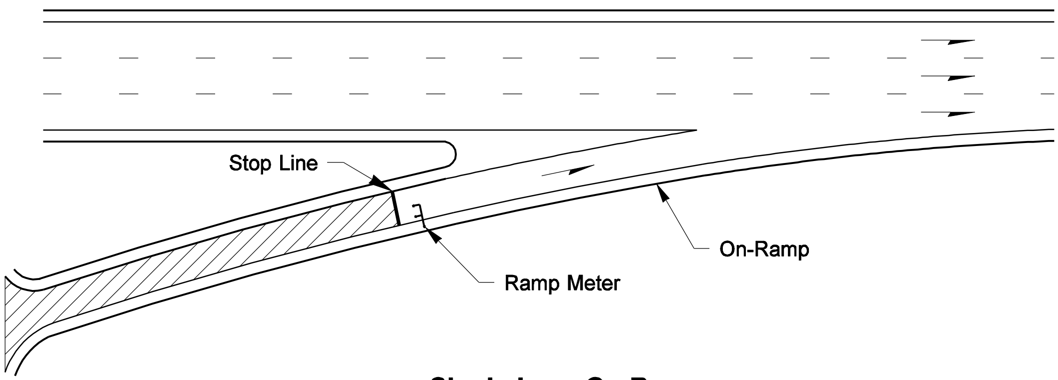


Exit-Only Lane
(The design area may be shifted up to 100 ft from the end of lane and the beginning of wide line; a minimum of two light standards of standard pole height required for design area.)

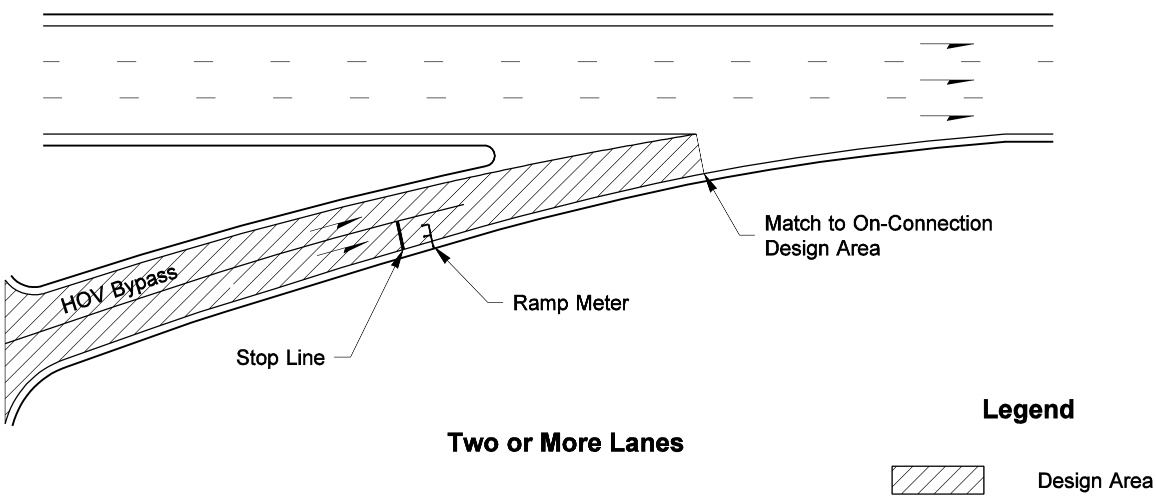
Freeway Lighting Applications
Figure 840-1c



Freeway Ramp Terminals
Figure 840-2

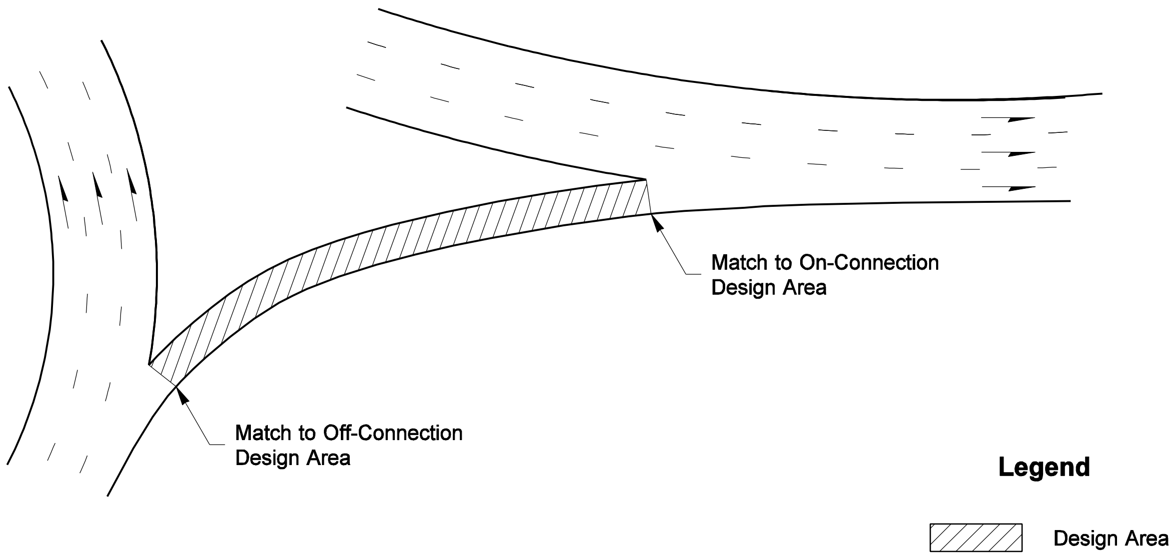


Single-Lane On-Ramp

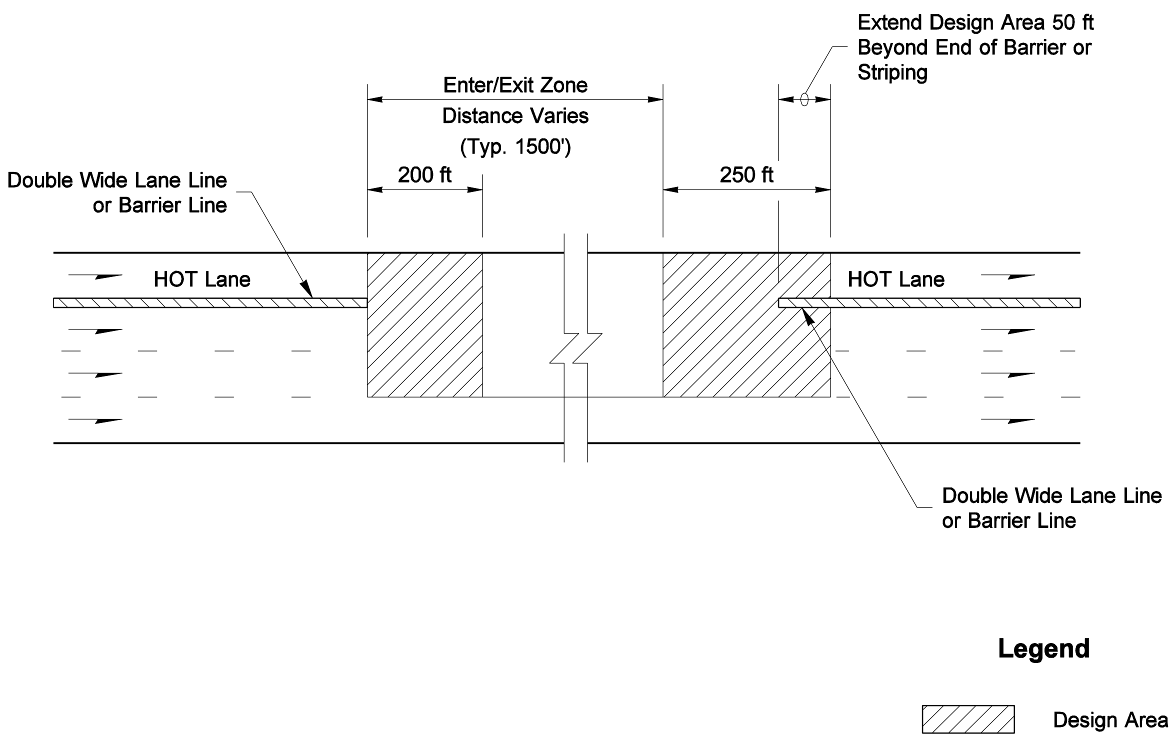


Two or More Lanes

Ramp With Meter
Figure 840-3

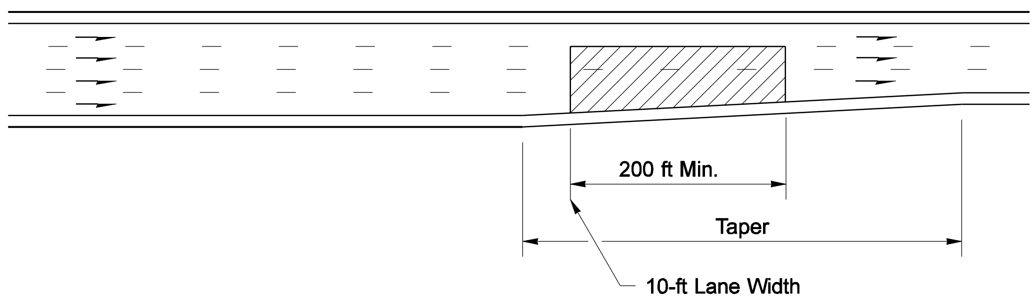


Freeway-to-Freeway Connection
Figure 840-4



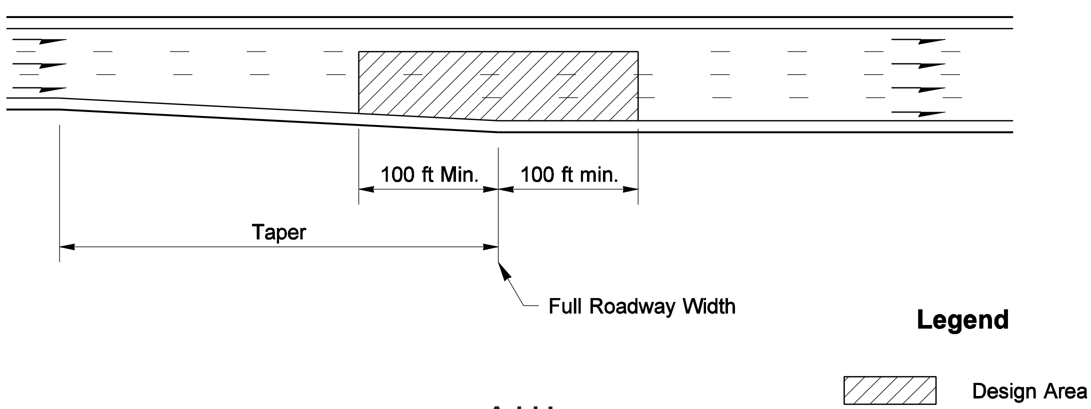
A minimum of two light standards of standard pole height required for each design area.

HOT (High Occupancy Toll) Lane Enter/Exit Zone
Figure 840-5



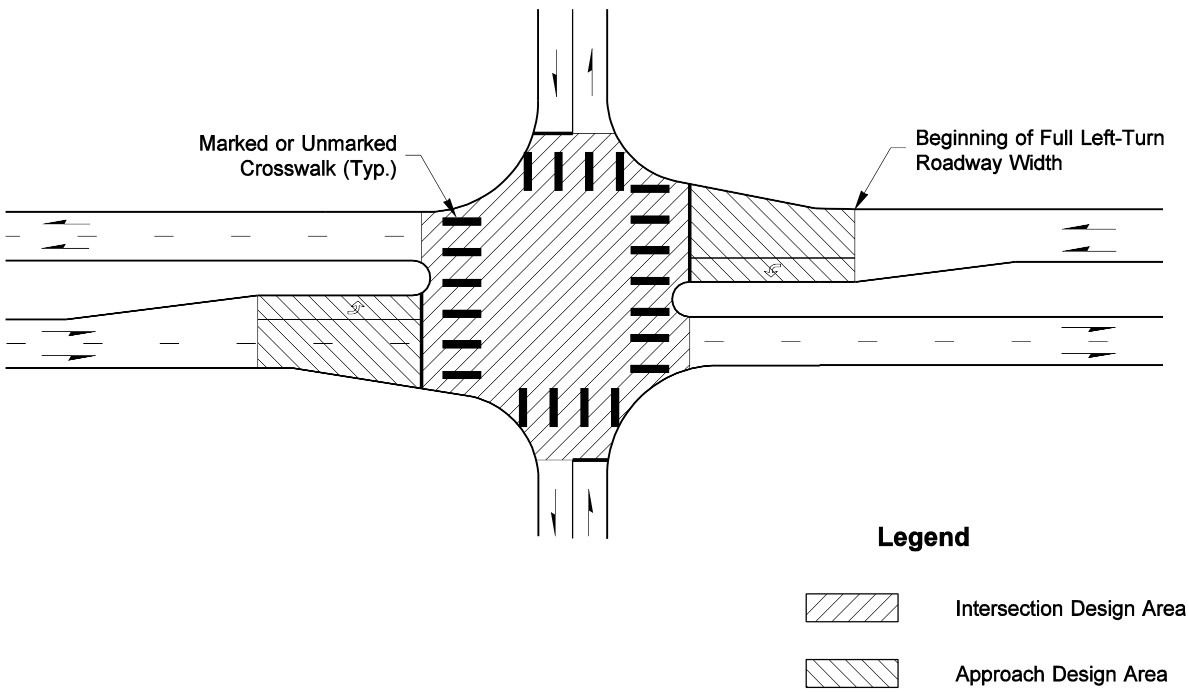
Lane Reduction
(A minimum of two light standards of standard pole height required for design area; design area may be shifted 100 ft.)

Lane Reduction
Figure 840-6

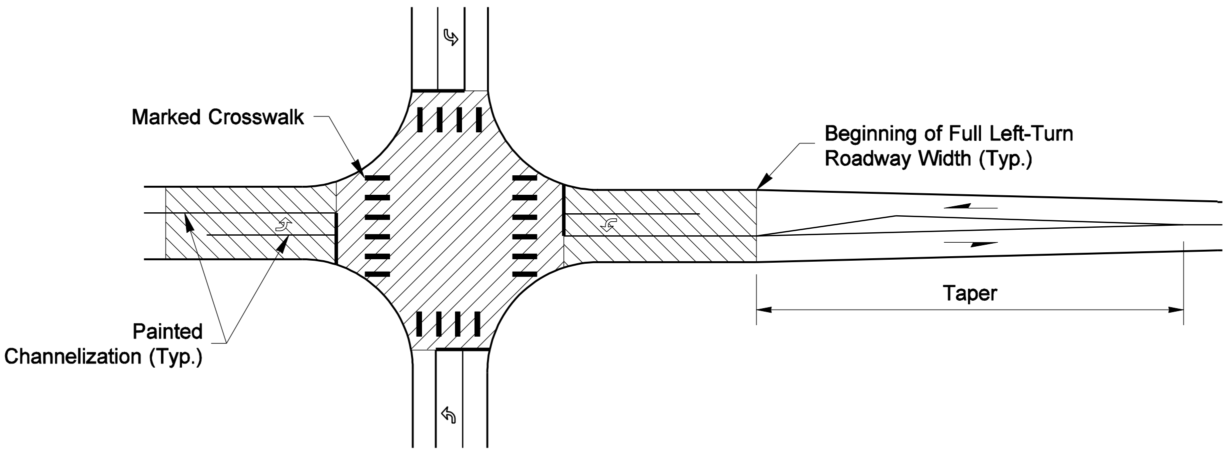


Add Lane
(A minimum of two light standards of standard pole height required for design area.)

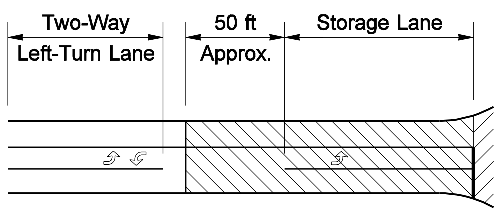
Add Lane
Figure 840-7



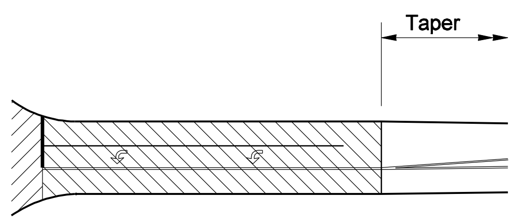
Intersections With Left-Turn Channelization
Figure 840-8a



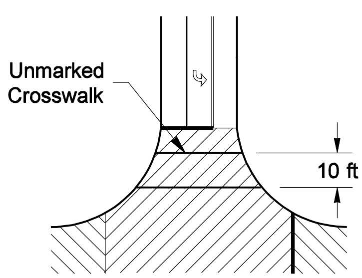
Intersection With Left-Turn Lane Channelization



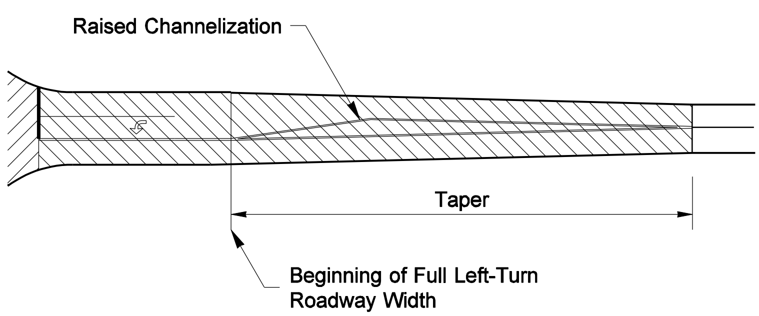
Alternate for Transitions to Two-Way Left-Turn Lanes



Alternate for Long Storage Lanes

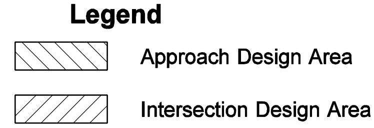


Unmarked Crosswalk Detail



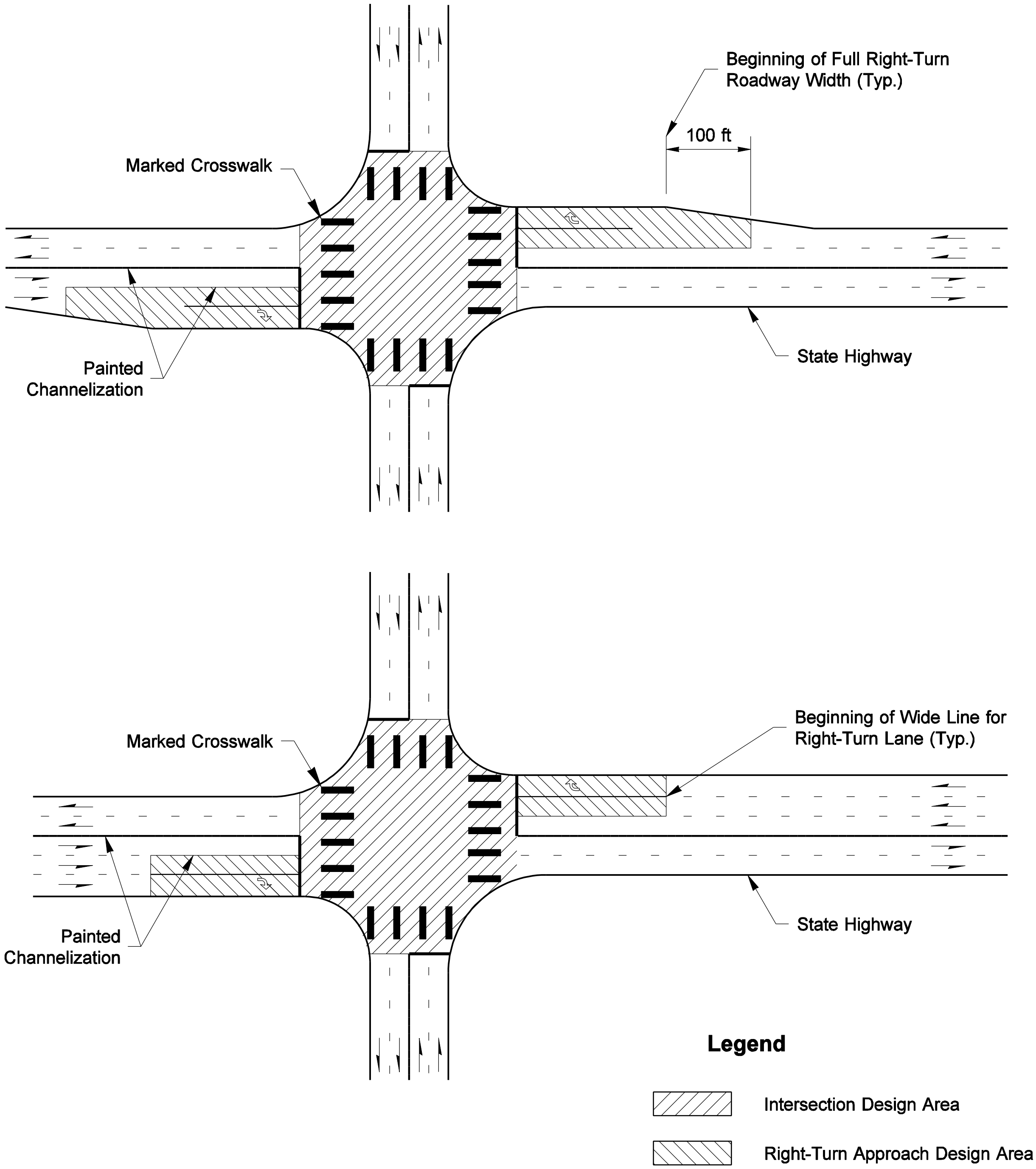
Alternate for Raised Channelization

Legend

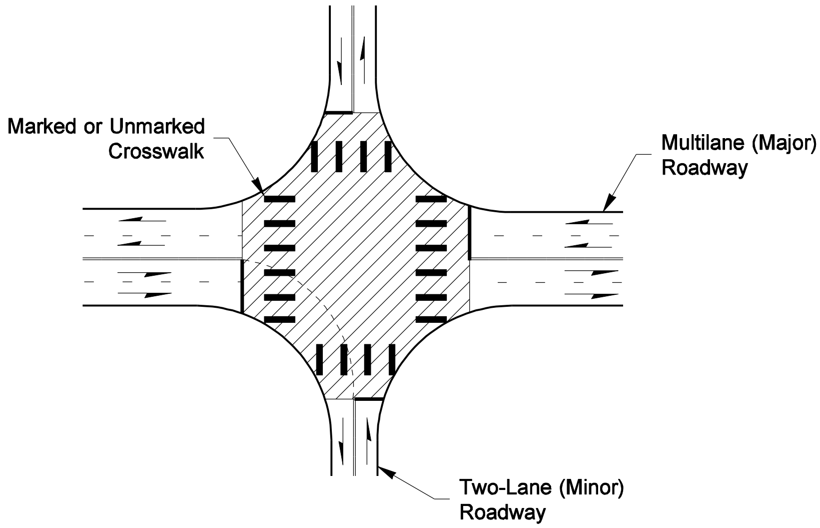


Intersections With Left-Turn Channelization

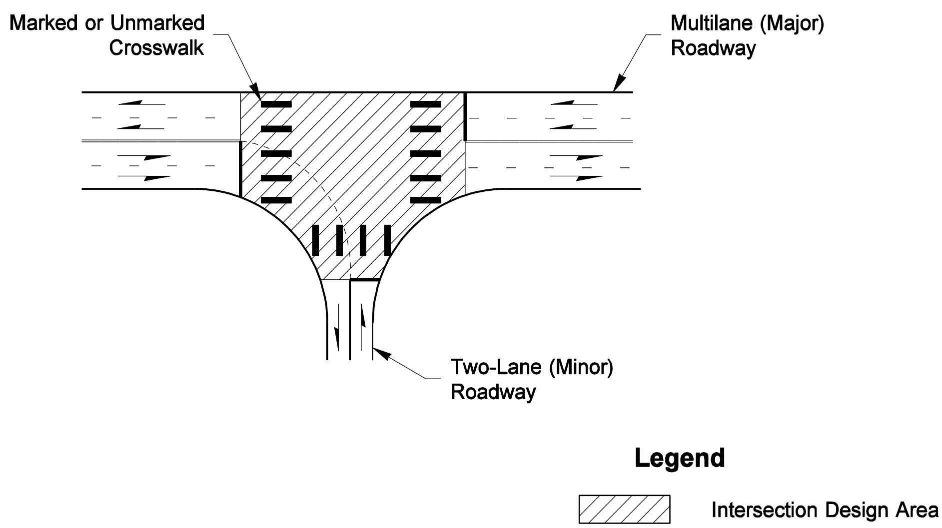
Figure 840-8b



Intersection With Drop Lane/Right-Turn Lane Channelization
Figure 840-9

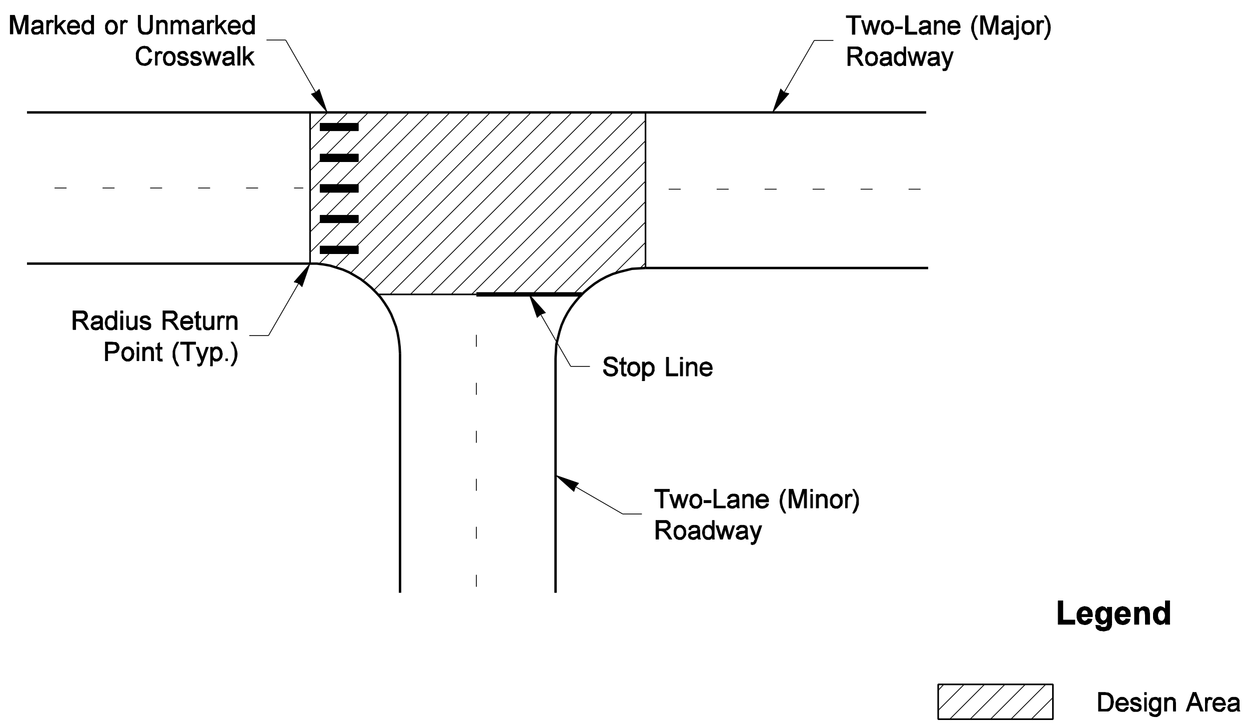


Four-Way Intersection
(Without left-turn channelization; a minimum of two light standards of standard pole height required for design area.)



Major Tee Intersection
(Without left-turn channelization; a minimum of two light standards of standard pole height required for design area.)

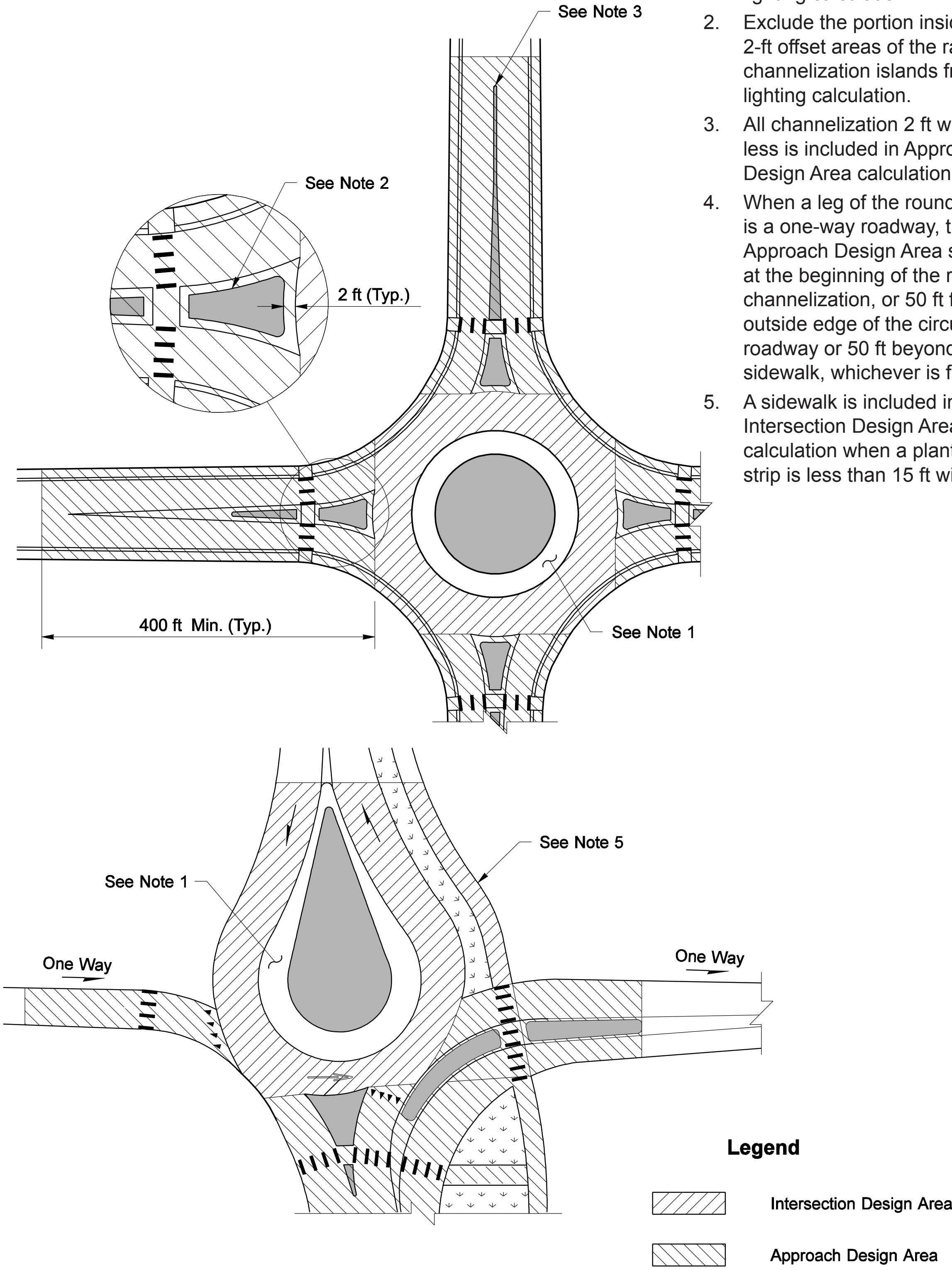
Intersections With Traffic Signals
Figure 840-10



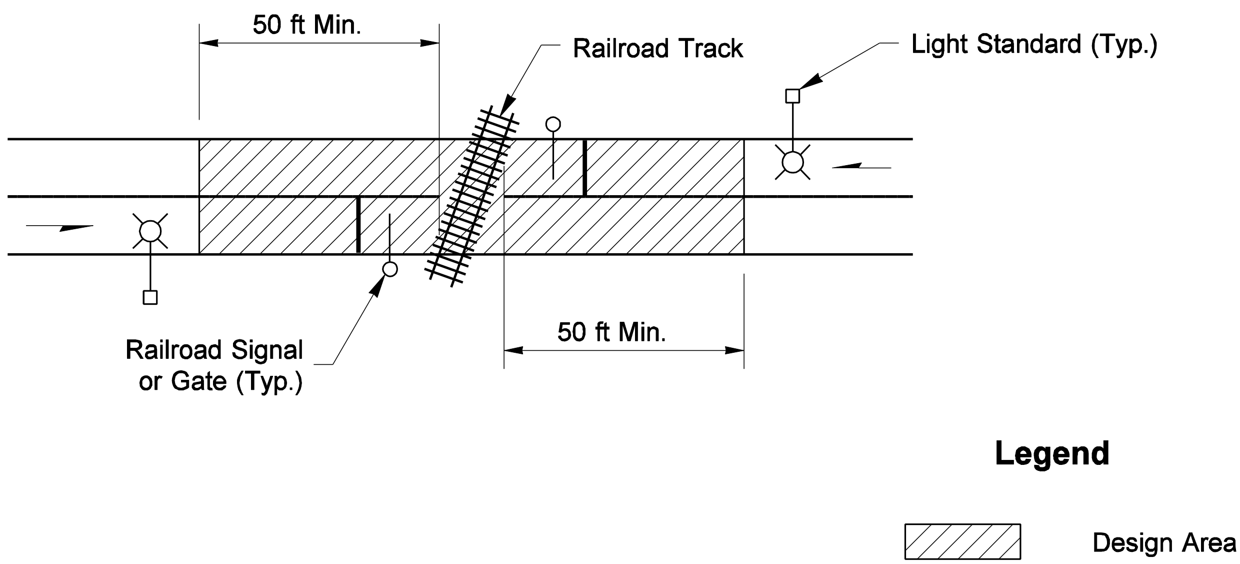
Intersection Without Channelization
Figure 840-11

Notes:

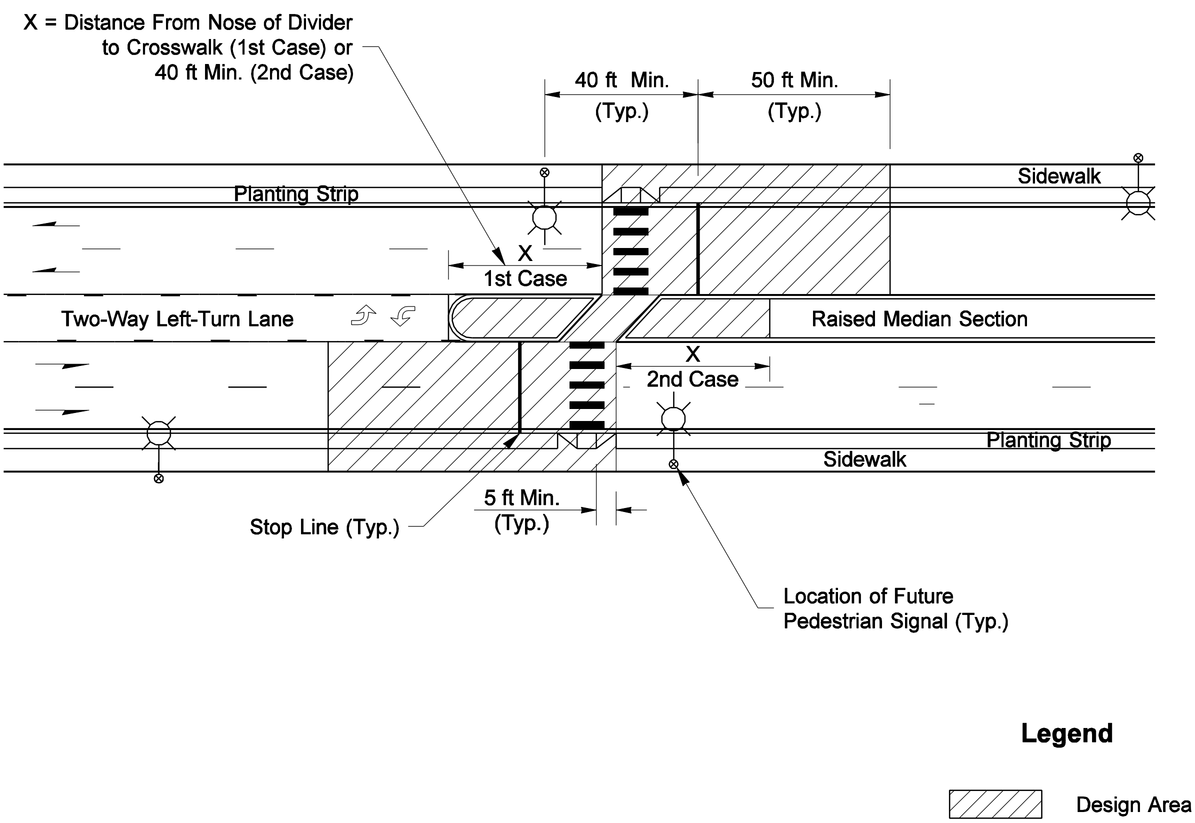
1. Exclude Truck Apron from lighting calculation.
2. Exclude the portion inside the 2-ft offset areas of the raised channelization islands from lighting calculation.
3. All channelization 2 ft wide or less is included in Approach Design Area calculation.
4. When a leg of the roundabout is a one-way roadway, the Approach Design Area starts at the beginning of the raised channelization, or 50 ft from the outside edge of the circulating roadway or 50 ft beyond a sidewalk, whichever is farther.
5. A sidewalk is included in the Intersection Design Area calculation when a planting strip is less than 15 ft wide.



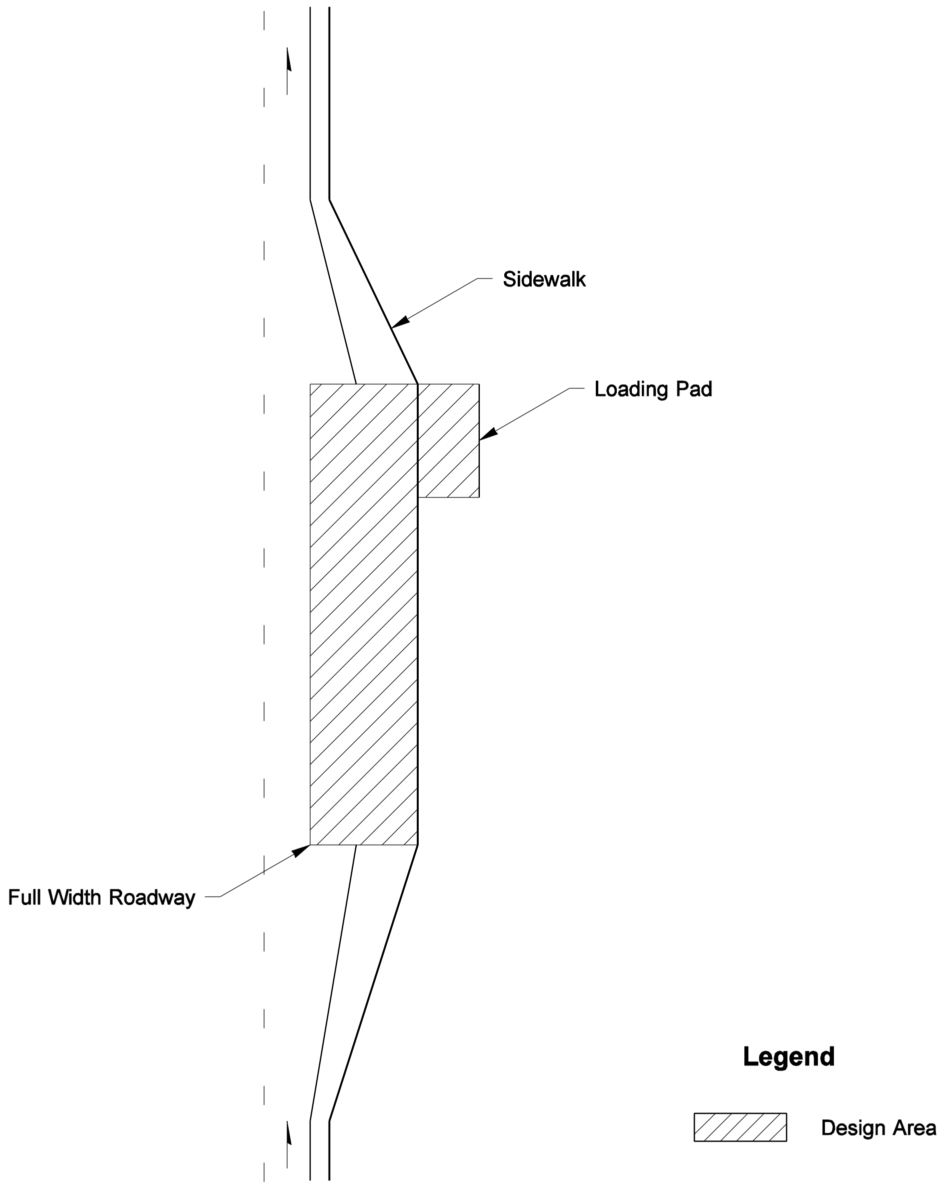
Roundabout
Figure 840-12



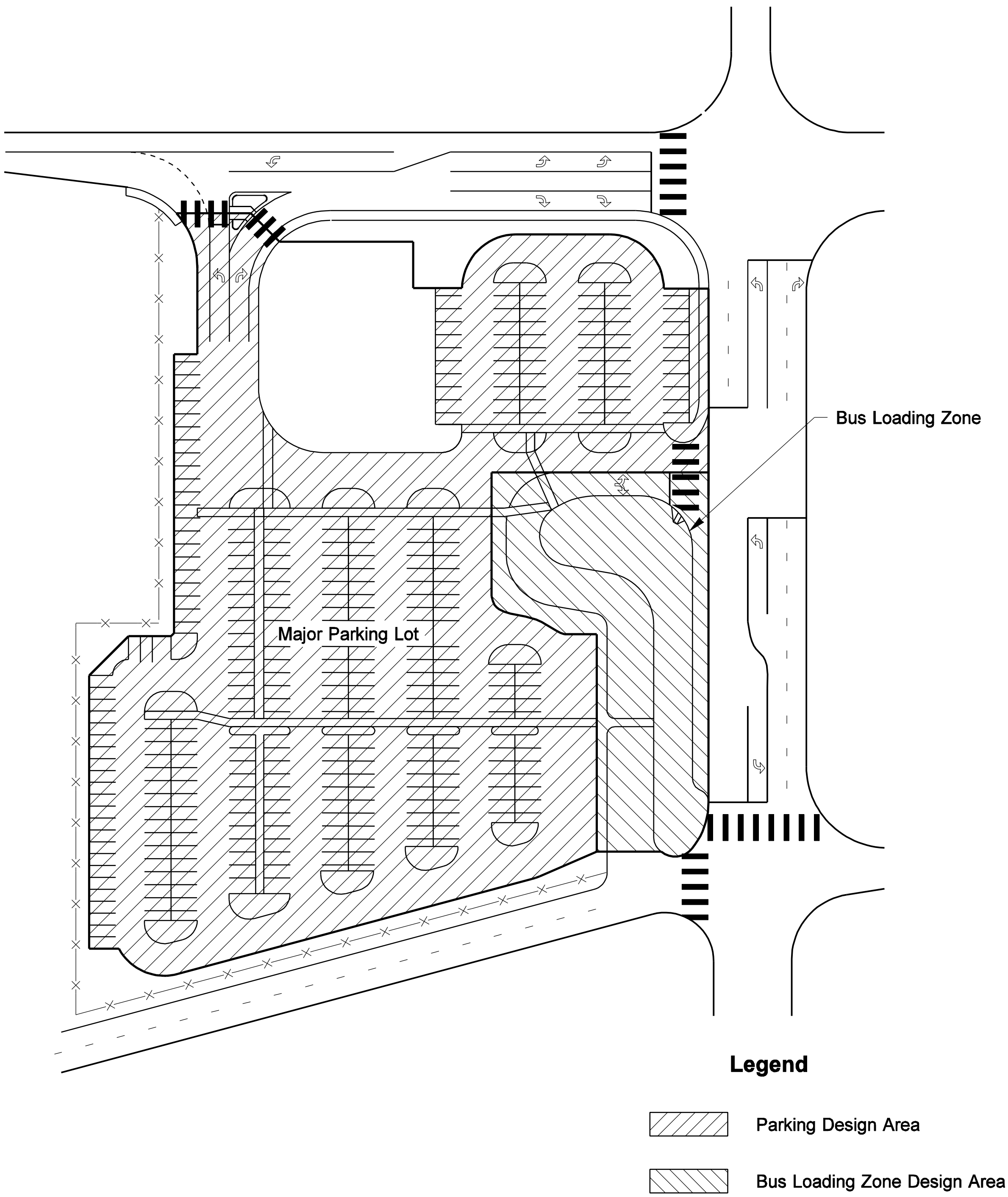
Railroad Crossing With Gates or Signals
Figure 840-13



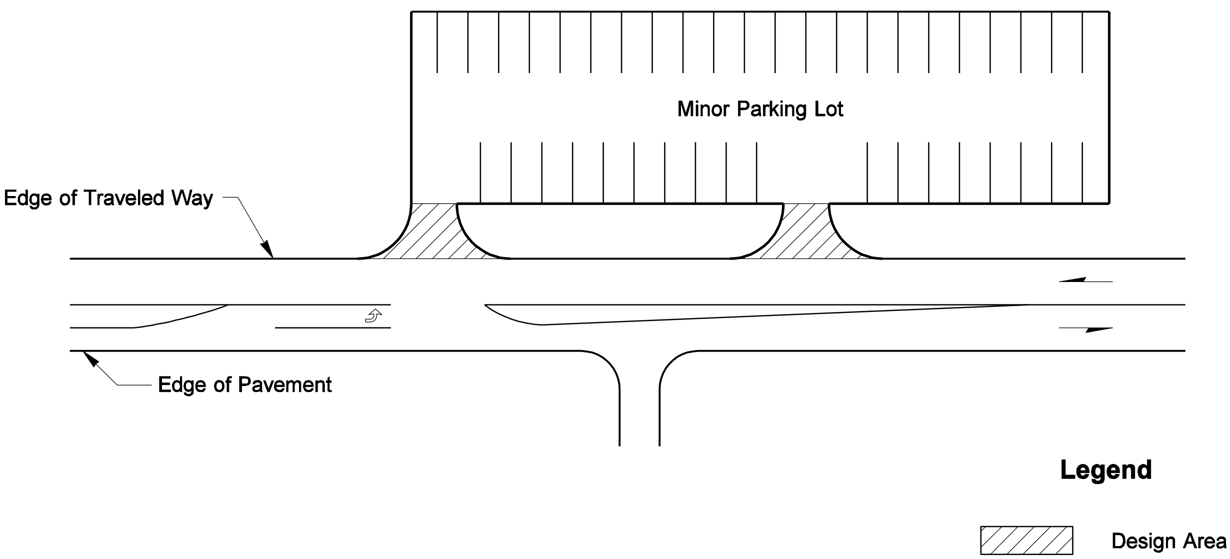
Midblock Pedestrian Crossing
Figure 840-14



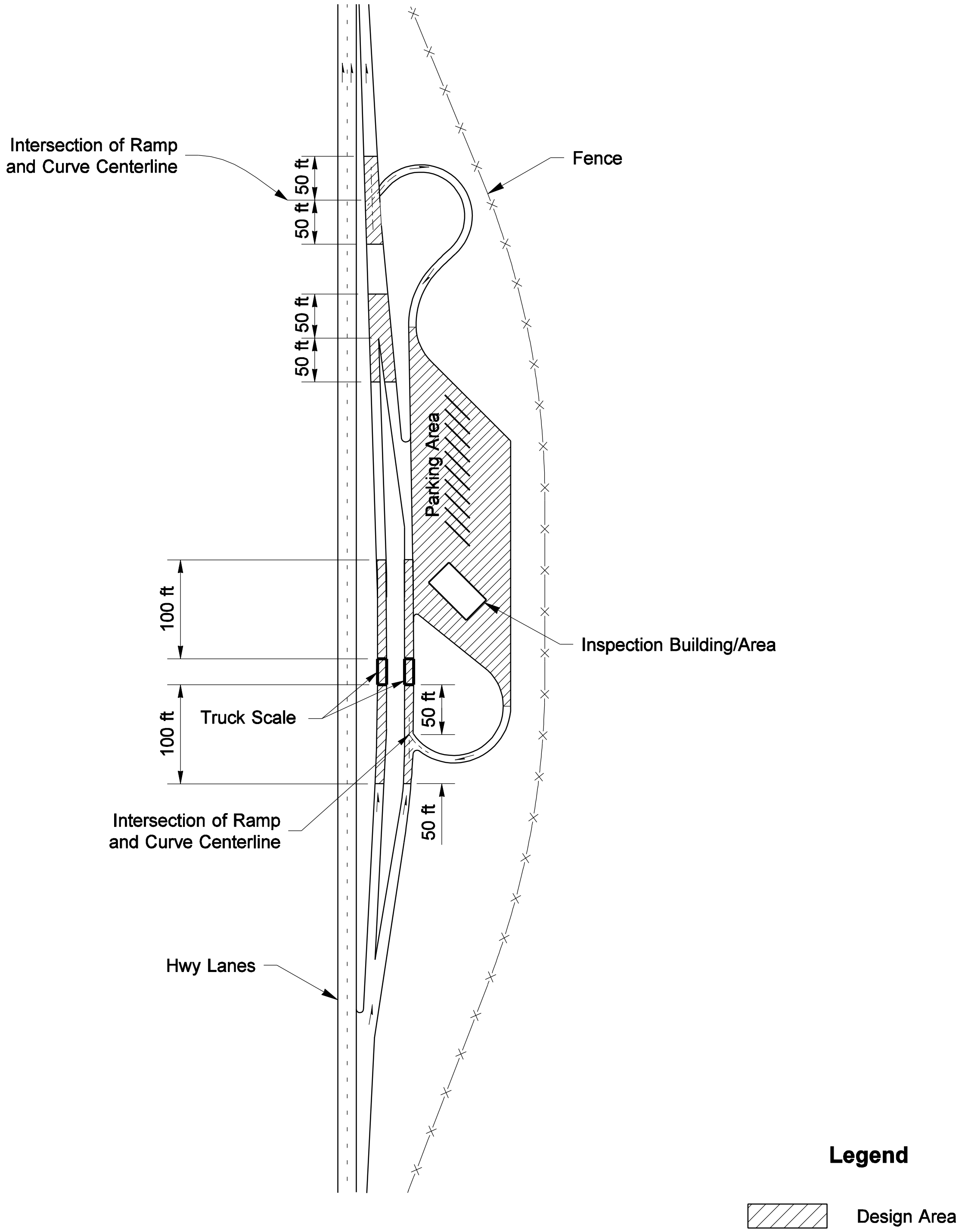
Transit Flyer Stop
Figure 840-15



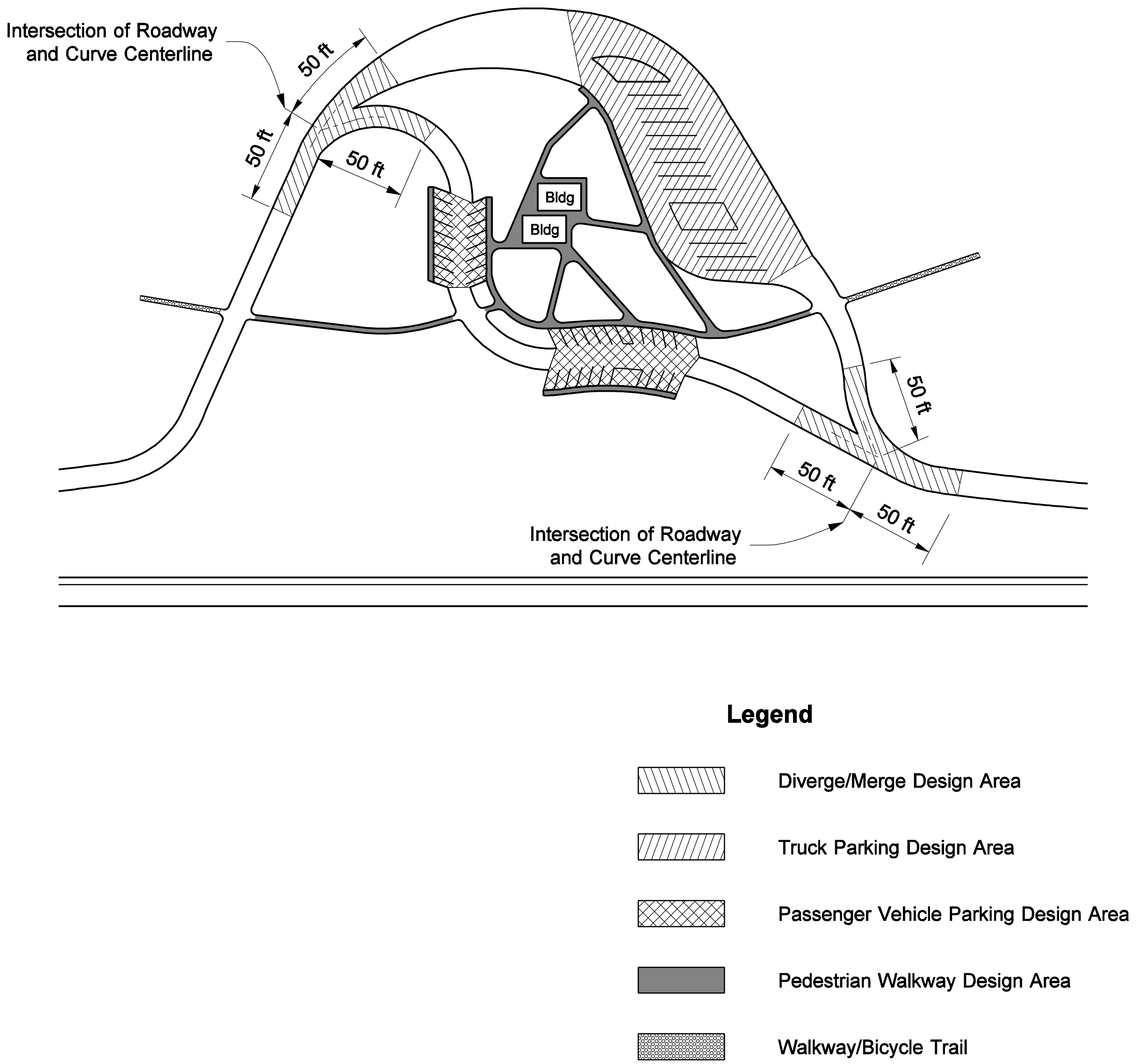
Major Parking Lot
Figure 840-16



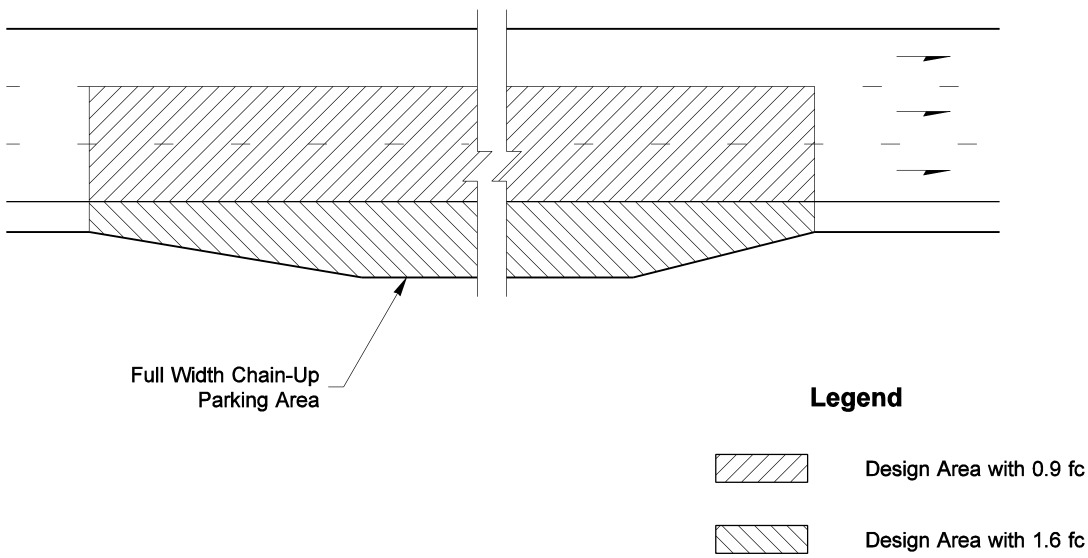
Minor Parking Lot
Figure 840-17



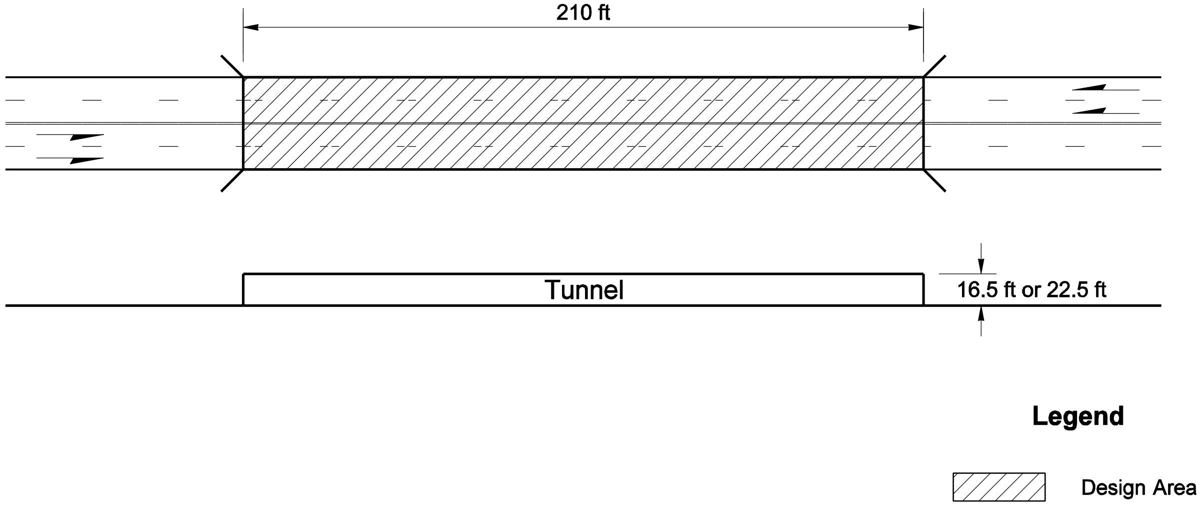
Truck Weigh Site
Figure 840-18



Safety Rest Area
Figure 840-19



Chain-Up/Chain-Off Parking Area
Figure 840-20



If tunnel length exceeds stopping sight distance, then it is classified as a long tunnel:

Example #1

- The stopping sight distance for a 30 mph roadway is 196.7'
- The tunnel length is 210'

196.7' < 210' – This would be a long tunnel.

Example #2

- The stopping sight distance for a 40 mph roadway is 300.6'
- The tunnel length is 210'

300.6' > 210' – This would be a short tunnel.

Determining whether a short tunnel needs illumination:

Example #1

- Vertical clearance is 16.5'
- Tunnel length is 210'

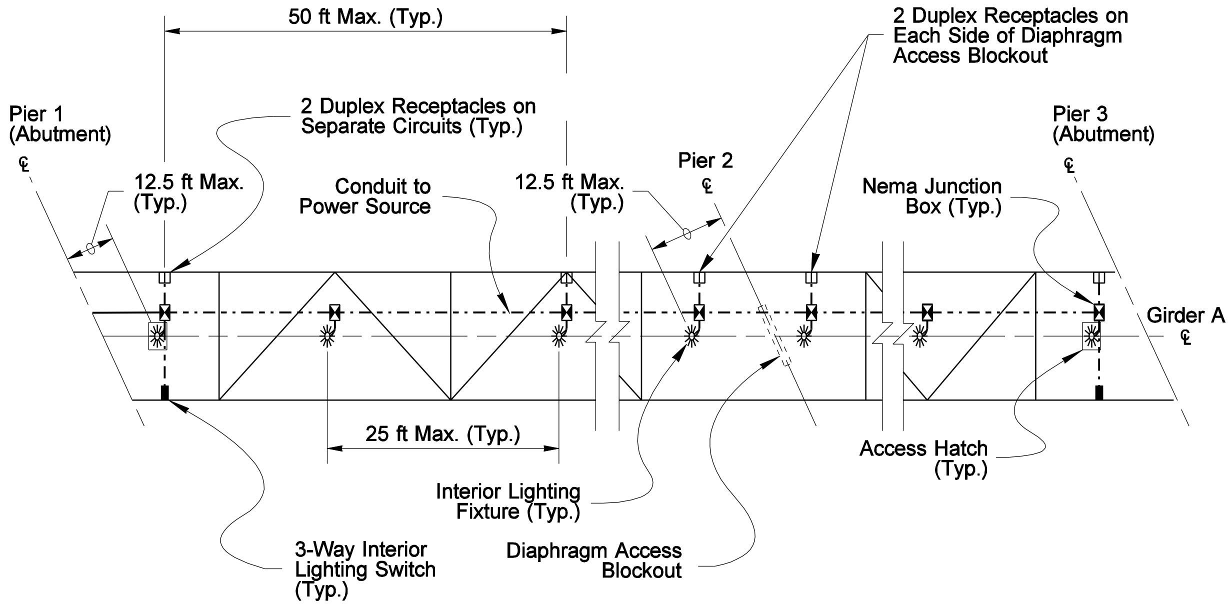
If horizontal-to-vertical ratio is 10:1 or greater, then illuminate.
210' divided by 16.5' = 12.7:1 ratio – This ratio exceeds the short tunnel horizontal-to-vertical ratio of 10:1, so this tunnel would need illumination—OR—How long can the tunnel be at a given height before it needs to be illuminated?
Tunnel height x maximum ratio factor of short tunnel (10:1 or less).
16.5' x 10 = 165'
165' < 210' – This tunnel would need illumination.

Example #2

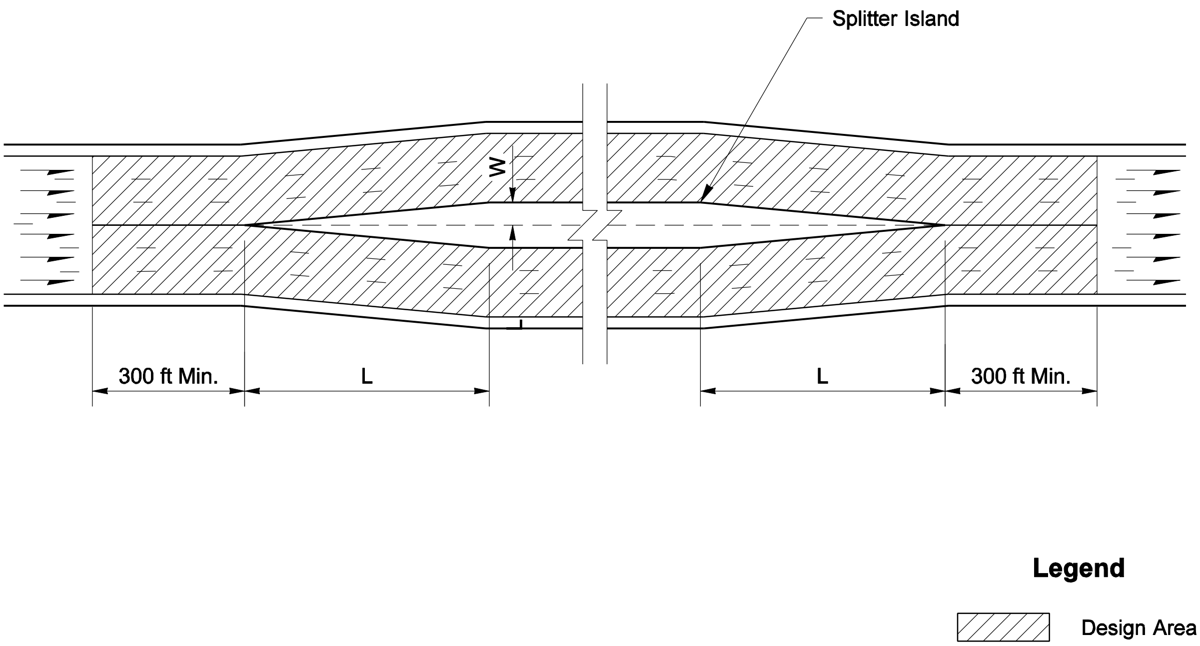
- Vertical clearance is 22.5'
- Tunnel length is 210'

If horizontal-to-vertical ratio is 10:1 or greater, then illuminate.
210' divided by 22.5' = 9.3:1 ratio – This ratio is less than the short tunnel horizontal-to-vertical ratio of 10:1, so this tunnel would not need illumination—OR—How long can the tunnel be at a given height before it needs to be illuminated?
Tunnel height x maximum ratio factor of short tunnel (10:1 or less).
22.5' x 10 = 225'
225' > 210' – This tunnel would not need illumination.

Tunnel
Figure 840-21



Bridge Inspection Lighting System
Figure 840-22



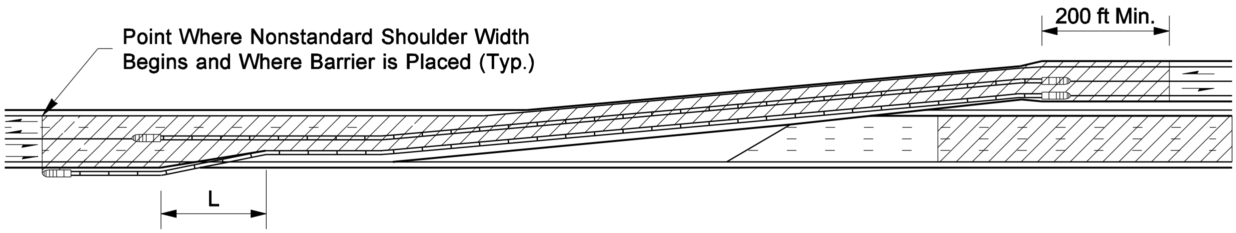
For speeds 45 mph or more: L = WS
For speeds less than 45 mph: L = WS/60

L = Taper in feet
W = Width of offset in feet
S = Posted speed

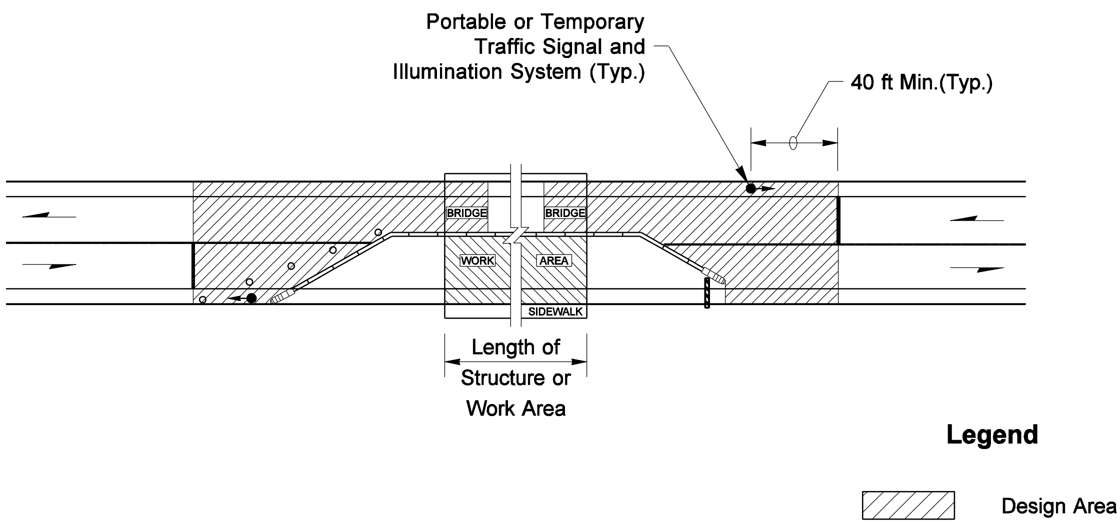
Note:

For temporary Work Zone Plan applications, a site-specific Traffic Control Plan is required. Refer to Chapters 710 and 720 for traffic barrier and attenuator information, Chapter 810 for Work Zone information, and Chapter 820 for signing information.

Traffic Split Around an Obstruction
Figure 840-23



Detour Traffic



Lane Closure With Barrier & Signals Without Flaggers or Spotters
(One direction closure shown/other direction closure typical.)

Note:
For temporary Work Zone Plan applications, a site-specific Traffic Control Plan is required. Refer to Chapters 710 and 720 for traffic barrier and attenuator information, Chapter 810 for Work Zone information, and Chapter 820 for signing information. Refer to the MUTCD Typical Application 12 for additional details.

Construction Work Zone and Detour
Figure 840-24

Light Level and Uniformity Ratio Chart					
Highway Design Class	Minimum Average Maintained Horizontal Light Level[2] — Pedestrian/Area Classification			Maximum Uniformity Ratio[6]	Maximum Veiling Luminance[7]
	High (footcandles)	Medium (footcandles)	Low (footcandles)		
Highways With Full Access Control[1]					
Main Line	0.6	0.6	0.6	4:1	0.3:1
Ramps	0.6	0.6	0.6	4:1	0.3:1
Crossroads	0.6	0.6	0.6	3:1	0.3:1
Ramp Intersections	0.9	0.9	0.9	3:1	0.3:1
Principal Arterials[3]					
Main Line	1.6	1.2	0.6	3:1	0.3:1
Intersections	1.6	1.2	0.9	3:1	0.3:1
Minor Arterials					
Main Line	1.2	0.9	0.6	4:1	0.3:1
Intersections	1.2	0.9	0.9	4:1	0.3:1
Collectors					
Main Line	1.1	0.8	0.6	4:1	0.3:1
Intersections	1.1	1.0	0.9	4:1	0.3:1
Construction Lanes and Detours	1.0	1.0	1.0	3:1	0.3:1
Major Parking Lots/Rest Areas[5]	0.8	0.8	0.8	3:1	0.3:1
Vehicle Inspection Areas	2.0	2.0	2.0	3:1	0.3:1
Walkways & Bicycle Trails	0.8	0.8	0.8	3:1	0.3:1
Weigh Scales	0.8	0.8	0.8	3:1	0.3:1
Transit Stops[4]	2.0	2.0	2.0	NA[8]	0.3:1
Midblock Ped X-ing	2.0	2.0	2.0	3:1	0.3:1

Notes:

[1] The minimum light level is 0.2 footcandle (fc) for any application with a minimum average maintained horizontal light level of 0.6 fc. The minimum light levels for all other applications are controlled by the uniformity ratio.

[2] Light level and uniformity ratio apply only when installation of more than one light standard is justified.

[3] Light levels shown also apply to modified and partial limited access control.

[4] For single light standard installations, provide the light level at the location where the bus stops for riders (see 840.06(6)).

[5] Includes illumination at ramp on- and off-connections.

[6] Minimum Average Maintained Light Level/Minimum Light Level = Maximum Uniformity Ratio.

[7] Maximum Veiling Luminance/Average Luminance = Maximum Veiling Luminance Ratio.

[8] The Maximum Uniformity Ratio is 3:1 when more than one light standard is justified.

Light Levels and Uniformity Ratios
Figure 840-25

Chapter 910 Intersections At Grade

910.01 General

Intersections are a critical part of highway design because of increased conflict potential. Traffic and driver characteristics, bicycle and pedestrian needs, physical features, and economics are considered during the design stage to develop channelization and traffic control to enhance safe and efficient multimodal traffic flow through intersections.

This chapter provides guidance for designing intersections at grade, including at-grade ramp terminals. Refer to the following chapters for additional information:

Chapter	**Subject**
915	Roundabouts
920	Road approaches
940	Interchanges
1025	Pedestrian design considerations

If an intersection design situation is not covered in this chapter, contact the Headquarters (HQ) Design Office for assistance.

910.02 References

(1) Federal/State Laws and Codes

Americans with Disabilities Act of 1990 (ADA) (23 CFR Part 36, Appendix A)

RCW 35.68.075, Curb ramps for persons with disabilities – Required – Standards and requirements

WAC 468-18-040, Design standards for rearranged county roads, frontage roads, access roads, intersections, ramps and crossings

WAC 468-52, Highway access management – access control classification system and standards

(2) Design Guidance

Local Agency Guidelines (LAG), M 36-63, WSDOT

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

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

(3) Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

Guidelines and Recommendations to Accommodate Older Drivers and Pedestrians, FHWA-RD-01-051, USDOT, FHWA, May 2001

Highway Capacity Manual (HCM), Special Report 209, Transportation Research Board, National Research Council

Highway Research Record No. 211, *Aspects of Traffic Control Devices*, pp 1-18, "Volume Warrants for Left-Turn Storage Lanes at Unsignalized Grade Intersections." Harmelink, M.D.

NCHRP 279, *Intersection Channelization Design Guide*

Roundabouts: An Informational Guide, FHWA-RD-00-067, USDOT, FHWA

910.03 Definitions

For definitions of ***design speed***, ***divided multilane***, ***expressway***, ***highway***, ***roadway***, ***rural design area***, ***suburban area***, ***traveled way***, ***undivided multilane***, and ***urban design area***, see Chapter 440; for ***lane***, ***median***, and ***shoulder***, see Chapter 640; and for ***decision sight distance***, ***sight distance***, and ***stopping sight distance***, see Chapter 650.

conflict An event involving two or more road users, in which the action of one user causes the other user to make an evasive maneuver to avoid a collision.

conflict point A point where traffic paths cross, merge, or diverge.

crossroad The minor roadway at an intersection. At a stop-controlled intersection, the crossroad has the stop.

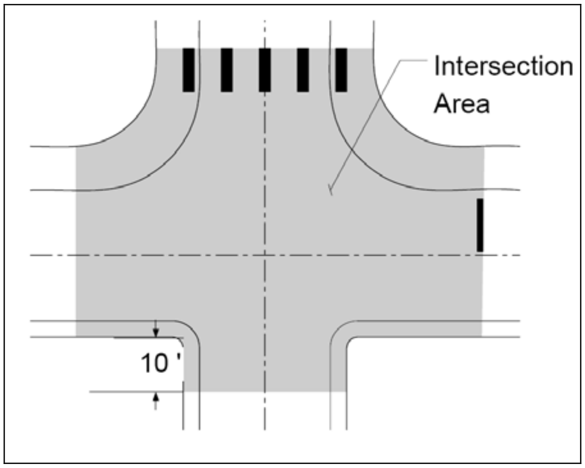
curb extensions A curb and sidewalk bulge or extension into the parking lane or shoulder to decrease the length of a pedestrian crossing (see Chapter 1025).

curb section A roadway cross section with curb and sidewalk.

design vehicle A vehicle, the dimensions and operating characteristics of which are used to establish the intersection geometry.

intersection angle The angle between any two intersecting legs at the point that the centerlines intersect.

intersection area The area of the intersecting roadways bounded by the edge of traveled ways and the area of the adjacent roadways for the farther distance (1) to the end of the corner radii, (2) through any marked crosswalks adjacent to the intersection, (3) to the stop bar, or (4) 10 feet from the edge of shoulder of the intersecting roadway (see Figure 910-1).



Intersection Area
Figure 910-1

intersection at grade The general area where a roadway or ramp terminal is met or crossed at a common grade or elevation by another roadway.

four-leg intersection An intersection formed by two crossing roadways.

split tee A four-leg intersection with the crossroad intersecting the through roadway at two tee intersections. The tee intersection must be offset at least the width of the roadway.

tee (T) intersection An intersection formed by two roadways where one roadway terminates at the point it meets a through roadway.

wye (Y) intersection An intersection formed by three legs in the general form of a "Y" and the angle between two legs is less than 60°.

intersection leg Any one of the roadways radiating from and forming part of an intersection.

entrance leg The lanes of an intersection leg for traffic entering the intersection.

exit leg The lanes of an intersection leg for traffic leaving the intersection.

Note: Whether an intersection leg is an entrance leg or an exit leg depends on which movement is being analyzed. For two-way roadways, each leg is an entrance leg for some movements and an exit leg for other movements.

intersection sight distance The required length of roadway visible to the driver for the safe operation of a vehicle entering an intersection.

island A defined area within an intersection, between traffic lanes, for the separation of vehicle movements or for pedestrian refuge.

channelization island An island that separates traffic movements into definite paths of travel and guides traffic into the intended route.

divisional island An island introduced at an intersection on an undivided roadway to warn drivers of the crossroad ahead and regulate traffic through the intersection.

refuge island An island at or near a crosswalk or bicycle path to aid and protect pedestrians and bicyclists crossing the roadway.

roundabout A circular intersection at grade (see Chapter 915).

rural intersection An intersection in a rural design area (see Chapter 440).

slip ramp A connection between legs of an intersection that allows right-turning vehicles to bypass the intersection or a connection between an expressway and a parallel frontage road.

two-way left-turn lane (TWLTL) A lane located between opposing lanes of traffic to be used by vehicles making left turns from either direction, from or onto the roadway.

urban intersection An intersection in an urban design area (see Chapter 440).

910.04 Intersection Configurations

At-grade intersection configurations in their simplest forms are three-leg, four-leg, and multileg. More complex designs are variations or combinations selected to accommodate the constraints and traffic presented by the location. The intersection configurations at any location are determined by the number of intersecting legs; the topography; the character of the intersecting roadways; the traffic volumes, patterns, and speeds; and the desired type of operation.

(1) Roundabouts

Modern roundabouts are circular intersections. They can be an effective intersection type.

When well designed, roundabouts are an efficient form of intersection control. They have fewer conflict points, lower speeds, easier decision making, and require less maintenance. When properly designed and located, they have been found to reduce injury accidents, traffic delays, fuel consumption, and air pollution. Roundabouts also permit U-turns.

Include roundabouts as an alternative at intersections where:

- Stop signs result in unacceptable delays for the crossroad traffic.
- There is a high left-turn percentage.
- There are more than four legs.
- A disproportionately high number of accidents involve crossing or turning traffic.
- The major traffic movement makes a turn.
- Traffic growth is expected to be high and future traffic patterns are uncertain.
- It is not desirable to give priority to either roadway.

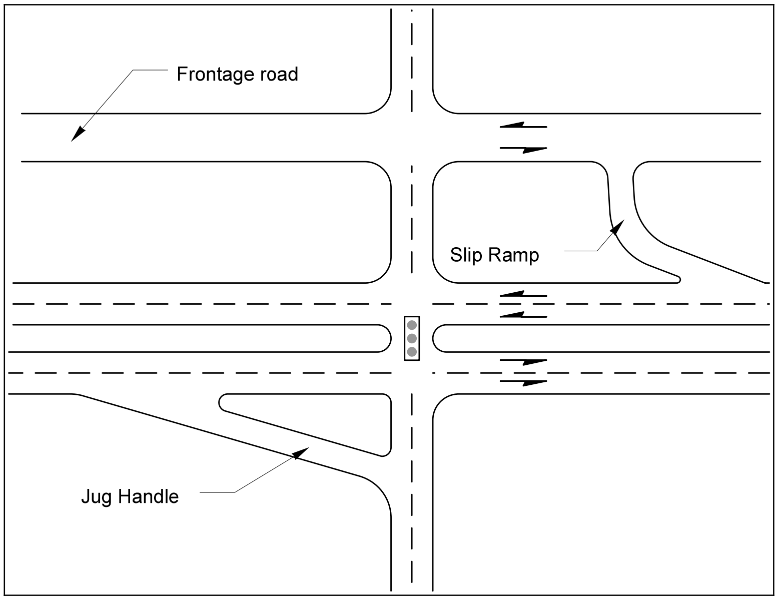
Other tradeoffs with roundabouts include:

- Roundabouts give equal priority to all legs.
- All traffic entering a roundabout is required to reduce speed.

Refer to Chapter 915 for information and requirements on the design and documentation of roundabouts.

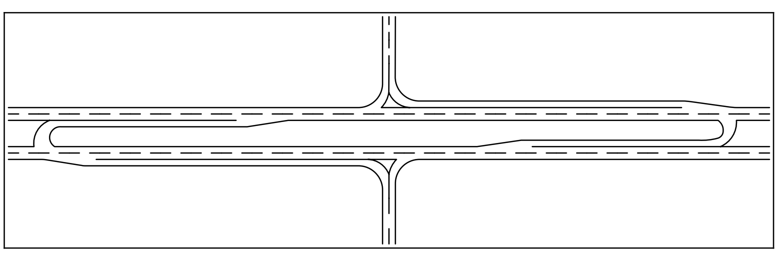
(2) Indirect Left Turns

At signalized intersections, indirect left-turn intersections reduce conflict points and delays to the major route by eliminating the left-turn phase (see Figure 910-2a for an example).



Indirect Left Turns (Signalized Intersections)
Figure 910-2a

At unsignalized intersections, indirect left-turn intersections help mitigate entering-at-angle collisions. Left-turning and through traffic on the crossroad must turn right and then make a U-turn at a median crossover or a nearby intersection (see Figure 910-2b for an example). Provide for weaving movements when selecting the distance between right turns and U-turns on major routes and the storage (if needed) for U-turning vehicles. This treatment eliminates conflict points while minimizing delays to the major route. (See 910.08 for guidance on the design of U-turn locations.)

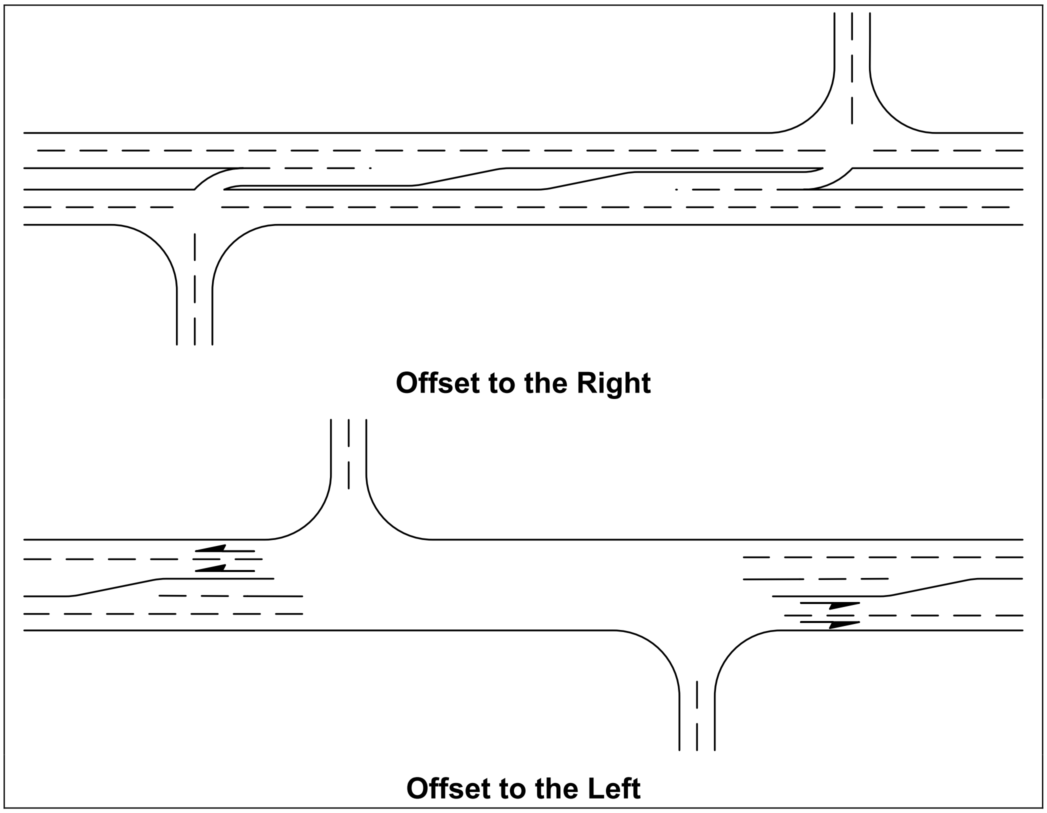


Indirect Left Turns (Unsignalized Intersections)
Figure 910-2b

(3) Split Tee

Avoid split tee intersections where there is less than the required intersection spacing (see 910.05(4)). Split tee intersections with an offset distance to the left greater than the width of the roadway, but less than the intersection spacing, may be designed, with justification. Evaluate the anticipated benefits against the increased difficulty for cross traffic in driving through the intersection and a more complicated traffic signal design.

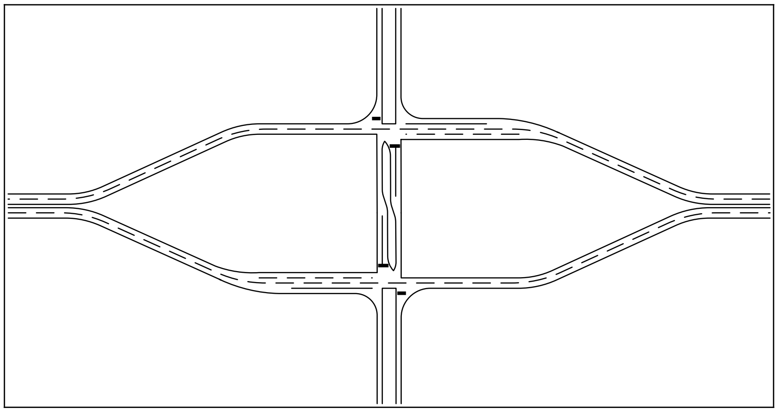
Split tee intersections with the offset to the right (see Figure 910-3) have the additional disadvantages of overlapping main line left-turn lanes, the increased possibility of wrong way movements, and a traffic signal design (if required) that will be even more complicated. Do not design a split tee intersection with an offset to the right less than the required intersection spacing (see 910.05(4)) unless traffic is restricted to right-in/right-out only.



Split Tee Intersections
Figure 910-3

(4) Split Intersections

Split intersections provide wide medians on divided multilane highways, which separate the traveled ways of the through roadway to allow storage of left-turning and crossing traffic (see Figure 910-4). Traffic on the crossroad makes the through and left-turn movements in two stages, reducing the required sight distance and the probability of the driver misjudging the required gap. The median width must be sufficient to store all crossing and left-turning vehicles to avoid potential conflicts with through traffic. The minimum median width is 100 feet, with 200 to 300 feet being desirable.



Split Intersections
Figure 910-4

(5) Nonstandard Configurations

Low average daily traffic (ADT) can hide operational problems. Do not design intersections with nonstandard configurations such as:

- Intersections with offset legs, except for split tee intersections (see 910.04(3)).
- Intersections with more than four legs.
- Tee intersections with the major traffic movement making a turn.
- Wye intersections that are not a one-way merge or diverge.

A roundabout might be an alternative to these nonstandard configurations (see 910.04(1) and Chapter 915).

With justification and approval from the Region Traffic Engineer, existing intersections with nonstandard configurations may remain in place when an analysis shows no collision history related to the configuration.

910.05 Design Considerations

Intersection design requires consideration of all potential users of the facility. This involves addressing the needs of a diverse mix of user groups, including passenger cars, heavy vehicles of varying classifications, bicycles, and pedestrians. Often, meeting the needs of one user group requires a compromise in service to others. Intersection design balances these competing needs, resulting in appropriate levels of operation for all users.

In addition to reducing the number of conflicts, minimize the conflict area as much as possible while still providing for the required design vehicle (see 910.06). This is done to control the speed of turning vehicles and reduce vehicle, bicyclist, and pedestrian exposure.

(1) Nongeometric Considerations

Geometric design considerations, such as sight distance and intersection angle, are important. Equally important are perception, contrast, and a driver's age. Perception is a factor in the majority of collisions. Regardless of the type of intersection control, the safe function of any intersection depends on the driver's ability to perceive what is happening with respect to the surroundings and other vehicles, whether it is the speed of the vehicles in front when approaching an intersection or the speed of approaching vehicles when selecting an acceptable gap in traffic to enter an intersection. In order to choose an acceptable gap, the driver must first clearly identify the approaching vehicle(s) and then determine the speed. The driver uses visual clues provided by the immediate surroundings in making these decisions. Thus, given equal sight distance, it may be easier for the driver to judge a vehicle's oncoming speed when there are more objects to pass by in the driver's line of sight. Contrast allows us to discern one object from another. Contrast sensitivity is affected by available light and the weather.

(2) Intersection Angle

An important intersection design characteristic is the intersection angle. The desirable intersection angle is 90°, with 75° to 105° allowed for new, reconstructed, or realigned intersections.

Existing intersections with an intersection angle between 60° and 120° may remain. Intersection angles outside this range tend to restrict visibility; increase the area required for turning; increase the difficulty of making a turn; increase the crossing distance and time for vehicles and pedestrians; and make traffic signal arms difficult or impossible to design.

(3) Lane Alignment

Design intersections with entrance lanes aligned with the exit lanes. Do not put angle points on the roadway alignments within intersection areas or on the through roadway alignment within 100 feet of the edge of traveled way of a crossroad. This includes short radius curves where both the PC and PT are within the intersection area. However, angle points within the intersection are allowed at intersections with a minor through movement, such as at a ramp terminal (see Figure 910-10).

When feasible, locate intersections such that curves do not begin or end within the intersection area. It is desirable to locate the PC and PT at least 250 feet from the intersection so that a driver can settle into the curve before the gap in the striping for the intersection area.

(4) Intersection Spacing

Adequate intersection spacing is required to provide for safety and the desired operational characteristics for the highway. The minimum spacing for highways with limited access control is covered in Chapters 1430. For other highways, the minimum spacing is dependent on the Highway Access Management Class. (See Chapter 1435 for minimum intersection spacing on managed access highways.)

As a minimum, provide enough space between intersections for left-turn lanes and storage length. Space signalized intersections and intersections expected to be signalized to maintain efficient signal operation. Space intersections so that queues will not block an adjacent intersection.

Evaluate existing intersections that are spaced less than shown in Chapters 1430 and 1435. Evaluate closing or restricting movements at intersections with operational problems. Document the spacing of existing intersections to remain in place and their effects on operation, capacity, and circulation.

(5) Design Vehicle

The geometric design of an intersection requires identifying and addressing the needs of all intersection users. There are competing design objectives when considering the turning requirements of larger vehicles and the crossing requirements of pedestrians. To reduce the operational impacts of large design vehicles, larger turn radii are used. This results in increased pavement areas, longer pedestrian crossing distances, and longer traffic signal arms.

To reduce the intersection area, a smaller design vehicle is used or encroachment is allowed. This reduces the potential for vehicle/pedestrian conflicts, decreases pedestrian crossing distance, and controls the speeds of turning vehicles.

If the selected design vehicle is too small, a capacity reduction and greater speed differences between turning vehicles and through vehicles might result. If the vehicle is larger than necessary, the pavement areas, pedestrian crossing distances, and traffic signal arms will also be larger than needed. (See 910.06 for information on selecting a design vehicle and acceptable encroachments.)

(6) Sight Distance

For traffic to move safely through intersections, drivers need to be able to see stop signs, traffic signals, and oncoming traffic in time to react accordingly.

Provide decision sight distance in advance of stop signs, traffic signals, and roundabouts. Where decision sight distance is not feasible, stopping sight distance may be provided. (See Chapter 650 for guidance.)

Drivers approaching an intersection on the through roadway need to be able to see the intersection far enough ahead to assess developing situations and take appropriate action. Locate new intersections where decision sight distance is available for through traffic. At crosswalks, provide decision sight distance to an area the width of the crosswalk and 6 feet from the edge of traveled way. Where decision sight distance is not feasible, stopping sight distance may be provided. (See Chapter 650 for guidance on decision and stopping sight distances.)

The driver of a vehicle that is stopped, waiting to cross or enter a through roadway, needs obstruction-free sight triangles in order to see enough of the through roadway to safely complete all legal maneuvers before an approaching vehicle on the through roadway can reach the intersection. (See 910.09 for guidance on intersection sight distance sight triangles.)

(7) Crossroads

When the crossroad is a city street or county road, design the crossroad beyond the intersection area according to the applicable design criteria given in Chapter 440.

When the crossroad is a state facility, design the crossroad according to the applicable design level and functional class (see Chapters 325, 430, and 440). Continue the cross slope of the through roadway shoulder as the grade for the crossroad. Use a vertical curve that is at least 60 feet long to connect to the grade of the crossroad.

Evaluate the profile of the crossroad in the intersection area. To prevent operational problems, the crown slope of the main line might need to be adjusted in the intersection area.

Design the grade for stop-controlled legs so that the cross slope for the crosswalk is not greater than 2%. For all other legs, adjust the grade so that the maximum crosswalk cross slope is 5%. (See Chapter 1025 for additional crosswalk information.)

In areas that experience accumulations of snow and ice for all legs that will require traffic to stop, design a maximum grade of ±4% for a length equal to the anticipated queue length for stopped vehicles.

(8) Rural Expressway At-Grade Intersections

At-grade intersections on high-speed rural expressways can result in safety problems. The main problem is right-angle, far-side collisions for crossroad traffic making a left-turn or crossing maneuver. Evaluate grade separations at all intersections on rural expressways.

Design high-speed at-grade intersections on rural expressways as indirect left turns, split intersections, or roundabouts.

The State Traffic Engineer's approval is required for any new intersection or signal on a rural expressway.

(9) Interchange Ramp Terminals

When stop control or traffic signal control is selected, the design to be used or modified is shown in Figure 910-10. Higher-volume intersections with multiple ramp lanes are designed individually.

In urban and suburban areas, match the design speed at the ramp terminal to the speed of the crossroad.

Where stop control or signal control is implemented, the intersection configuration requirements for ramp terminals are normally the same as for other intersections. One exception to this is that an angle point is allowed between an off-ramp and an on-ramp. This is because the through movement of traffic getting off the freeway, going through the intersection, and back on the freeway is minor.

Another exception is at ramp terminals where the through movement is eliminated (for example at a single point interchange). For ramp terminals that have two wye connections, one for right turns and the other for left turns and no through movement, the intersection angle has little meaning and does not need to be considered.

Due to the probable development of large traffic generators adjacent to an interchange, width for a median on the local road is desirable whenever such development is believed to be imminent. This allows for future left-turn channelization. Use median channelization when justified by capacity determination and analysis or by the need to provide a smooth traffic flow.

Adjust the alignment of the intersection legs to fit the traffic movements and to discourage wrong-way movements. Use the allowed intersecting angles of 75° to 105° (60° to 120° for modified design level) to avoid broken back or reverse curves in the ramp alignment.

910.06 Design Vehicle Selection

When selecting a design vehicle for an intersection, the needs of all users and the costs must be considered. The primary use of the design vehicle is to determine radii requirements for each leg of the intersection. It is possible for each leg to have a different design vehicle. Figure 910-5 shows commonly used design vehicle types.

Evaluate the existing and anticipated future traffic to select a design vehicle that is the largest vehicle that normally uses the intersection. Figure 910-6 shows the minimum design vehicles. Provide justification to use a smaller vehicle; include a traffic analysis showing that the proposed vehicle is appropriate.

To minimize the disruption to other traffic, design the intersection to allow the design vehicles to make each turning movement without encroaching on curbs, opposing lanes, or same-direction lanes at the entrance leg. Use turning path templates (see Figures 910-20a through 20c, templates from another published source, or computer-generated templates) to verify that the design vehicle can make the turning movements.

Encroachment on the same-direction lanes of the exit leg and the shoulder might be necessary to minimize crosswalk distances; however, this might negatively impact vehicular operations. Document and justify the operational tradeoffs associated with this encroachment. When encroachment on the shoulder is required, increase the pavement structure to support the anticipated traffic.

Design Symbol	Vehicle Type
P	Passenger car, including light delivery trucks.
BUS	Single-unit bus
A-BUS	Articulated bus
SU	Single-unit truck
WB-40	Semitrailer truck, overall wheelbase of 40 ft
WB-50	Semitrailer truck, overall wheelbase of 50 ft
WB-67	Semitrailer truck, overall wheelbase of 67 ft
MH	Motor home
P/T	Passenger car pulling a camper trailer
MH/B	Motor home pulling a boat trailer

Design Vehicle Types
Figure 910-5

Intersection Type	Design Vehicle
Junction of Major Truck Routes	WB-67
Junction of State Routes	WB-50
Ramp Terminals	WB-50
Other Rural	WB-50
Industrial	WB-40
Commercial	SU[1][2]
Residential	SU[1][2]

Notes:

[1] To accommodate pedestrians, the P vehicle may be used as the design vehicle if justification, with a traffic analysis, is documented.

[2] When the intersection is on a transit or school bus route, use the BUS design vehicle as a minimum. (See Chapter 1060 for additional guidance on transit facilities.)

Minimum Intersection Design Vehicle
Figure 910-6

In addition to the design vehicle, intersections must often be designed to accommodate a larger vehicle. When vehicles larger than the design vehicle are allowed and are anticipated to occasionally use the intersection, make certain that they can make the turn without leaving the paved shoulders or encroaching on a sidewalk. The amount of encroachment allowed is dependent on the frequency of the vehicle and the resulting disruption to other traffic. Use the WB-67 as the largest vehicle at all state route-to-state route junctions. Document and justify any required encroachment into other lanes and any degradation of intersection operation.

910.07 Design Elements

The geometric design of an intersection requires identifying and addressing the needs of all intersection users. There can be competing design objectives when considering the turning requirements of the design vehicle and the crossing requirements of pedestrians. To reduce the operational impacts of large trucks, right-turn radii are designed so that the truck can complete its turn without encroaching on the adjacent lanes. This results in larger corner radii; increased pavement area and pedestrian crossing distances; a larger conflict area; and higher turning speeds for smaller vehicles.

When pedestrian issues are a primary concern, the design objective becomes one of reducing the potential for vehicle/pedestrian conflicts. This is done by minimizing pedestrian crossing distances and controlling the speeds of turning vehicles. This normally leads to right-corner designs with smaller turning radii. The negative impacts include possible capacity reductions and greater speed differences between turning vehicles and through vehicles.

Pedestrian refuge islands can also improve pedestrian safety. Pedestrian refuge islands minimize the crossing distance, reduce the conflict area, and minimize the impacts on vehicular traffic. When designing islands, speeds can be reduced by designing the turning roadway with a taper or large radius curve at the beginning of the turn and a small radius curve at the end. This allows larger islands while forcing the turning traffic to slow down.

Channelization, the separation or regulation of traffic movements into delineated paths of travel, can facilitate the safe and orderly movement of vehicles, bicycles, and pedestrians. Channelization includes left-turn lanes, right-turn lanes, speed change lanes (both acceleration and deceleration lanes), and islands.

(1) Right-Turn Corners

Figure 910-11 shows right-turn corner designs for the design vehicles. These are considered the minimum pavement area to accommodate the design vehicles without encroachment on the adjacent lane at either leg of the curve.

With an evaluate upgrade, right-turn corner designs given in Figure 910-11 may be modified. Document the benefits and impacts of the modified design, including changes to vehicle-pedestrian conflicts; vehicle encroachment on the shoulder or adjacent same direction lane at the exit leg; capacity restrictions for right-turning vehicles or other degradation of intersection operations; and the effects on other traffic movements. To verify that the design vehicle can make the turn, include a plot of the design showing the design vehicle turning path template.

(2) Left-Turn Lanes and Turn Radii

Left-turn lanes provide storage, separate from the through lanes, for left-turning vehicles waiting for a signal to change or for a gap in opposing traffic. (See 910.07(4) for a discussion on speed change lanes.)

Design left-turn channelization to provide sufficient operational flexibility to function under peak loads and adverse conditions.

(a) **One-Way Left-Turn Lanes** are separate storage lanes for vehicles turning left from one roadway onto another. When recommended, one-way left-turn lanes may be an economical way to lessen delays and accident potential involving left-turning vehicles. In addition, they can allow deceleration clear of the through traffic lanes. When evaluating left-turn lanes, include impacts to all intersection movements and users.

At signalized intersections, use a traffic signal analysis to determine whether a left-turn lane is needed and what the storage requirements are (see Chapter 850).

At unsignalized intersections, use the following as a guide to determine whether or not to provide one-way left-turn lanes:

- A traffic analysis indicates that a left-turn lane will reduce congestion. On two-lane highways, use Figure 910-12a, based on total traffic volume (DHV) for both directions and percent left-turn traffic, to determine whether further investigation is needed. On four-lane highways, use Figure 910-12b to determine whether a left-turn lane is recommended.
- An accident study indicates that a left-turn lane will reduce accidents.
- Restrictive geometrics require left-turning vehicles to slow greatly below the speed of the through traffic.
- There is less than decision sight distance at the approach to the intersection.

An HCM analysis may also be used to determine whether left-turn lanes are necessary to maintain the desired level of service.

Determine the storage length required on two-lane highways by using Figures 910-13a through 13c. On four-lane highways, use Figure 910-12b. These lengths do not consider trucks. Use Figure 910-7 for storage length when trucks are present.

Storage* Length (ft)	% Trucks in Left-Turn Movement				
	10	**20**	**30**	**40**	**50**
100	125	125	150	150	150
150	175	200	200	200	200
200	225	250	275	300	300
250	275	300	325	350	375
300	350	375	400	400	400
*Length from Figures 910-12b, 13a, 13b, or 13c.					

Left-Turn Storage With Trucks (ft)
Figure 910-7

Use turning templates to verify that left-turn movements for the design vehicle(s) do not have conflicts. Design opposing left-turn design vehicle paths with a minimum 4-foot (12-foot desirable) clearance between opposing turning paths. Existing signalized intersections that do not meet the 4-foot clearance may remain with split signal phasing, an evaluate upgrade, and concurrence from the Region Traffic Office.

Where one-way left-turn channelization with curbing is to be provided, ensure that surface water will drain.

Provide illumination at left-turn lanes in accordance with the guidelines in Chapter 840.

At signalized intersections with high left-turn volumes, double left-turn lanes may be needed to maintain the desired level of service. A throat width of 30 to 36 feet is desirable on the exit leg of the turn to offset vehicle offtracking and the difficulty of two vehicles turning abreast. Use turning path templates to verify that the design vehicle can complete the turn. Where the design vehicle is a WB-40 or larger, it is preferred to provide for the design vehicle in the outside lane and an SU vehicle turning abreast rather than two design vehicles turning abreast.

Figures 910-14a through 14e show one-way left-turn lane geometrics. Figure 910-14a shows widening to accommodate the new lane. Figures 910-14b, 14c, and 14d show the use of a median. Figure 910-14e shows the minimum protected left turn with a median.

1. **Widening** (see Figure 910-14a). It is desirable that offsets and pavement widening be symmetrical about the centerline or baseline. Where right of way or topographic restrictions, crossroad alignments, or other circumstances preclude symmetrical widening, pavement widening may be on one side only.
2. **Divided Highways** (see Figures 910-14b through 14d). Widening is not required for left-turn lane channelization where medians are 11 feet wide or wider. For medians between 13 feet and 23 feet or where the acceleration

lane is not provided, it is desirable to design the left-turn lane adjacent to the opposing lane (shown in Figure 910-14b) to improve sight distance and increase opposing left-turn clearances.

A median acceleration lane (shown in Figures 910-14c and 14d) may be provided where the median is 23 feet or wider. The median acceleration lane might not be necessary at a signalized intersection. When a median acceleration lane is to be used, design it in accordance with 910.07(4), Speed Change Lanes. Where medians have sufficient width, provide a 2-foot shoulder adjacent to a left-turn lane.

3. **Minimum Protected Left Turn With a Median** (see Figure 910-14e). At intersections on divided highways where channelized left-turn lanes are not provided, provide the minimum protected storage area.

With an evaluate upgrade, the left-turn lane designs given in Figures 910-14a through 14e may be modified. Document the benefits and impacts of the modified design, including changes to vehicle-pedestrian conflicts; vehicle encroachment; deceleration length; capacity restrictions for turning vehicles or other degradation of intersection operations; and the effects on other traffic movements. The modified design must be able to accommodate the design vehicle and provide for the striping requirements of the *Standard Plans* and the MUTCD. To verify that the design vehicle can make the turn, include a plot of the design showing the design vehicle turning path template.

(b) **Two Way Left-Turn Lanes** (TWLTL) are located between opposing lanes of traffic. They are used by vehicles making left turns from either direction, from or onto the roadway.

Use TWLTLs only on managed access highways where there are no more than two through lanes in each direction. Evaluate installation of TWLTLs where:

- An accident study indicates that a TWLTL will reduce accidents.
- There are existing closely spaced access points or minor street intersections.
- There are unacceptable through traffic delays or capacity reductions because of left-turning vehicles.

A TWLTL can reduce delays to through traffic, reduce rear-end accidents, and provide separation between opposing lanes of traffic. However, they do not provide a safe refuge for pedestrians and can encourage strip development with additional closely spaced access points. Evaluate other alternatives (such as prohibiting midblock left turns and providing for U-turns) before using a TWLTL. (See Chapters 440 and 1435 for additional restrictions on the use of TWLTLs.)

The basic design for a TWLTL is illustrated in Figure 910-14f. Additional criteria are:

- The desirable length of a TWLTL is not less than 250 feet.
- Provide illumination in accordance with the guidelines in Chapter 840.
- Pavement markings, signs, and other traffic control devices must be in accordance with the MUTCD and the *Standard Plans*.
- Provide clear channelization when changing from TWLTLs to one-way left-turn lanes at an intersection.

(3) Right-Turn Lanes

Right-turn movements influence intersection capacity even though there is no conflict between right-turning vehicles and opposing traffic. Right-turn lanes might be needed to maintain efficient intersection operation. Use the following guidelines to determine when to provide right-turn lanes at unsignalized intersections.

- Recommendation from Figure 910-15 based on same-direction approach and right-turn traffic volumes for multilane roadways with a posted speed 45 mph or above and for all two-lane roadways.
- An accident study indicates that a right-turn lane will result in an overall accident reduction.
- The presence of pedestrians who require right-turning vehicles to stop.
- Restrictive geometrics that require right-turning vehicles to slow greatly below the speed of the through traffic.
- Less than decision sight distance at the approach to the intersection.

For unsignalized intersections, see 910.07(4), Speed Change Lanes, for guidance on right-turn lane lengths. For signalized intersections, use a traffic signal analysis to determine whether a right-turn lane is needed and the length requirement (see Chapter 850).

A capacity analysis may be used to determine whether right-turn lanes are necessary to maintain the desired level of service.

Where adequate right of way exists, providing right-turn lanes is relatively inexpensive and can provide increased safety and operational efficiency.

The right-turn pocket or the right-turn taper (see Figure 910-16) may be used at any minor intersection where a right-turn lane is not required. These designs will cause less interference and delay to the through movement by offering an earlier exit to right-turning vehicles.

If the right-turn pocket is used, Figure 910-16 shows taper lengths for various posted speeds.

(4) Speed Change Lanes

A speed change lane is an auxiliary lane primarily for the acceleration or deceleration of vehicles entering or leaving the through traveled way. Speed change lanes are normally provided for at-grade intersections on multilane divided highways with access control. Where roadside conditions and right of way allow, speed change lanes may be provided on other through roadways. Justification for a speed change lane depends on many factors, including speed, traffic volumes, capacity, type of highway, the design and frequency of intersections, and accident history.

A deceleration lane (Figure 910-17) is advantageous because, if a deceleration lane is not provided, the driver leaving the highway must slow down in the through lane regardless of following traffic.

An acceleration lane (Figure 910-18) is not as advantageous because entering drivers can wait for an opportunity to merge without disrupting through traffic. However, acceleration lanes for left-turning vehicles provide a safe benefit by allowing the turn to be made in two movements.

When either deceleration or acceleration lanes are to be used, design them in accordance with Figures 910-17 and 18. When the design speed of the turning traffic is greater than 20 mph, design the speed change lane as a ramp in accordance with Chapter 940. When a deceleration lane is used with a left-turn lane, add the deceleration length to the storage length.

(5) Drop Lanes

A lane may be dropped at an intersection with a turn-only lane or beyond the intersection. Do not allow a lane-reduction taper to cross an intersection or end less than 100 feet before an intersection. (See Chapter 620 for lane reduction pavement transitions.)

When a lane is dropped beyond signalized intersections, provide a lane of sufficient length to allow smooth merging. For facilities with a posted speed of 45 mph or higher, use a minimum length of 1500 feet. For facilities with a posted speed less than 45 mph, provide a lane of sufficient length so that the advanced lane reduction warning sign will be placed not less than 100 feet beyond the intersection area.

When a lane is dropped beyond unsignalized intersections, provide a lane beyond the intersection not less than the acceleration lane length from Figure 910-18.

(6) Shoulders

With justification, shoulder width requirements may be reduced within areas channelized for intersection turning lanes or speed change lanes. Apply left shoulder width criteria to the median shoulder of divided highways. On one-way couplets, apply the width criteria for the right shoulder to both the right and left shoulders.

For roadways without curb sections, the shoulder adjacent to turn lanes and speed change lanes may be reduced to 2 feet on the left and 4 feet on the right. When a curb and sidewalk section is used with a turn lane or speed change lane 400 feet or less in length, the shoulder abutting the turn lane may be eliminated. In instances where curb is used without sidewalk, provide a minimum of 4-foot-wide shoulders on the right. Where curbing is used adjacent to left-turn lanes, the shoulder may be eliminated. Adjust the design of the intersection as necessary to allow for vehicle tracking.

Reducing the shoulder width at intersections facilitates the installation of turn lanes without unduly affecting the overall width of the roadway. A narrower roadway also reduces pedestrian exposure in crosswalks and discourages motorists from using the shoulder to bypass other turning traffic.

On routes where provisions are made for bicycles, continue the bicycle facility between the turn lane and the through lane. (See Chapter 1020 for information on bicycle facilities.)

(7) Islands

An island is a defined area within an intersection between traffic lanes for the separation of vehicle movements or for pedestrian refuge. Within an intersection, a median is considered an island. Design islands to clearly delineate the traffic channels to drivers and pedestrians.

Traffic islands perform the following functions:

- Channelization islands control and direct traffic movements
- Divisional islands separate traffic movements
- Refuge islands provide refuge for pedestrians
- Islands can provide for the placement of traffic control devices and luminaires
- Islands can provide areas within the roadway for landscaping

(a) **Size and Shape**. Divisional and refuge islands are normally elongated and at least 4 feet wide and 20 feet long.

Channelization islands are normally triangular. In rural areas, 75 ft^2 is the minimum island area and 100 ft^2 is desirable. In urban areas where posted speeds are 25 mph or less, smaller islands are acceptable. Use islands with at least 200 ft^2 if pedestrians will be crossing or traffic control devices or luminaires will be installed.

Design triangular-shaped islands as shown in Figures 910-19a through 19c. The shoulder and offset widths illustrated are for islands with vertical curbs 6 inches or higher. Where painted islands are used, such as in rural areas, these widths are desirable but may be omitted. (See Chapter 641 for <u>desirable</u> turning roadway widths.)

Island markings may be supplemented with reflective raised pavement markers.

Barrier-free access must be provided at crosswalk locations where raised islands are used (see Chapter 1025).

(b) **Location**. Design the approach ends of islands to provide adequate visibility to alert motorists to their presence. Position the island so that a smooth transition in vehicle speed and direction is attained. Begin transverse lane shifts far enough in advance of the intersection to allow gradual transitions. Avoid introducing islands on a horizontal or vertical curve. If the use of an island on a curve cannot be avoided, provide adequate sight distance, illumination, or extension of the island.

(c) **Compound Right-Turn Lane**. To design large islands, the common method is to use a large radius curve for the turning traffic. While this does provide a larger island, it also encourages higher turning speeds. Where pedestrians are a concern, higher turning speeds are undesirable. An alternative is a compound curve with a large radius followed by a small radius (see Figure 910-19b). This design forces the turning traffic to slow down.

(d) **Curbing**. Provide vertical curb 6 inches or higher for:

- Islands with luminaires, signals, or other traffic control devices.
- Pedestrian refuge islands.

Also consider curbing for:

- Divisional and channelizing islands.
- Landscaped islands.

In general, unless required for the uses listed above, it is preferred not to use curbs on facilities with a posted speed of 45 mph or greater.

Avoid using curbs if the same objective can be attained with pavement markings.

Refer to Chapter 440 for additional information and requirements on the use of curbs.

910.08 U-Turns

For divided multilane highways without full access control that have access points where the median prevents left turns, evaluate the demand for locations that allow U-turns. Normally, U-turn opportunities are provided at intersections. However, where intersections are spaced far apart, U-turn median openings may be required between intersections to accommodate U-turns. Use the desirable U-turn spacing (see Figure 910-8) as a guide to determine when to provide U-turn median openings between intersections. When the U-turning volumes are low, longer spacing may be used.

Locate U-turn median openings where intersection sight distance can be provided.

	Desirable	Minimum
Urban[1]	1,000 ft	[2]
Suburban	½ mi	¼ mi[3]
Rural	1 mi	½ mi

Notes:

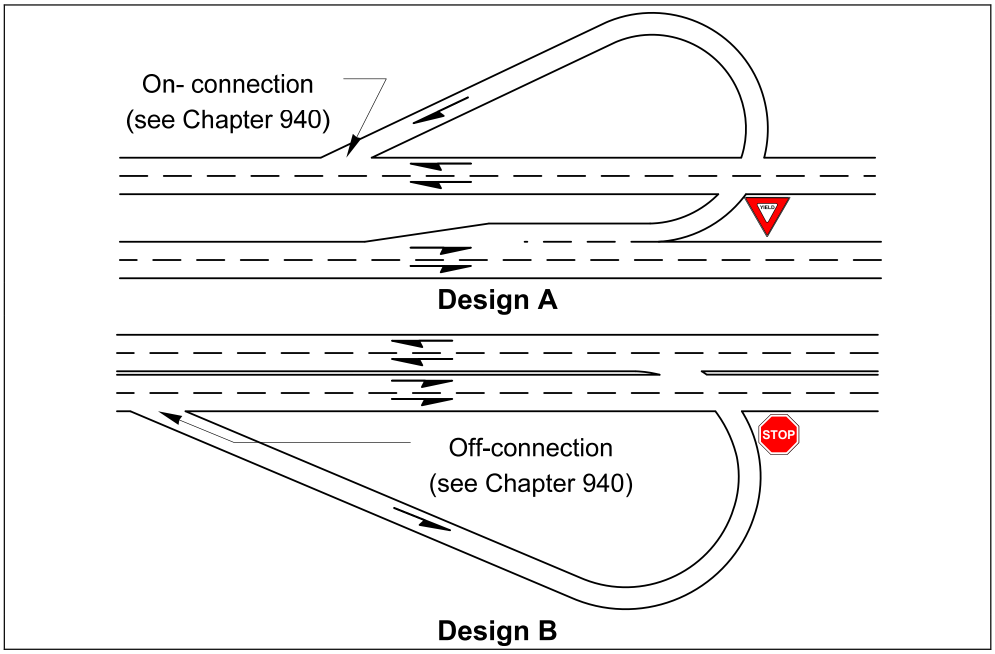
[1] For design speeds greater than 45 mph, use suburban spacing.

[2] The minimum spacing is the acceleration lane length from a stop (Figure 910-18) plus 300 ft.

[3] For design speeds 60 mph or greater, the minimum spacing is the acceleration lane length from a stop (Figure 910-18) plus 300 ft.

U-Turn Spacing
Figure 910-8

When designing U-turn median openings, use Figure 910-21 as a guide. Where the median is less than 40 feet wide and a large design vehicle is required, provide a U-turn roadway (see Figure 910-9). Design A, with the U-turn roadway after the left-turn, is preferred. Use Design A when the median can accommodate a left-turn lane. Use Design B only with narrow medians where left-turn channelization cannot be built in the median.



U-Turn Roadway
Figure 910-9

Document the need for U-turn locations and the spacing used, and justify the selected design vehicle. If the design vehicle is smaller than the largest vehicle using the facility, provide an alternate route.

U-turns at signal-controlled intersections do not require the acceleration lanes shown in Figure 910-21. For new U-turn locations at signal-controlled intersections, ensure that right-turning vehicles from side streets will not conflict with U-turning vehicles. Warning signs on the cross street might be appropriate.

910.09 Intersection Sight Distance

For traffic to move safely through intersections, drivers need to be able to see stop signs, traffic signals, and oncoming traffic in time to react accordingly.

Provide decision sight distance, where feasible, in advance of stop signs, traffic signals, and roundabouts. (See Chapter 650 for guidance.)

The driver of a vehicle that is stopped and waiting to cross or enter a through roadway needs obstruction-free sight triangles in order to see enough of the through roadway to safely complete all legal maneuvers before an approaching vehicle on the through roadway can reach the intersection. Use Figure 910-22a to determine minimum sight distance along the through roadway.

The sight triangle is determined as shown in Figure 910-22b. Within the sight triangle, lay back the cut slopes and remove, lower, or move hedges, trees, signs, utility poles, signal poles, and anything else large enough to be a sight obstruction. Eliminating parking will remove obstructions to sight distance. In order to maintain the sight distance, the sight triangle must be within the right of way or a state maintenance easement (see Chapter 1410).

The minimum setback distance for the sight triangle is 18 feet from the edge of traveled way. This is for a vehicle stopped 10 feet from the edge of traveled way. The driver is almost always 8 feet or less from the front of the vehicle; therefore, 8 feet are added to the setback. When the stop bar is placed more than 10 feet from the edge of traveled way, providing the sight triangle to a point 8 feet back of the stop bar is desirable.

Provide a clear sight triangle for a P vehicle at all intersections. In addition, provide a clear sight triangle for the SU vehicle for rural highway conditions. If there is significant combination truck traffic, use the WB-50 or WB-67 rather than the SU. In areas where SU or WB vehicles are minimal and right of way restrictions prohibit adequate sight triangle clearing, only the P vehicle sight distance needs to be provided.

At existing intersections, when sight obstructions within the sight triangle cannot be removed due to limited right of way, the intersection sight distance may be modified. A driver who does not have the desired sight distance will creep out until the sight distance is available; therefore, the setback may be reduced to 10 feet. Document the right of way width and provide a brief analysis of the intersection sight distance clarifying the reasons for reduction. Verify and document that there is not an accident problem at the intersection. Document the intersection location and the available sight distance in the Design Variance Inventory (see Chapter 330) as a design exception.

If the intersection sight distance cannot be provided using the reductions in the preceding paragraph, where stopping sight distance is provided for the major roadway, the intersection sight distance, at the 10-foot setback point, may be reduced to the stopping sight distance required for the major roadway, with an evaluate upgrade and HQ Design Office review and concurrence. (See Chapter 650 for required stopping sight distance.) Document the right of way width and provide a brief analysis of the intersection sight distance clarifying the reasons for reduction. Verify and document that there is not an accident problem at the intersection. Document the intersection location and the available sight distance in the Design Variance Inventory (see Chapter 330) as an evaluate upgrade.

In some instances, intersection sight distance is provided at the time of construction, but subsequent vegetative growth has degraded the sight distance available. The growth may be seasonal or occur over time. In these instances, intersection sight distance will be restored through the periodically scheduled maintenance of vegetation in the sight triangle within the WSDOT right of way or state maintenance easement.

At intersections controlled by traffic signals, provide sight distance for right-turning vehicles.

Designs for movements that cross divided highways are influenced by median widths. If the median is wide enough to store the design vehicle, with a 3-foot clearance at both ends of the vehicle, sight distances are determined in two steps. The first step is for crossing from a stopped position to the median storage; the second step is for the movement, either across or left into the through roadway.

Design sight distance for ramp terminals as at-grade intersections with only left- and right-turning movements. An added element at ramp terminals is the grade separation structure. Figure 910-22b gives the sight distance guidance in the vicinity of a structure. In addition, when the crossroad is an undercrossing, check the sight distance under the structure graphically using a truck eye height of 6 feet and an object height of 1.5 feet.

Document a brief description of the intersection area, sight distance restrictions, and traffic characteristics to support the design vehicle and sight distances chosen.

910.10 Traffic Control at Intersections

Intersection traffic control is the process of moving traffic safely through areas of potential conflict where two or more roadways meet. Signs, signals, channelization, and physical layout are the major tools used to establish intersection control.

There are three objectives to intersection traffic control that can greatly improve intersection operations.

- **Maximize Intersection Capacity**. Since two or more traffic streams cross, converge, or diverge at intersections, the capacity of an intersection is normally less than the roadway between intersections. It is usually necessary to assign right of way through the use of traffic control devices to maximize capacity for all users of the intersection. Turn prohibitions may be used to increase intersection capacity.
- **Reduce Conflict Points**. The crossing, converging, and diverging of traffic creates conflicts that increase the potential for accidents. Establishing appropriate controls can reduce the possibility of two cars attempting to occupy the same space at the same time. Pedestrian accident potential can also be reduced by appropriate controls.
- **Prioritize Major Street Traffic**. Traffic on major routes is normally given the right of way over traffic on minor streets to increase intersection operational efficiency.

If a signal is being considered or exists at an intersection that is to be modified, a preliminary signal plan is required (see Chapter 850). If a new signal permit is required, it must be approved before the design is approved.

A proposal to install a traffic signal or a roundabout on a state route, either NHS or Non-NHS, with a posted speed limit of 45 mph or higher requires an analysis of alternatives, approved by the Region Traffic Engineer, with review and comment by the HQ Design Office, prior to proceeding with the design. Include the following alternatives in the analysis:

- Channelization, providing deceleration lanes, storage, and acceleration lanes for left- and right-turning traffic
- Right-off/right-on with U-turn opportunities
- Grade separation
- Roundabouts
- Traffic control signals

Include a copy of the analysis with the preliminary signal plan or roundabout justification.

910.11 Signing and Pavement Marking

Use the MUTCD and the *Standard Plans* for signing and pavement marking criteria. Provide a route confirmation sign on all state routes shortly after major intersections. (See Chapter 820 for additional information on signing.)

Painted or plastic pavement markings are normally used to delineate travel paths. For pavement marking details, see the MUTCD, Chapter 830, and the *Standard Plans*.

Contact the Region or HQ Traffic Office for additional information when designing signing and pavement markings.

910.12 Procedures

Document design considerations and conclusions in accordance with Chapter 330. For highways with limited access control, see Chapter 1430 for requirements.

(1) Approval

An intersection is approved in accordance with Chapter 330. When required, the following items must be completed before an intersection may be approved:

- Traffic analysis
- Deviations approved in accordance with Chapter 330
- Approved Traffic Signal Permit (DOT Form 242-014 EF) (see Chapter 850)
- HQ Design Office approval for intersections with roundabouts (see Chapter 915 for approval procedures)

(2) Intersection Plans

Intersection plans are required for any increases in capacity (turn lanes) at an intersection, modification of channelization, or change of intersection geometrics. Support the need for intersection or channelization modifications with history; school bus and mail route studies; hazardous materials route studies; pedestrian use; public meeting comments; and so forth.

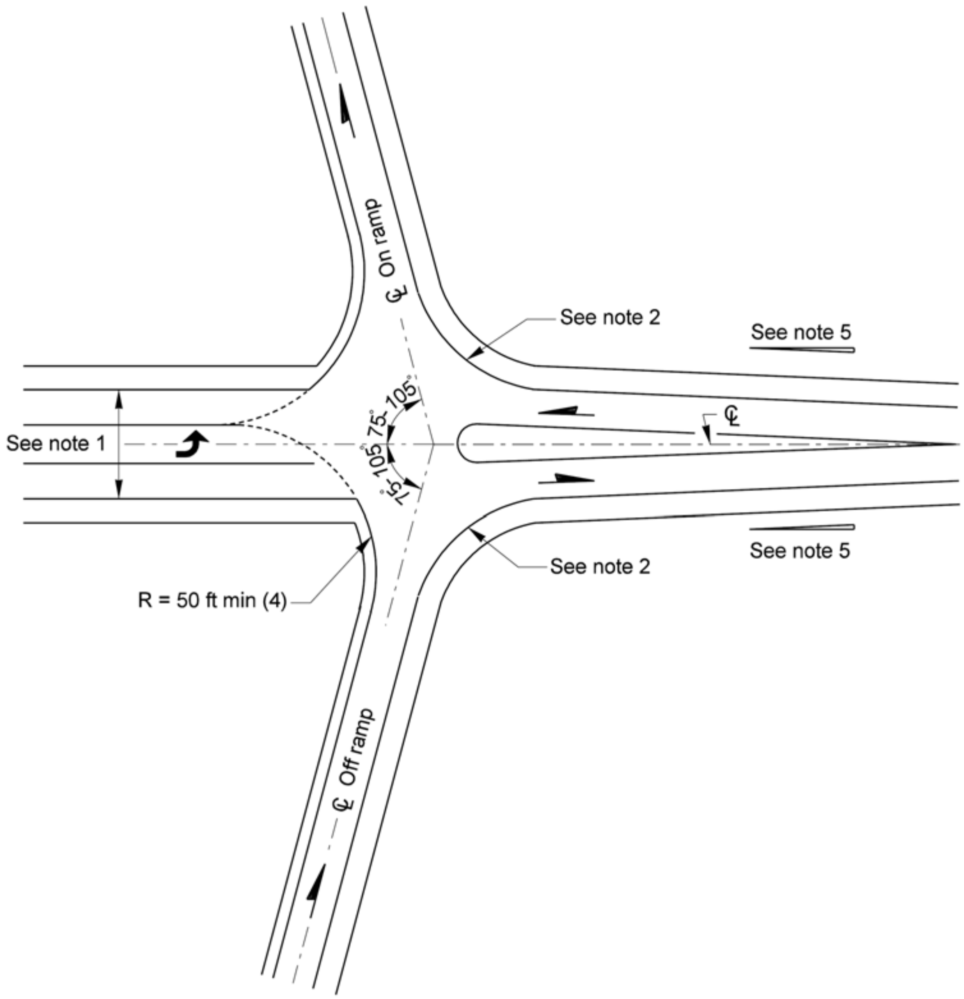
For information to be included on the Intersection Plan for Approval, see the Intersection/Channelization Plan for Approval Checklist on the following web site:
www.wsdot.wa.gov/design/projectdev/

(3) Local Agency or Developer-Initiated Intersections

There is a separate procedure for local agency or developer-initiated projects at intersections with state routes. The project initiator submits an intersection plan and the documentation of design decisions that led to the plan to the Region for approval. For those plans requiring a design variance, the deviation or evaluate upgrade must be approved in accordance with Chapter 330 prior to approval of the plan. After the plan approval, the Region prepares a construction agreement with the project initiator (see the *Utilities Manual*).

910.13 Documentation

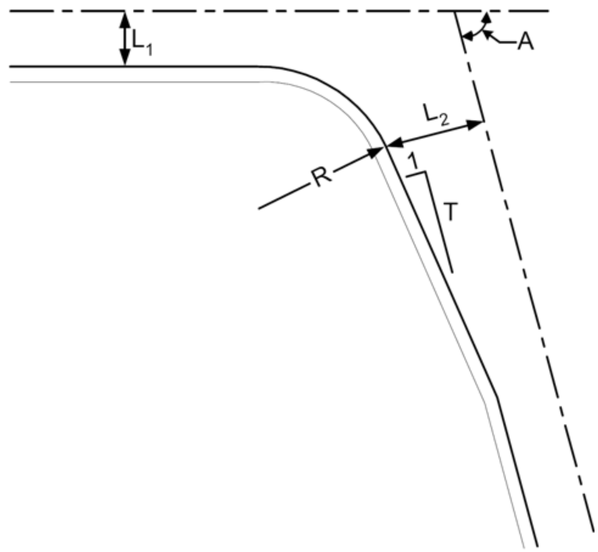
For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/



Notes:

[1] 12-ft through lanes and 13-ft left-turn lane desirable.
[2] For right-turn corner design, see Figure 910-11.
[3] Intersections may be designed individually.
[4] Use templates to verify that the design vehicle can make the turn.
[5] For taper rates, see Figure 910-14a, Table 1.

Interchange Ramp <u>Terminal</u> Details
Figure 910-10



L_1 = Minimum available roadway width[2] that the vehicle is turning from

L_2 = Available roadway width[2] for the vehicle leaving the intersection

R = Radius to the edge of traveled way

T = Taper rate (length per unit of width of widening)

A = Delta angle of the turning vehicle

Vehicle	A	R	L1[1]	L2[2]	T	Vehicle	A	R	L1[1]	L2[2]	T
WB-67	60	85	11	22	7	WB-40	60	55	11	15	7.5
	75	75	11	21	8		75	55	11	15	7.5
	90	70	11	21	8		90	55	11	14	7.5
	105	55	11	24	7		105	45	11	16	7.5
	120	50	11	24	7		120	45	11	15	7.5
WB-50	60	55	11	19	6	SU & BUS	All	50	11	11	25
	75	55	11	18	6	P	All	35	11	11	25
	90	55	11	17	6						
	105	50	11	17	6						
	120	45	11	18	6						

Notes:

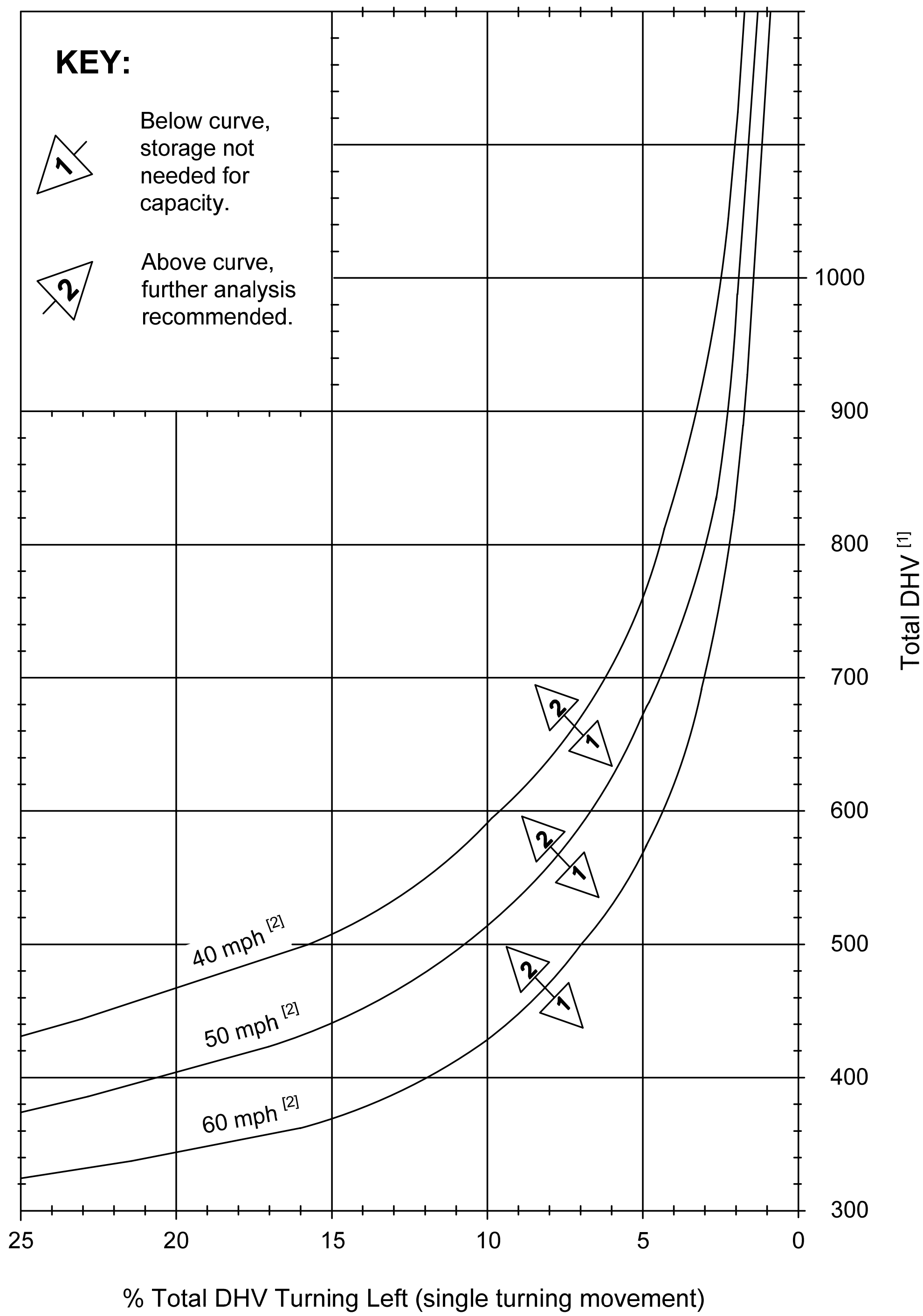
[1] When available roadway width is less than 11 ft, widen at 25:1.

[2] Available roadway width includes the shoulder, less a 2-ft clearance to a curb, and all the same-direction lanes of the exit leg at signalized intersections.

[3] All distances given in feet and angles in degrees.

Right-Turn Corner

Figure 910-11

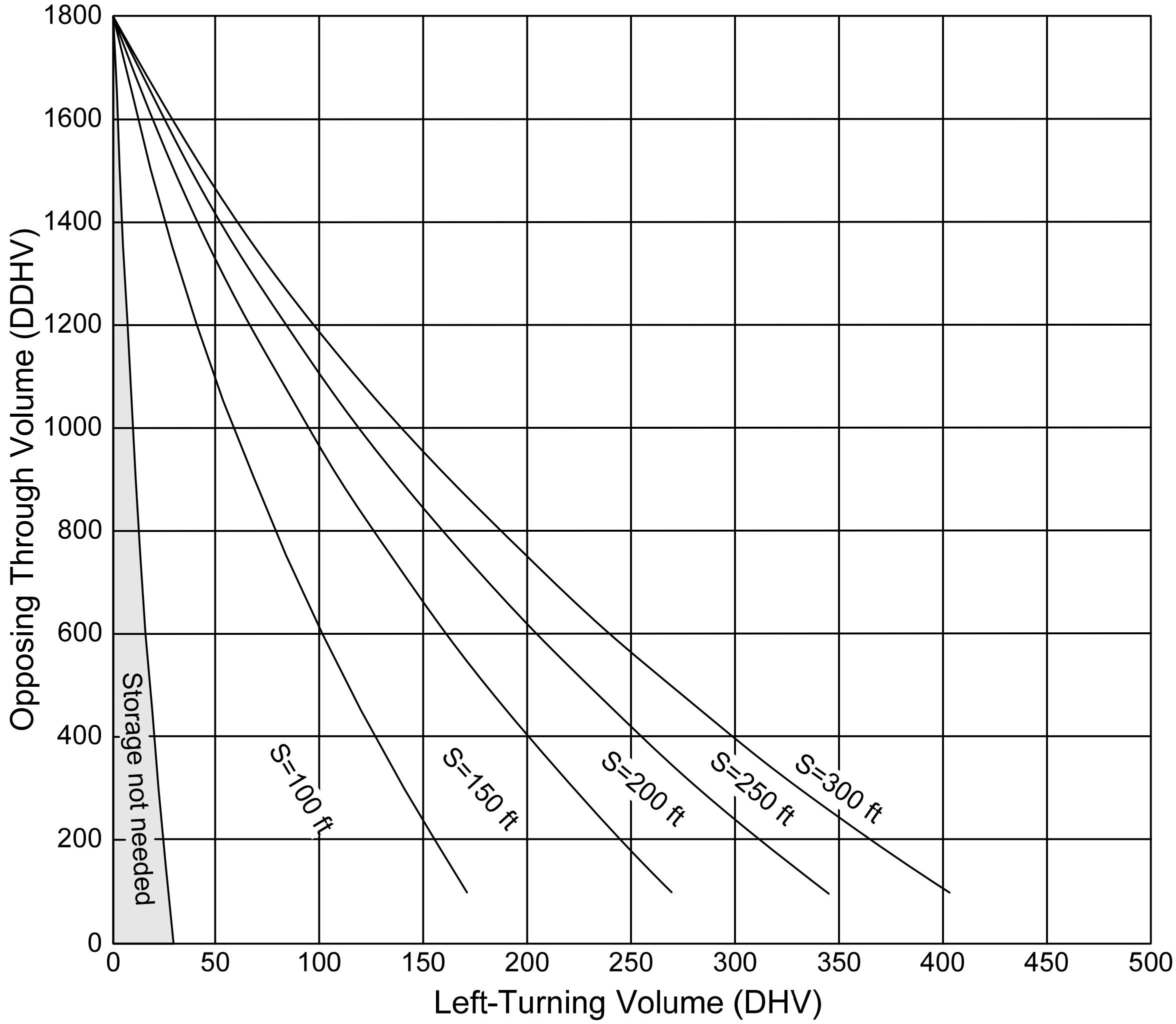


Notes:

[1] DHV is total volume from both directions.

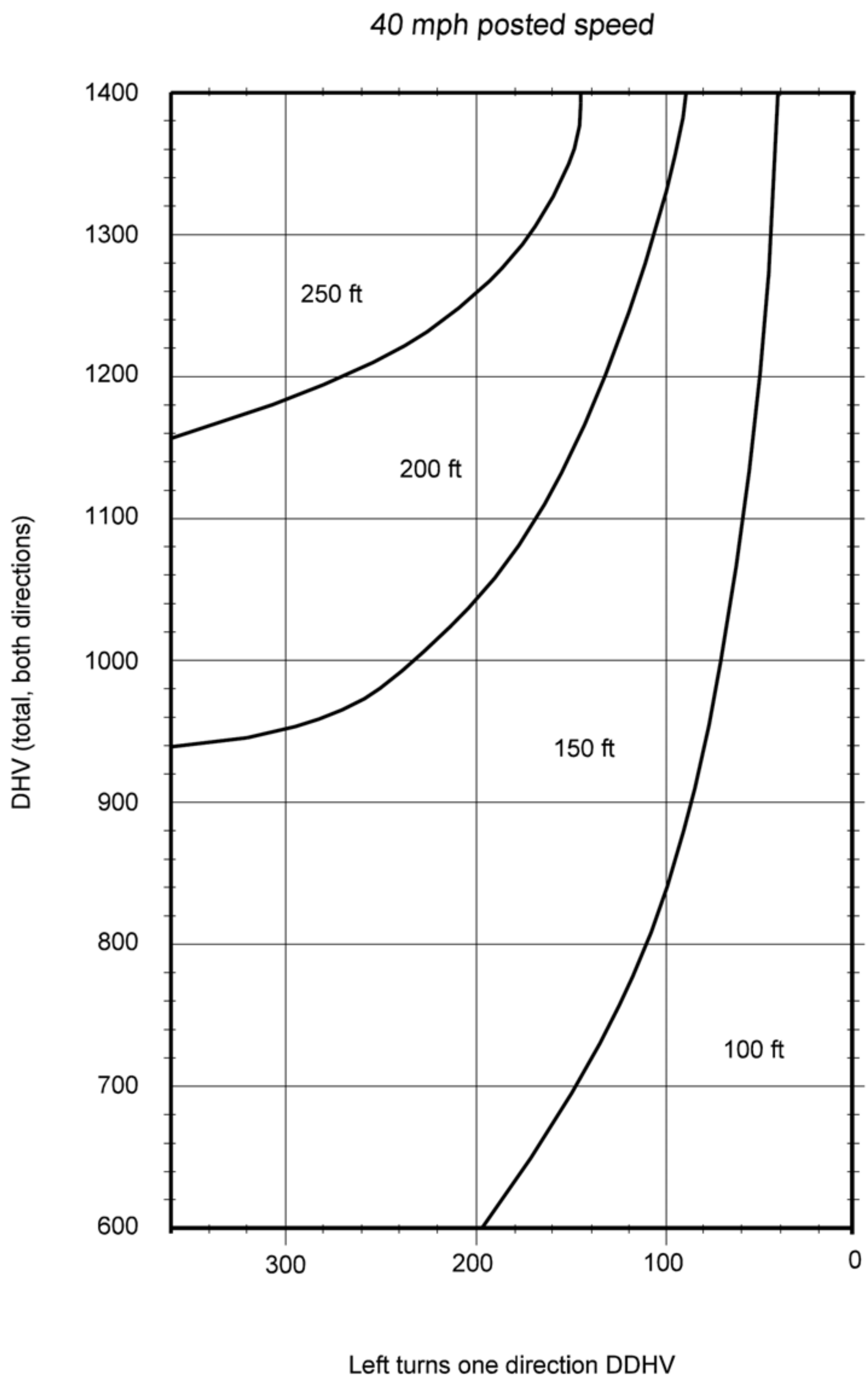
[2] Speeds are posted speeds.

Left-Turn Storage Guidelines: Two-Lane, Unsignalized
Figure 910-12a

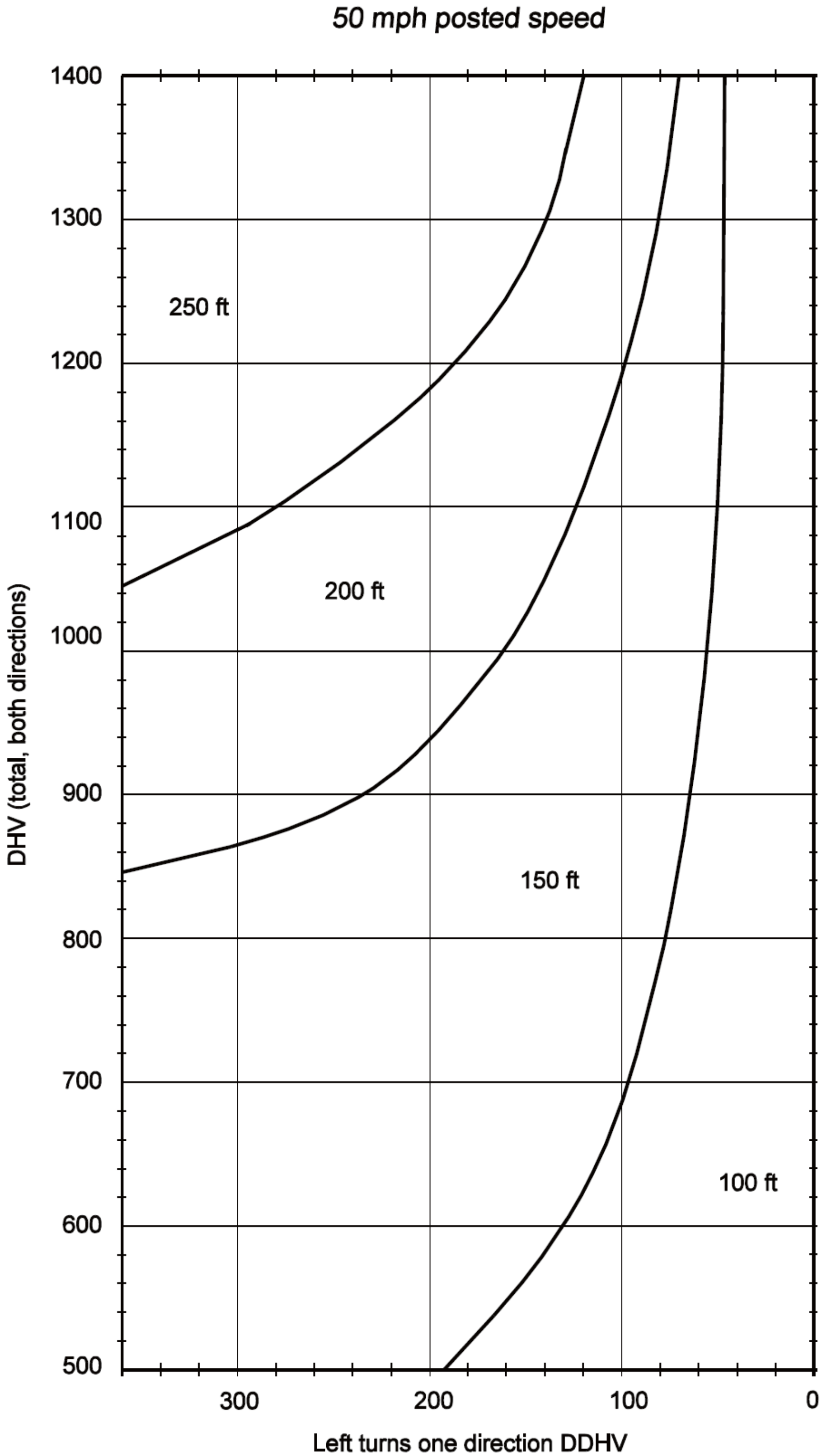


Note:
S = Left-turn storage length

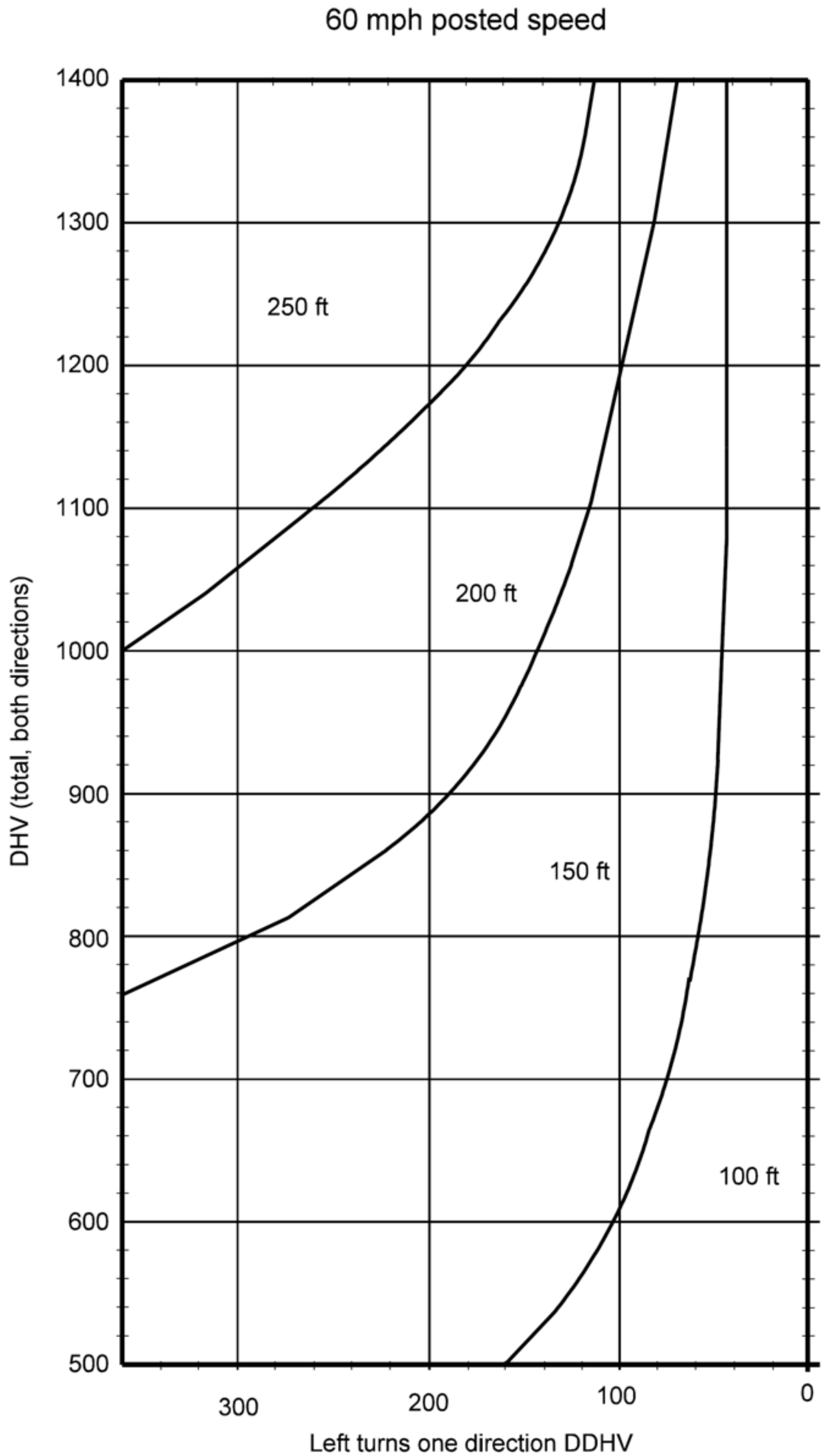
Left-Turn Storage Guidelines: Four-Lane, Unsignalized
Figure 910-12b



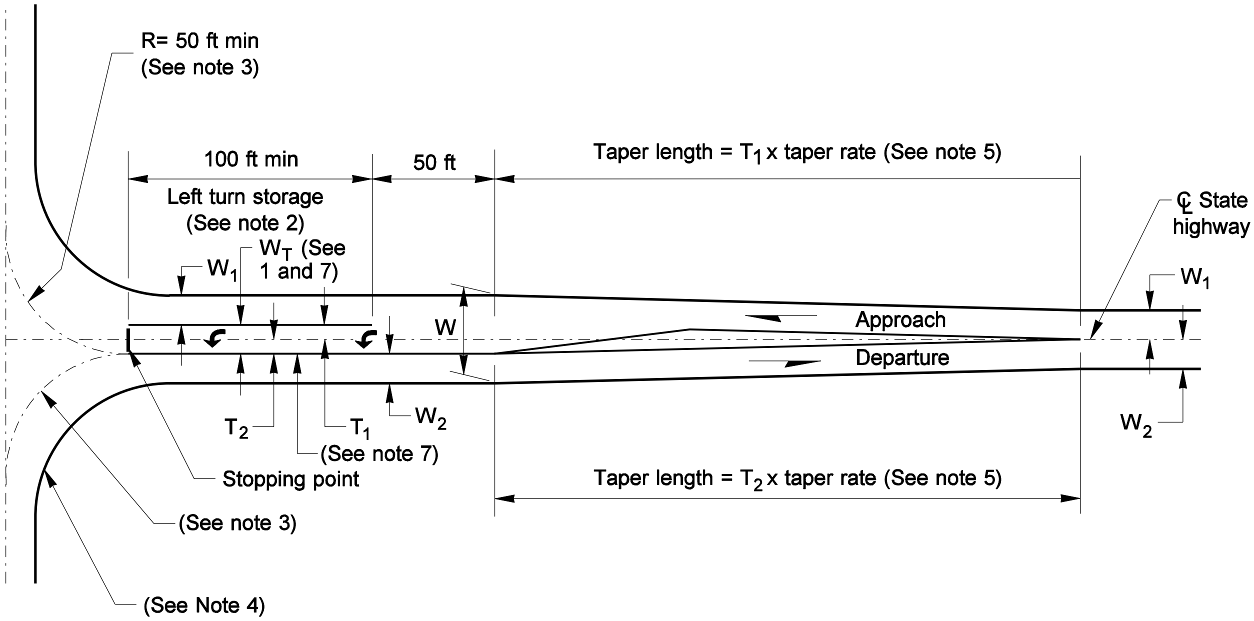
Left-Turn Storage Length: Two-Lane, Unsignalized
Figure 910-13a



Left-Turn Storage Length: Two-Lane, Unsignalized
Figure 910-13b



Left-Turn Storage Length: Two-Lane, Unsignalized
Figure 910-13c



Notes:

[1] The minimum width of the left-turn storage lane (T1+T2) is 11 ft. The desirable width is 12 ft.

[2] For left-turn storage length, see Figures 910-12b for 4-lane roadways or 13a through 13c for 2-lane roadways.

[3] Desirable radius not less than 50 ft. Use templates to verify that the design vehicle can make the turn.

[4] For right-turn corner design, see Figure 910-11.

[5] For desirable taper rates, see Table 1. With justification, taper rates from Table 2, Figure 910-14c, may be used.

[6] For pavement marking details, see the *Standard Plans* and the MUTCD.

[7] When curb is provided, add the width of the curb and the required shoulders to the left-turn lane width. For required shoulder widths at curbs, see 910.07(6) and Chapter 440.

W_1 = Approaching through lane

W_2 = Departing lane

T_1 = Width of left-turn lane on approach side of centerline

T_2 = Width of left-turn lane on departure side of centerline

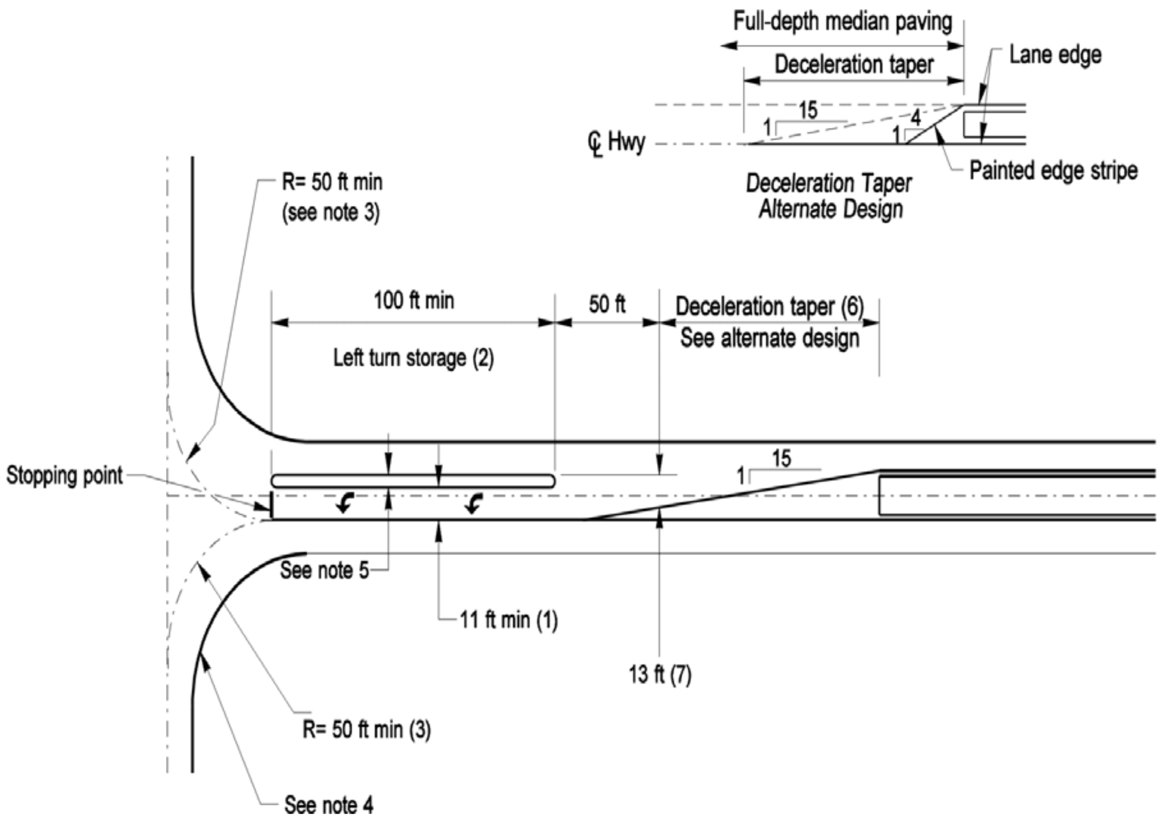
W_T Total width of left-turn lane

W = Total width of channelization ($W_1+W_2+T_1+T_2$)

Posted Speed	Desirable Taper Rate[6]
55 mph	55:1
50 mph	50:1
45 mph	45:1
40 mph	40:1
35 mph	35:1
30 mph	30:1
25 mph	25:1

Table 1

Median Channelization: Widening
Figure 910-14a



Notes:

[1] Lane width of 13 ft is desirable.

[2] For left-turn storage length, see Figures 910-12b for 4-lane roadways or 13a through 13c for 2-lane roadways.

[3] Desirable radius not less than 50 ft. Use templates to verify that the design vehicle can make the turn.

[4] For right-turn corner design, see Figure 910-11.

[5] For median widths greater than 13 ft, it is desirable to locate the left-turn lane adjacent to the opposing through lane with excess median width between the same direction through lane and the turn lane.

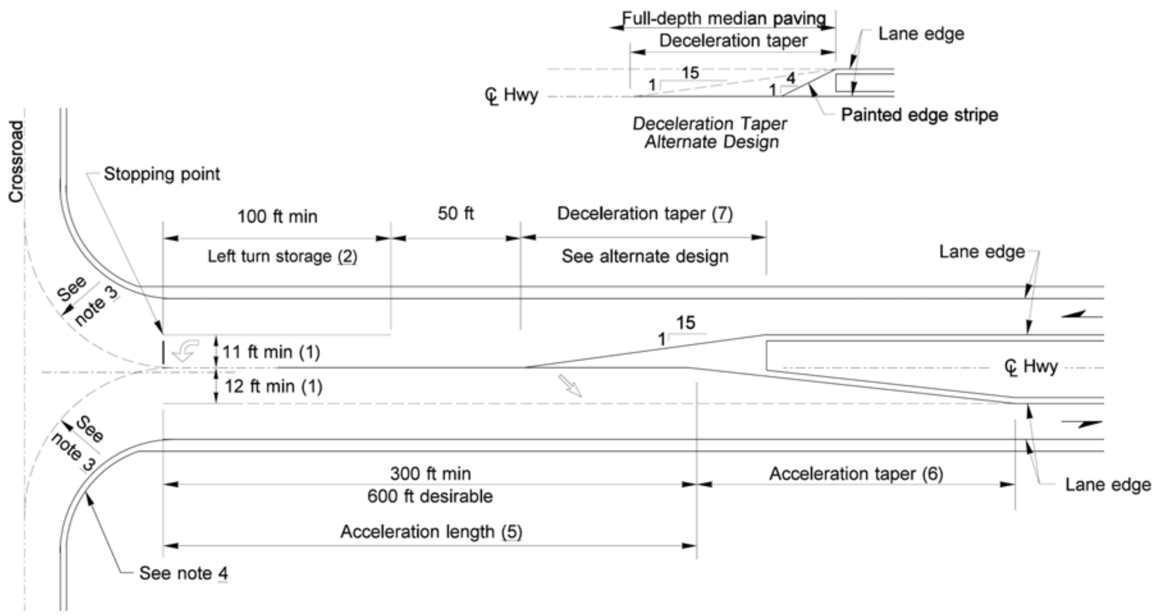
[6] For increased storage capacity, the left-turn deceleration taper alternate design may be used.

[7] Reduce to lane width for medians less than 13 ft wide.

[8] For pavement marking details, see the *Standard Plans* and the MUTCD.

Median Channelization: Median Width 11 ft or More

Figure 910-14b



Notes:

[1] Lane widths of 13 ft are desirable for both the left-turn storage lane and the median acceleration lane.

[2] For left-turn storage length, see Figures 910-12b for 4-lane roadways or 13a through 13c for 2-lane roadways.

[3] Desirable radius not less than 50 ft. Use templates to verify that the design vehicle can make the turn.

[4] For right-turn corner design, see Figure 910-11.

[5] The minimum total length of the median acceleration lane is shown in Figure 910-18.

[6] For acceleration taper rate, see Table 2.

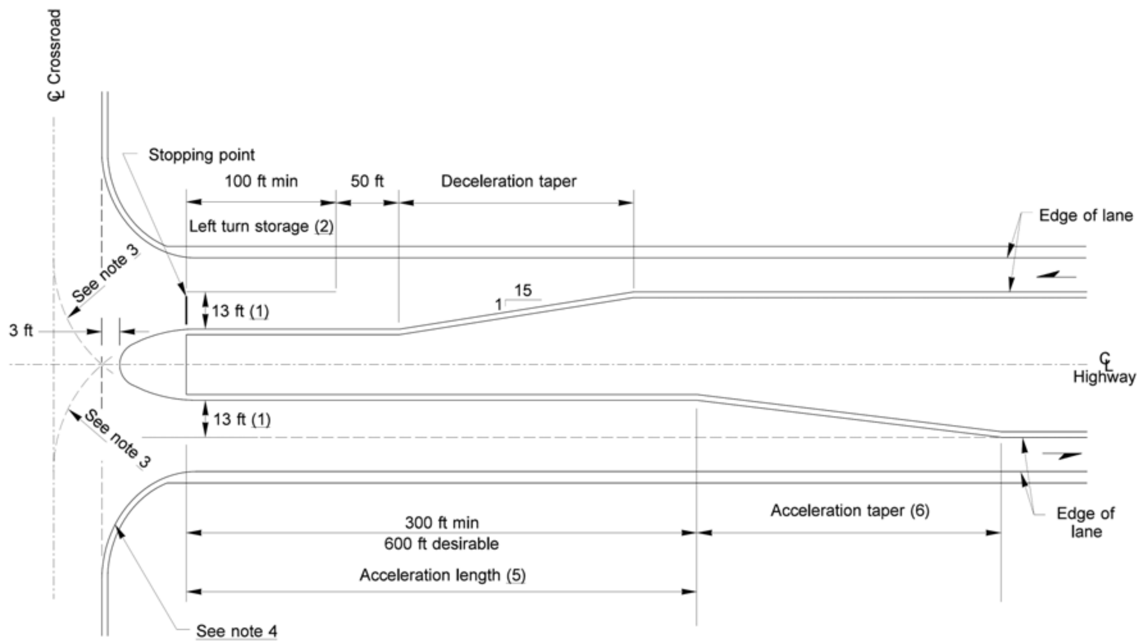
[7] For increased storage capacity, the left-turn deceleration taper alternate design may be used.

[8] For pavement marking details, see the *Standard Plans* and the MUTCD.

Posted Speed	Taper Rate
55 mph	55:1
50 mph	50:1
45 mph	45:1
40 mph	27:1
35 mph	21:1
30 mph	15:1
25 mph	11:1

Table 2

Median Channelization: Median Width 23 ft to 26 ft
Figure 910-14c



Notes:

[1] May be reduced to 11 ft, with justification.

[2] For left-turn storage length, see Figures 910-12b for 4-lane roadways or 13a through 13c for 2-lane roadways.

[3] Desirable radius not less than 50 ft. Use templates to verify that the design vehicle can make the turn.

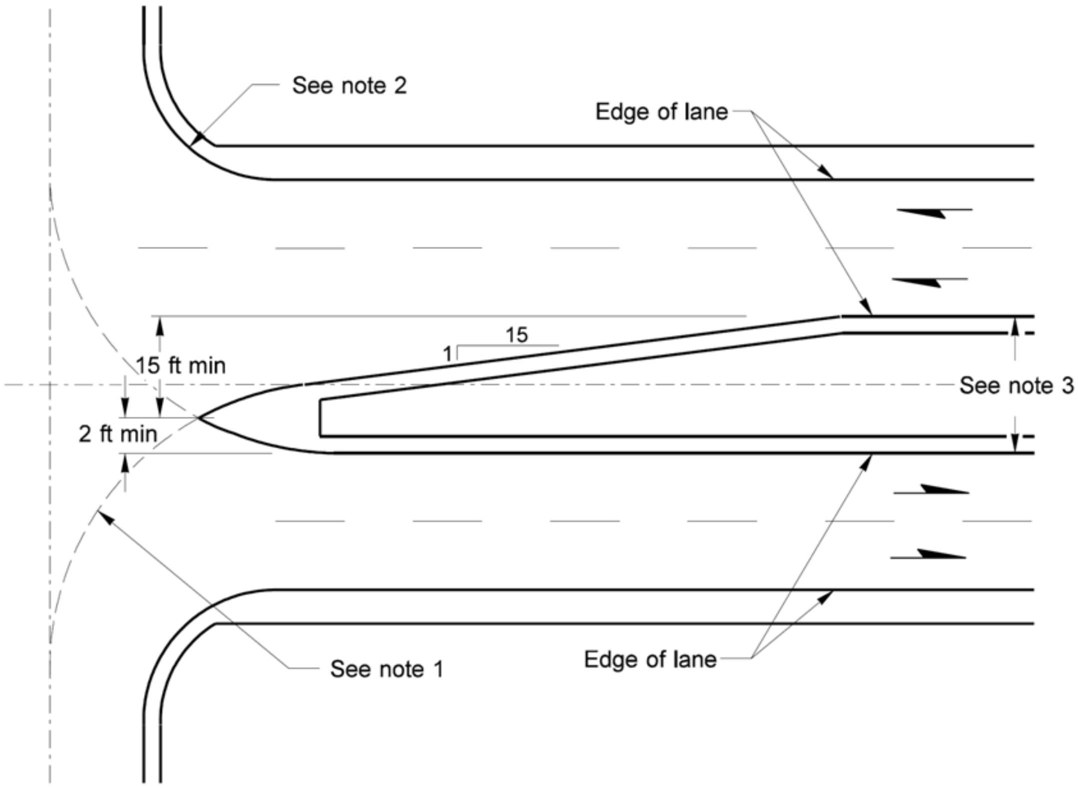
[4] For right-turn corner design, see Figure 910-11.

[5] The minimum length of the median acceleration lane is shown in Figure 910-18.

[6] For acceleration taper rate, see Figure 910-14c, Table 2.

[7] For pavement marking details, see the *Standard Plans* and the MUTCD.

Median Channelization: Median Width of More Than 26 ft
Figure 910-14d



Notes:

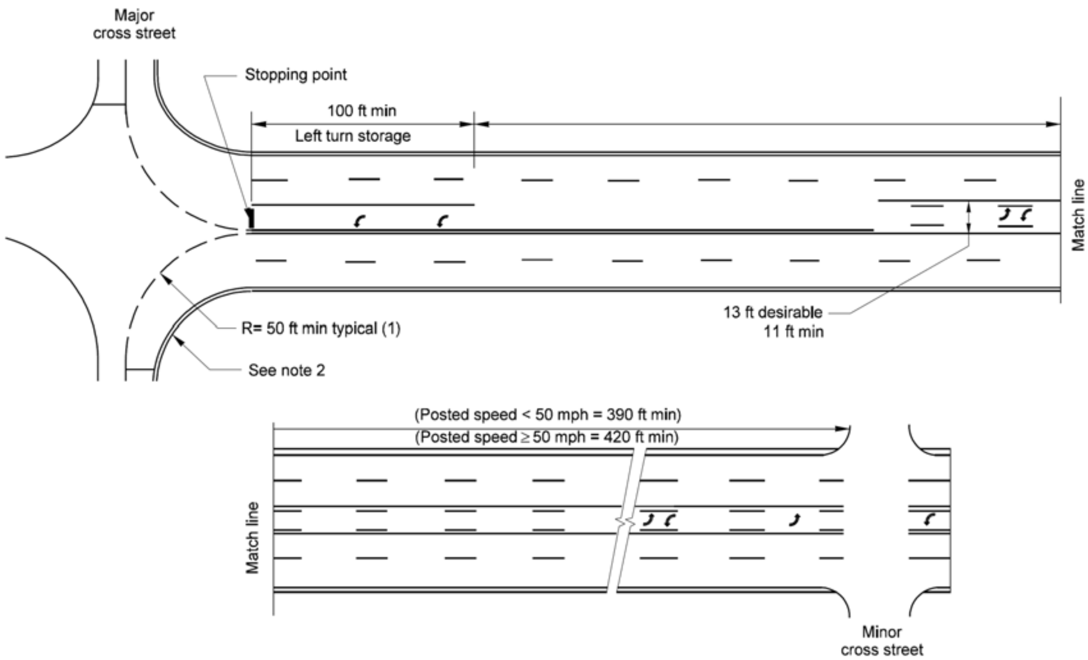
[1] Desirable radius not less than 50 ft. Use templates to verify that the design vehicle can make the turn.

[2] For right-turn corner design, see Figure 910-11.

[3] For median width 17 ft or more. For median width less than 17 ft, widen to 17 ft or use Figure 910-14b.

[4] For pavement marking details, see the *Standard Plans* and the MUTCD.

Median Channelization: Minimum Protected Storage
Figure 910-14e



Notes:

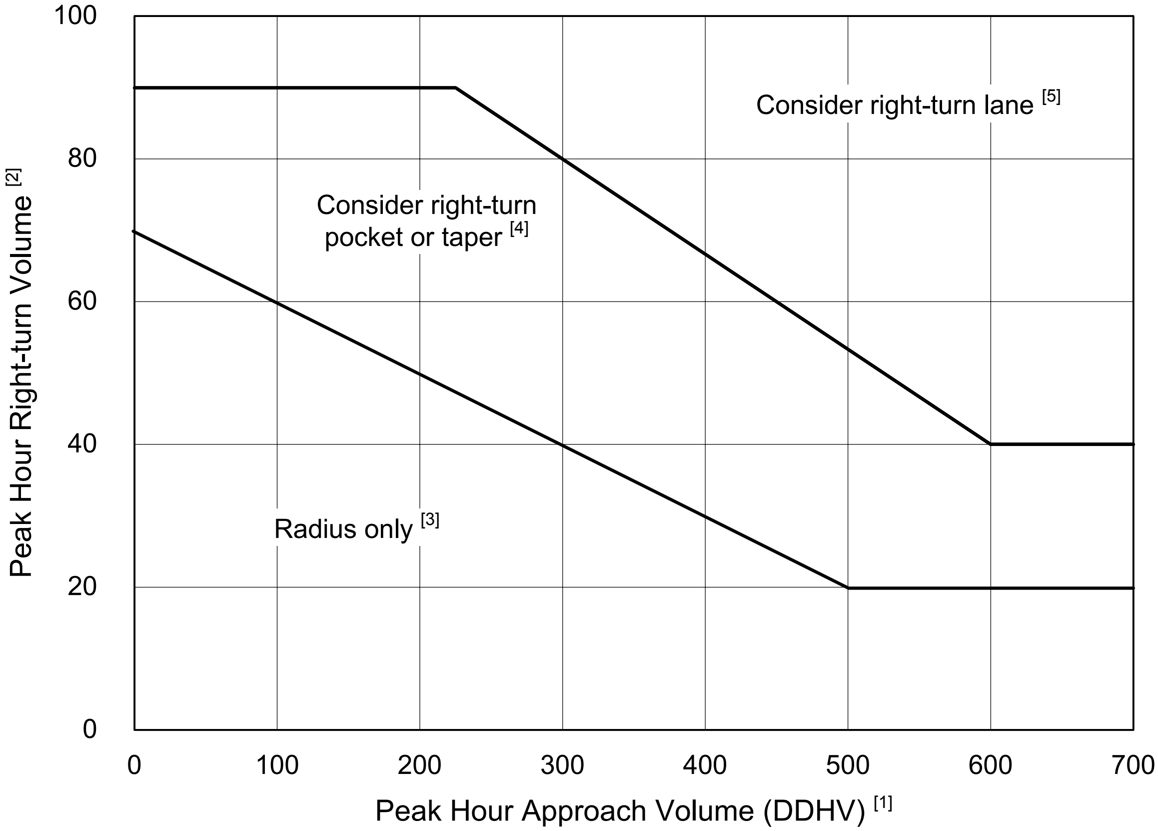
[1] Desirable radius not less than 50 ft. Use templates to verify that the design vehicle can make the turn.

[2] For right-turn corner design, see Figure 910-11.

[3] For pavement marking details and signing criteria, see the *Standard Plans* and the MUTCD.

Median Channelization: Two-way Left-Turn Lane

Figure 910-14f



Notes:

[1] For two-lane highways, use the peak hour DDHV (through + right-turn).

For multilane, high-speed highways (posted speed 45 mph or above), use the right-lane peak hour approach volume (through + right-turn).

[2] When all three of the following conditions are met, reduce the right-turn DDHV by 20.

- The posted speed is 45 mph or less
- The right-turn volume is greater than 40 VPH
- The peak hour approach volume (DDHV) is less than 300 VPH

[3] For right-turn corner design, see Figure 910-11.

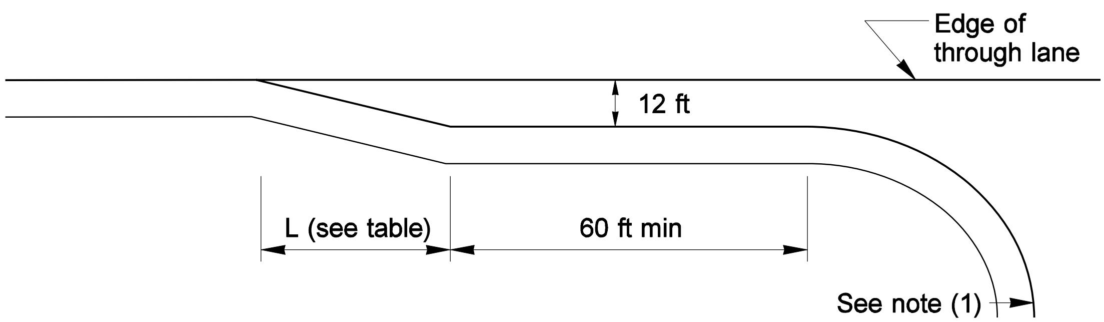
[4] For right-turn pocket or taper design, see Figure 910-16.

[5] For right-turn lane design, see Figure 910-17.

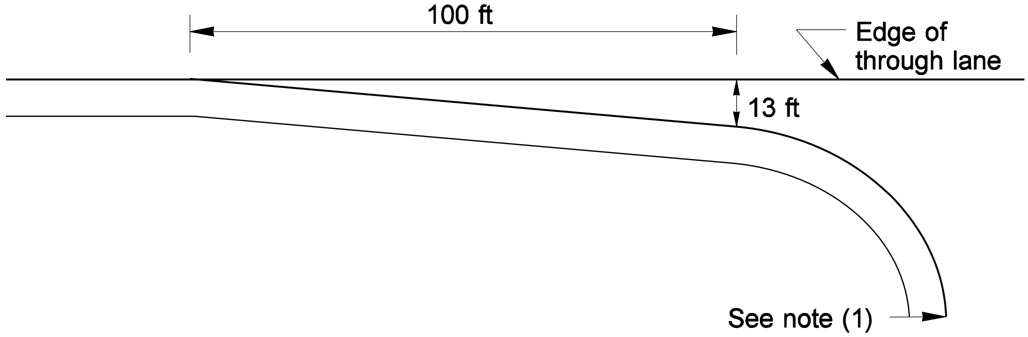
[6] For additional guidance, see 910.07(3).

Right-Turn Lane Guidelines[6]

Figure 910-15



Right-Turn Pocket



Right-Turn Taper

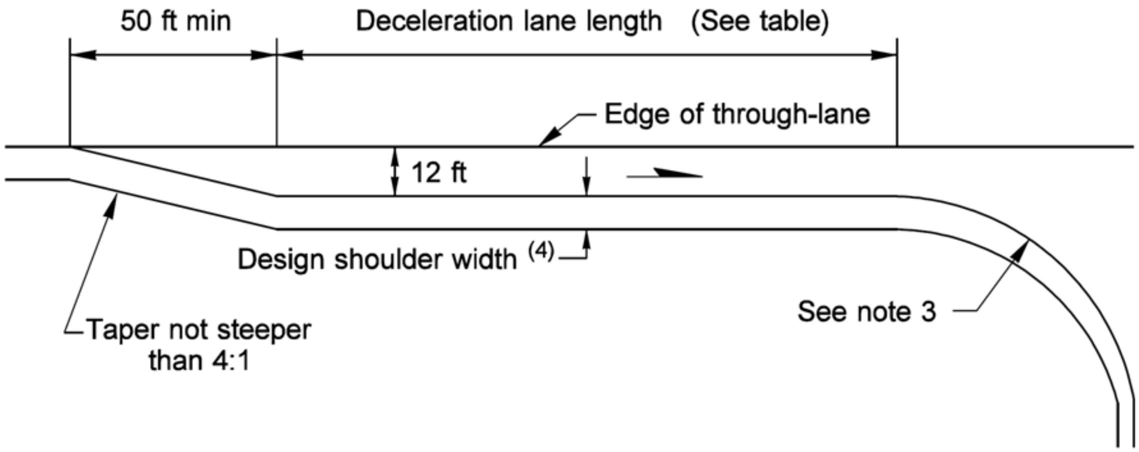
Posted Speed Limit	L
Below 40 mph	40 ft
40 mph or above	100 ft

Notes:

[1] 12 ft desirable.

[2] For right-turn corner design, see Figure 910-11.

Right-Turn Pocket and Right-Turn Taper
Figure 910-16



Highway Design Speed (mph)	Turning Roadway Design Speed (mph)		
	Stop[1]	15	20
30	235	200[2]	170[2]
35	280	250	210
40	320	295	265
45	385	350	325
50	435	405	385
55	480	455	440
60	530	500	480
65	570	540	520
70	615	590	570

Minimum Deceleration Lane Length (ft)

Grade	Upgrade	Downgrade
3% to less than 5%	0.9	1.2
5% or more	0.8	1.35

Adjustment Multiplier for Grades 3% or Greater

Notes:

[1] For use when the turning traffic is likely to stop before completing the turn (for example, where pedestrians are present).

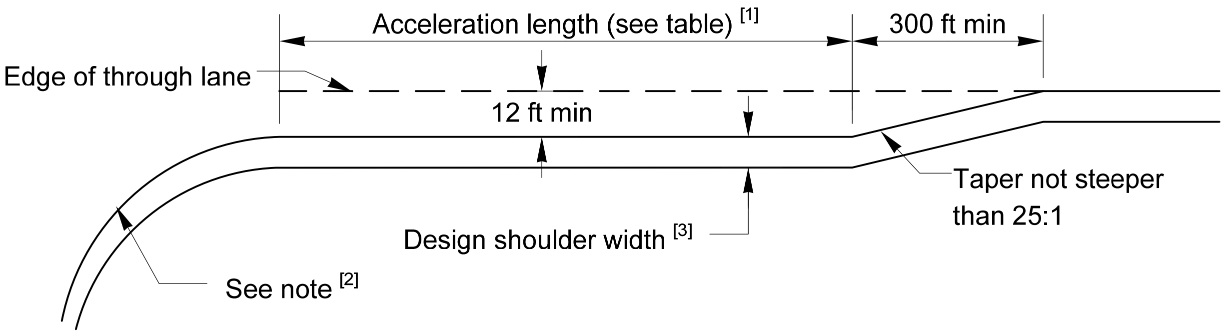
[2] When adjusting for grade, do not reduce the deceleration lane to less than 150 ft.

[3] For right-turn corner design, see Figure 910-11.

[4] May be reduced (see 910.07).

[5] For pavement marking details, see the *Standard Plans* and the MUTCD.

Right-Turn Lane
Figure 910-17



Highway Design Speed (mph)	Turning Roadway Design Speed (mph)		
	Stop	15	20
30	180	140	
35	280	220	160
40	360	300	270
45	560	490	440
50	720	660	610
55	960	900	810
60	1200	1140	1100
65	1410	1350	1310
70	1620	1560	1520

Minimum Acceleration Lane Length (ft)[1]

Highway Design Speed (mph)	% Grade	Upgrade	Downgrade
40	3% to less than 5%	1.3	0.7
50		1.3	0.65
60		1.4	0.6
70		1.5	0.6
40	5% or more	1.5	0.6
50		1.5	0.55
60		1.7	0.5
70		2.0	0.5

Adjustment Multiplier for Grades 3% or Greater

Notes:

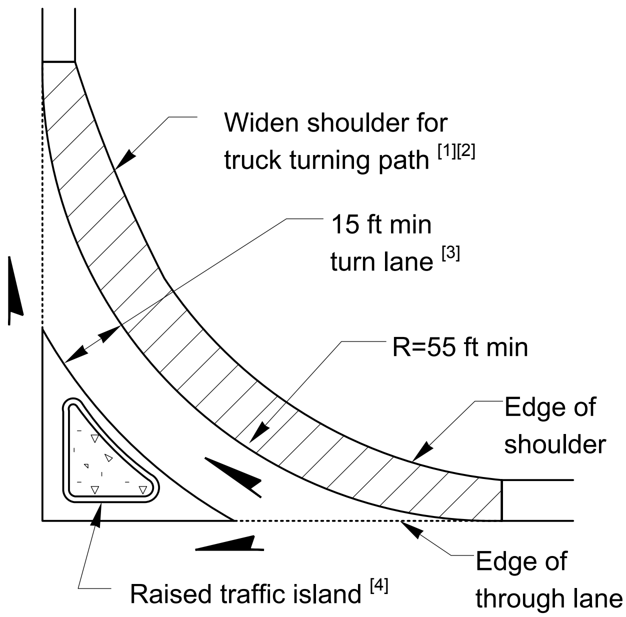
[1] At free-right turns (no stop required) and all left turns, the minimum acceleration lane length is not less than 300 ft.

[2] For right-turn corner design, see Figure 910-11.

[3] May be reduced (see 910.07(6)).

[4] For pavement-marking details, see the *Standard Plans* and the MUTCD.

Acceleration Lane
Figure 910-18



Small Traffic Island Design [5]

Notes:

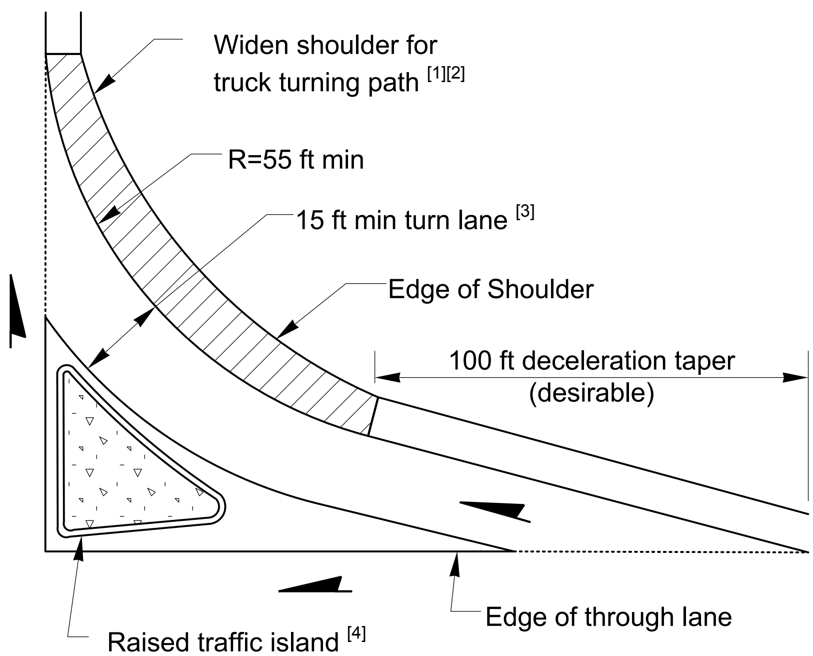
[1] Widen shoulders when adequate right-turn radii or roadway width cannot be provided for large trucks. Design widened shoulder pavement the same depth as the right-turn lane.

[2] Use the truck turning path templates for the design vehicle and a minimum of 2 ft clearance between the wheel paths and the face of curb or edge of shoulder to determine the width of the widened shoulder.

[3] For desirable turning roadway widths, see Chapter 641.

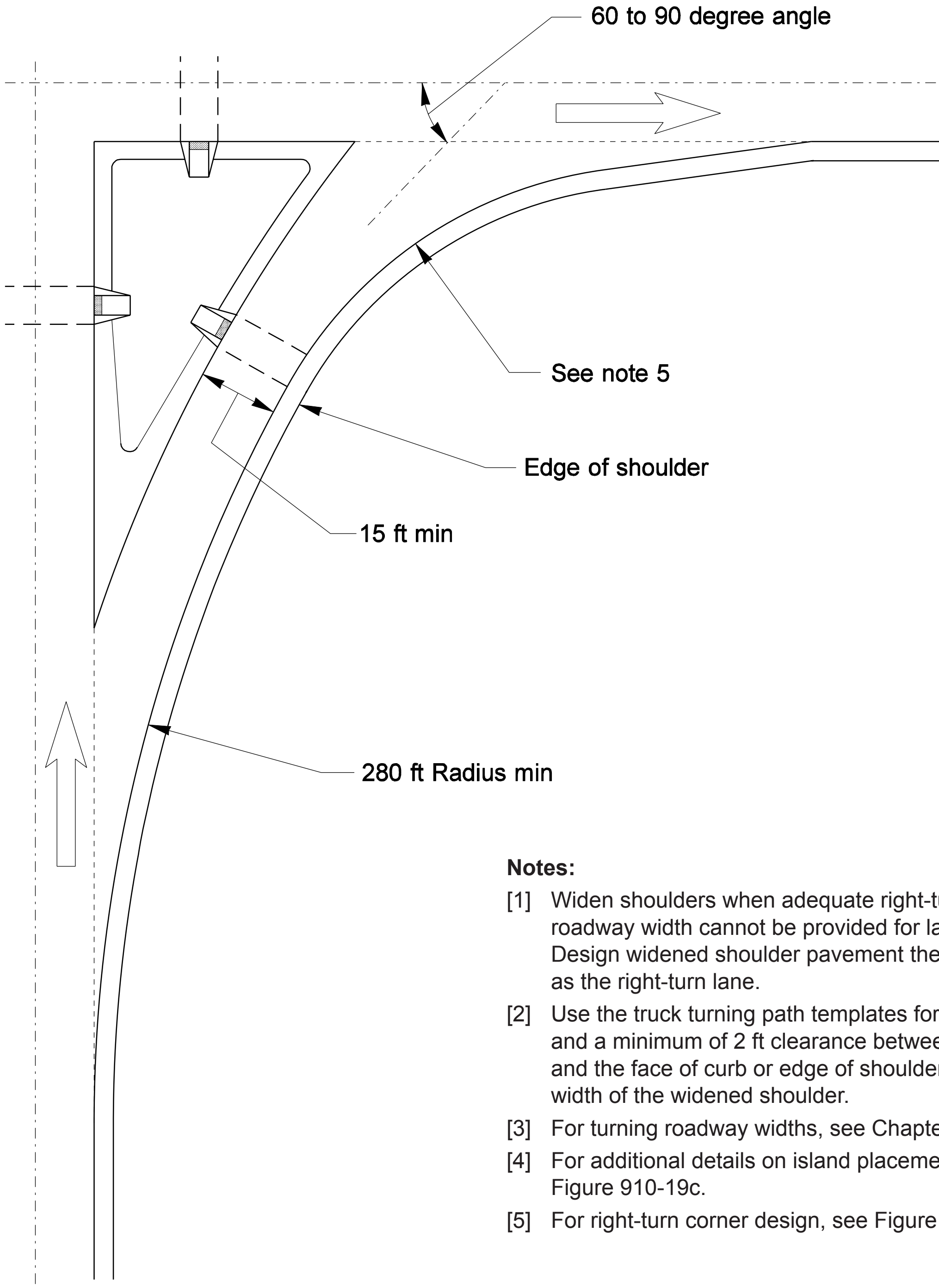
[4] For additional details on island placement, see Figure 910-19c.

[5] Small traffic islands have an area of 100 ft^2 or less; large traffic islands have an area greater than 100 ft^2.



Large Traffic Island Design [5]

Traffic Island Designs
Figure 910-19a



Notes:

[1] Widen shoulders when adequate right-turn radii and roadway width cannot be provided for large trucks. Design widened shoulder pavement the same depth as the right-turn lane.

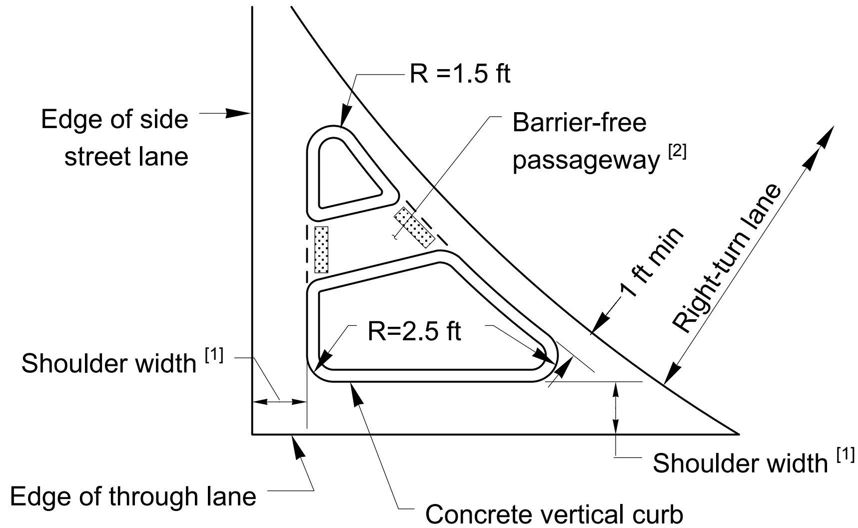
[2] Use the truck turning path templates for the design vehicle and a minimum of 2 ft clearance between the wheel paths and the face of curb or edge of shoulder to determine the width of the widened shoulder.

[3] For turning roadway widths, see Chapter 641.

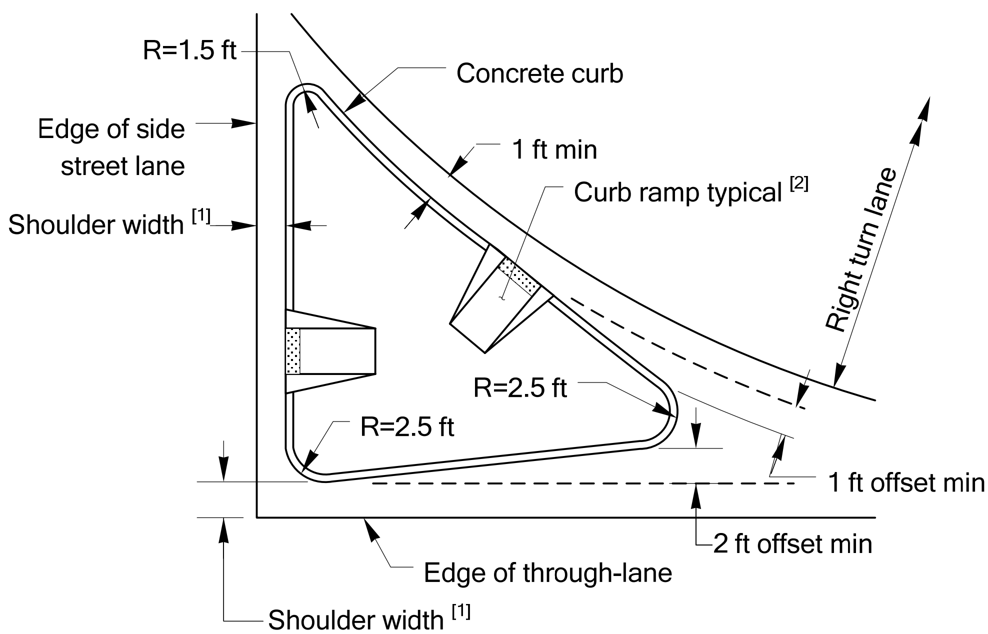
[4] For additional details on island placement, see Figure 910-19c.

[5] For right-turn corner design, see Figure 910-11.

Traffic Island Designs (Compound Curve)
Figure 910-19b



Small Raised Traffic Island [3]



Large Raised Traffic Island

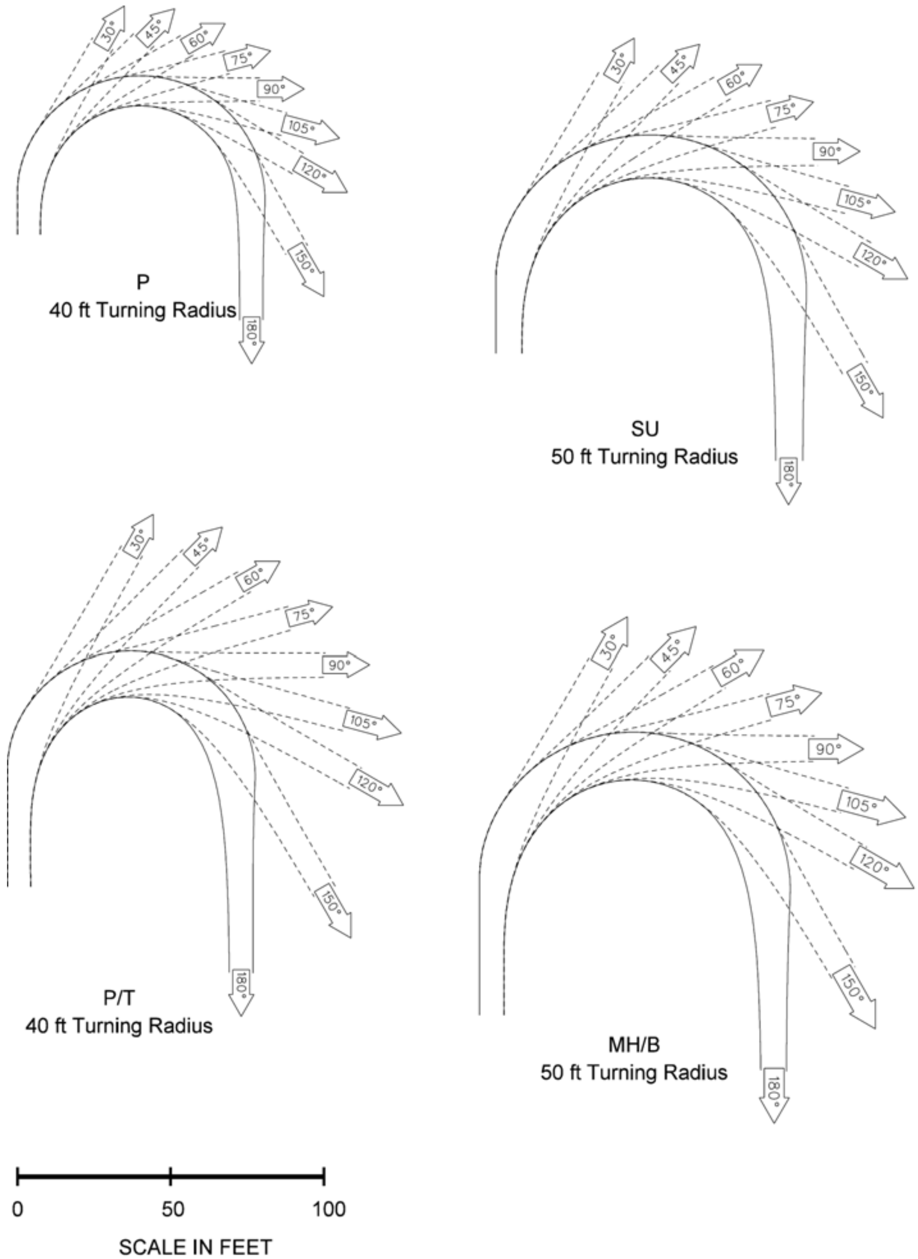
Notes:

[1] For minimum shoulder width <u>at curbs</u>, see Chapter 440. For additional information on shoulders at <u>turn lanes</u>, see 910.07(6).

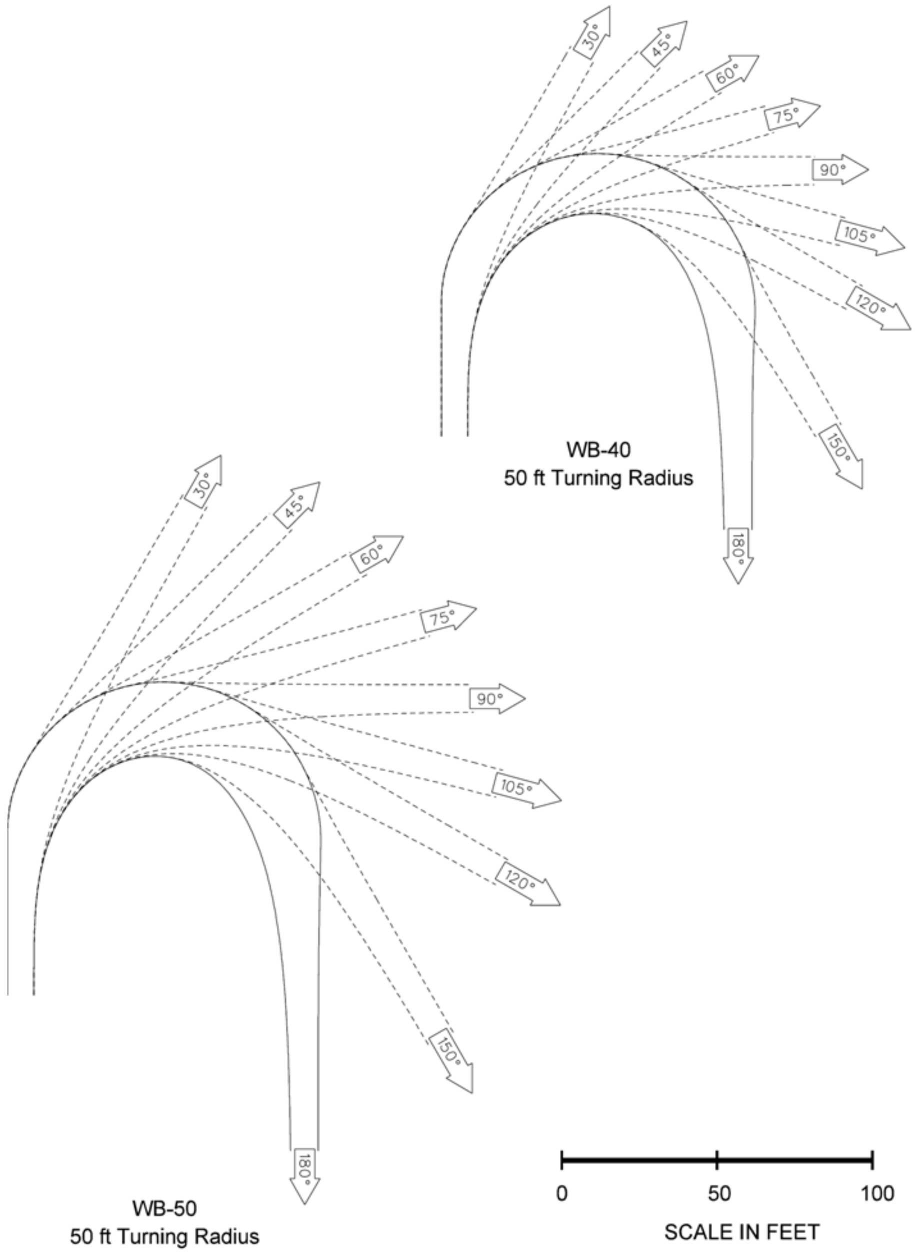
[2] Provide barrier-free passageways or curb ramps when required (see Chapter 1025).

[3] Small traffic islands have an area of 100 ft^2 or less; large traffic islands have an area greater than 100 ft^2.

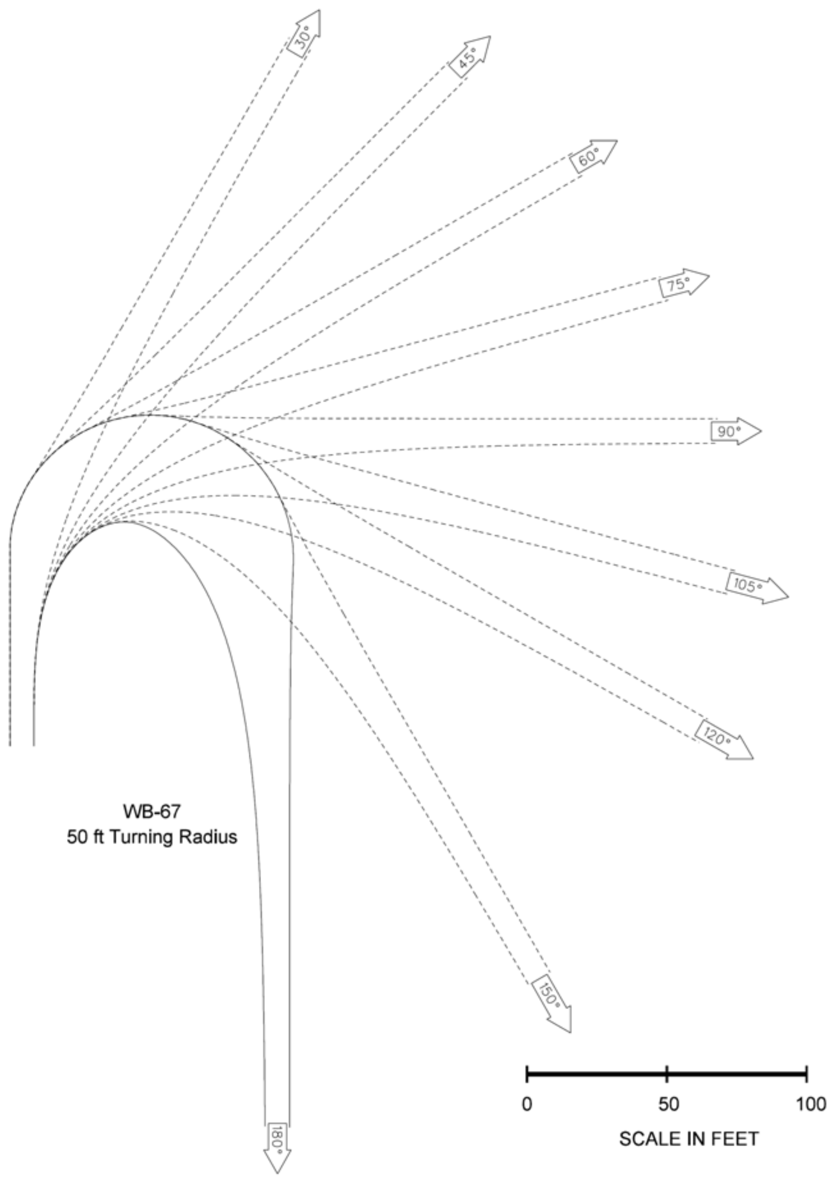
Traffic Island Designs
Figure 910-19c



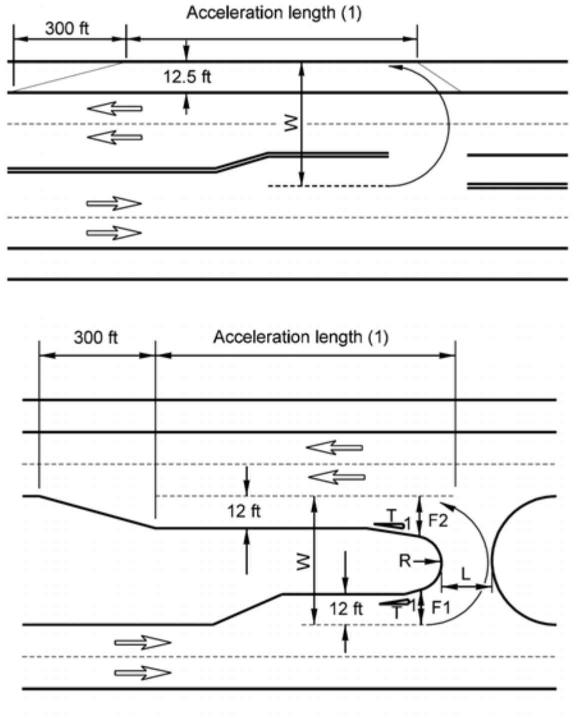
Turning Path Template
Figure 910-20a



Turning Path Template
Figure 910-20b



Turning Path Template
Figure 910-20c



Vehicle	W	R	L	F1	F2	T
P	52	14	14	12	12	—
SU	87	30	20	13	15	10:1
BUS	87	28	23	14	18	10:1
WB-40	84	25	27	15	20	6:1
WB-50	94	26	31	16	25	6:1
WB-67	94	22	49	15	35	6:1
MH	84	27	20	15	16	10:1
P/T	52	11	13	12	18	6:1
MH/B	103	36	22	15	16	10:1

U-Turn Design Dimensions

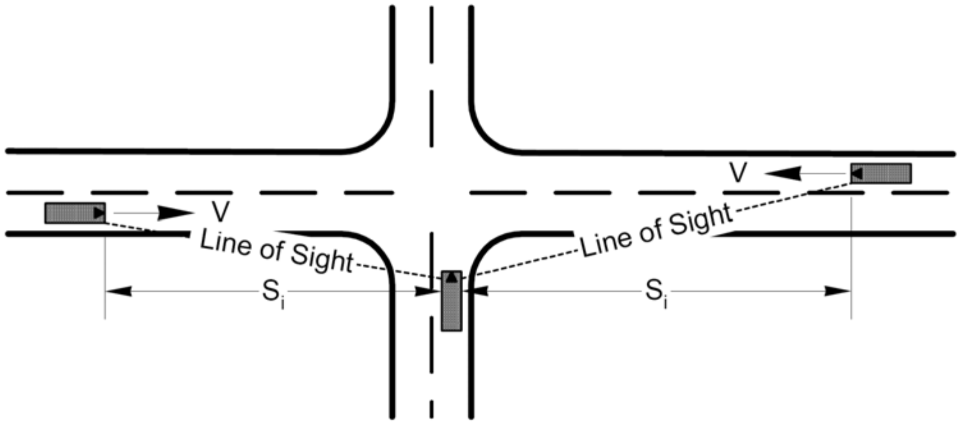
Notes:

[1] The minimum length of the acceleration lane is shown in Figure 910-18. Acceleration lane may be eliminated at signal-controlled intersections.

[1] All dimensions in feet.

[1] When U-turn uses the shoulder, provide 12.5-ft shoulder width and shoulder pavement designed to the same depth as the through lanes for the acceleration length and taper.

U-Turn Median Openings
Figure 910-21



$S_i = 1.47Vtg$		
Where:		
S_i	=	Intersection Sight Distance (ft)
V	=	Design speed of the through roadway (mph)
t_g	=	Time gap for the minor roadway traffic to enter or cross the through roadway (sec)

Intersection Sight Distance Equation
Table 1

Design Vehicle	Time Gap (t_g) in Sec
Passenger car (P)	7.5
Single-unit trucks and buses (SU & BUS)	9.5
Combination trucks (WB-40, WB-50, & WB-67)	11.5
Note: Values are for a stopped vehicle to turn left onto a two-lane two-way roadway with no median and grades 3% or less.	

Intersection Sight Distance Gap Times (t_g)
Table 2

The t_g values listed in Table 2 require the following adjustments:

Crossing or right-turn maneuvers:

All vehicles subtract 1.0 sec

Multilane roadways:

Left turns, for each lane in excess of one, to be crossed and for medians wider than 4 ft:

Passenger cars add 0.5 sec
All trucks and buses add 0.7 sec

Crossing maneuvers, for each lane in excess of two, to be crossed and for medians wider than 4 ft:

Passenger cars add 0.5 sec
All trucks and buses add 0.7 sec

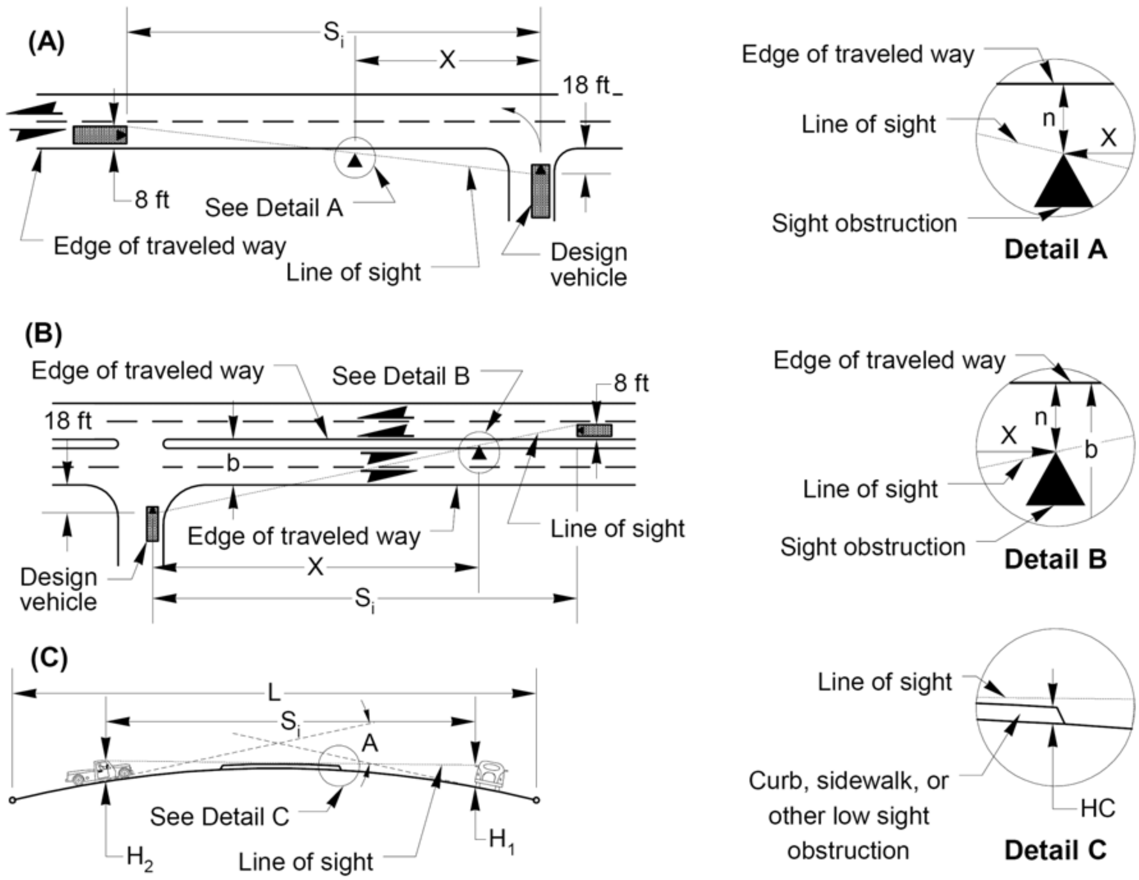
Note: Where medians are wide enough to store the design vehicle, determine the sight distance as two maneuvers.

Crossroad grade greater than 3%:

All movements upgrade, for each percent that exceeds 3%:

All vehicles add 0.2 sec

Sight Distance at Intersections
Figure 910-22a



For sight obstruction driver cannot see over:

$$S_i = \frac{(26+b)(x)}{(18+b-n)}$$

Where:

S_i = Available intersection sight distance (ft)

n = Offset from sight obstruction to edge of lane (ft)

b = Distance from near edge of traveled way to near edge of lane approaching from right (ft) (b=0 for sight distance to the left)

X = Distance from centerline of lane to sight obstruction (ft)

For crest vertical curve over a low sight obstruction where S<L:

$$S = \sqrt{\frac{100L\left[\sqrt{2(H_1 - HC)} + \sqrt{2(H_2 - HC)}\right]^2}{A}}$$

$$L = \frac{AS^2}{100\left[\sqrt{2(H_1 - HC)} + \sqrt{2(H_2 - HC)}\right]^2}$$

Where:

S = Available sight distance (ft)

H_1 = Eye height (3.5 ft for passenger cars; 6 ft for all trucks)

H_2 = Object height (3.5 ft)

HC = Sight obstruction height (ft)

L = Vertical curve length (ft).

A = Algebraic difference in grades (%)

Sight Distance at Intersections

Figure 910-22b

Chapter 915 Roundabouts

915.01 General

Modern roundabouts are circular intersections at grade. They are an effective intersection type with fewer conflict points and lower speeds, and they provide for easier decision making than conventional intersections. They also require less maintenance than traffic signals and have a traffic-calming effect. Well-designed roundabouts have been found to reduce all crashes (especially fatal and severe injury collisions), traffic delays, fuel consumption, and air pollution. For additional information and details on roundabouts, see *Roundabouts: An Informational Guide*.

Selection of a roundabout as the preferred intersection type is based on an engineering analysis that examines traffic volumes and patterns, including space requirements and right of way availability.

Modern roundabouts differ from older circular intersections in three ways: they have splitter islands that provide entry deflection to slow down entering vehicles; they have yield-at-entry, which requires entering vehicles to yield to vehicles in the roundabout to allow free flow of circulating traffic; and they have a smaller diameter that constrains circulating speeds.

915.02 References

Federal/State Laws and Codes

Americans with Disabilities Act of 1990 (ADA)

Revised Code of Washington (RCW) 47.05.021, Functional classification of highways

Washington Administrative Code (WAC) 468-58-080, Guides for control of access on crossroads and interchange ramps

Chapter 468-95 WAC, "Manual on uniform traffic control devices for streets and highways" (MUTCD)
www.wsdot.wa.gov/biz/trafficoperations/mutcd.htm

Design Guidance

ADA Accessibility Guidelines for Buildings and Facilities (ADAAG), U.S. Access Board
www.access-board.gov/adaag/html/adaag.htm

ADA Standards for Accessible Design, U.S. Department of Justice
www.usdoj.gov/crt/ada/adahom1.htm

Local Agency Guidelines (LAG), M 36-63, WSDOT

Manual on Uniform Traffic Control Devices for Streets and Highways, USDOT, FHWA, as adopted and modified by WAC 468-95

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

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

Crash Reductions Following Installation of Roundabouts in the United States, Insurance Institute for Highway Safety, March 2000
www.nysdot.gov/portal/page/portal/main/roundabouts/files/insurance_report.pdf

Guide to Traffic Engineering Practice, Part 6 – Roundabouts (Austroad Guide), Sydney, Australia: Austroad, 1993

Highway Capacity Manual (HCM), Special Report 209, Transportation Research Board, National Research Council

NCHRP Synthesis 264, Modern Roundabout Practice in the United States, Transportation Research Board, 1998 at: onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_264.pdf

Roundabouts: An Informational Guide, FHWA-RD-00-067, USDOT, FHWA www.tfhrc.gov/safety/00068.htm

Roundabout Design Guidelines, Ourston & Doctors, Santa Barbara, California, 1995

The Traffic Capacity of Roundabouts, TRRL Laboratory Report 942, Kimber, R.M., Crowthorne, England: Transport and Road Research Laboratory, 1980

Use of Roundabouts, ITE Technical Council Committee 5B-17, Feb. 1992 www.ite.org/traffic/documents/JBA92A42.pdf

The Design of Roundabouts: State of the Art Review, Brown, Mike, Transportation Research Laboratory, Department of Transport. London, HMSO, 1995

Understanding Flexibility in Transportation Design – Washington, WSDOT, 2005 www.wsdot.wa.gov/eesc/design/Urban/

915.03 Definitions

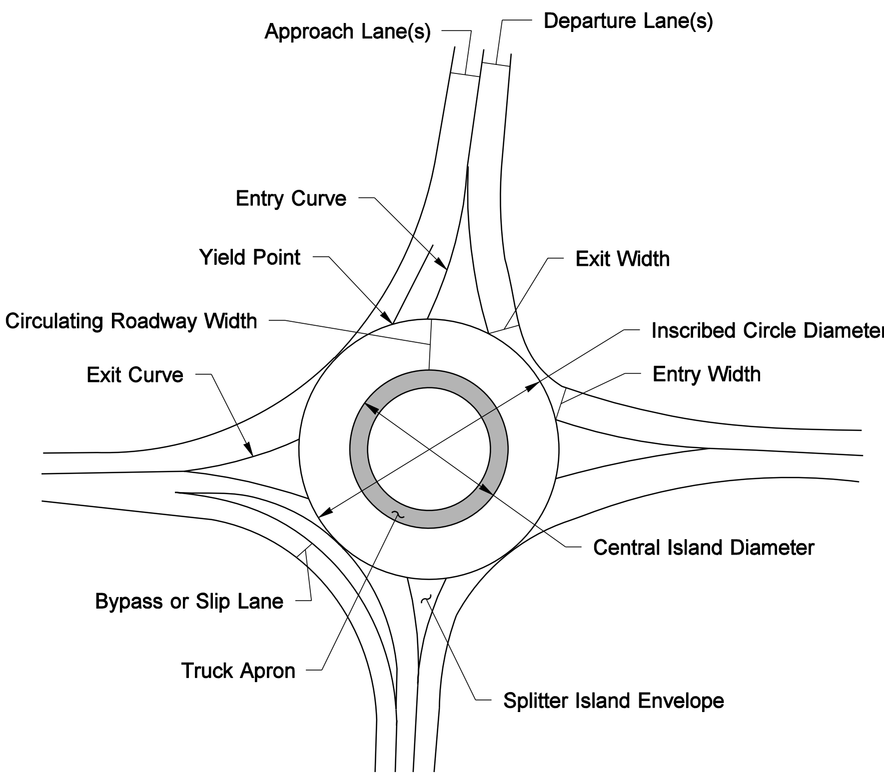
approach design speed The design speed of the roadway leading into the roundabout.

approach lanes The lane or set of lanes for traffic approaching the roundabout (see Figure 915-1).

central island The area of the roundabout including the truck apron that is surrounded by the circulating roadway.

central island diameter The diameter of the central island, including the truck apron (see Figure 915-1).

circulating lane A lane used by vehicles circulating in the roundabout.



Roundabout Elements
Figure 915-1

Chapter 1435 Managed Access

1435.01 General

Access management is the systematic regulation of the location, spacing, design, and operation of driveway, city street, and county road connections to state highways. This chapter describes the access management process for granting permission to connect to managed access highways within cities and unincorporated areas. For an overview of access control, as well as the references list and definitions of terminology for this chapter, see Chapter 1420, "Access Control."

In Washington State, managed access highways include all state highways that are not limited access highways. State highways that are planned for or established as limited access, as listed in the Access Control Tracking System database (www.wsdot.wa.gov/eesc/design/access/), are treated as managed access highways until the limited access rights are acquired.

Access to managed access highways is regulated by the governmental entity with jurisdiction over a highway's roadsides. Access connection permits are issued on managed access highways. WSDOT has access connection permitting authority over all state highways outside incorporated towns and cities. Incorporated towns and cities have access connection permitting authority for city streets that are part of state highways, as specified in RCW 47.24.020. When a project is developed on a state highway, state law requires that existing permitted access connections be evaluated to determine whether they are consistent with all current department spacing, location, and design standards (see 1435.05).

1435.02 References

(1) Federal/State Laws and Codes

See Chapter 1420, "Access Control."

(2) Design Guidance

See Chapter 325, "Design Matrix Procedures."

See Chapter 700, "Roadside Safety."

See Chapter 910, "Intersections At Grade."

See Chapter 920, "Road Approaches."

See Chapter 1420, "Access Control."

1435.03 Definitions

local roads For the purposes of this chapter, local roads are nonstate highways that are publicly owned.

median Used to separate opposing traffic and control access. Restrictive medians limit left turns to defined locations typically through the use of raised medians or barrier (see Chapter 440).

MPO Metropolitan Planning Organization.

RTPO Regional Transportation Planning Organization.

For additional definitions, see Chapter 1420, "Access Control."

1435.04 Design Considerations

Evaluate Access Connections when the Access column on the design matrices (see Chapter 325) indicates Evaluate Upgrade (EU) or Full Design Level (F). Use the Access Control Tracking System database (www.wsdot.wa.gov/eesc/design/access/) to identify the route classification and determine access connection requirements. Review all connections and verify whether they are in the Roadway Access Management Permit System (RAMPS) database. Contact the Region Development Services Office or the Headquarters (HQ) Access and Hearings Unit for permission to access the RAMPS database.

If a nonconforming connection is identified, consider relocating, modifying, or eliminating the connection. It is not the intent of the managed access program that modifications to the connection will change the general functionality of the property.

Where current department standards cannot be met while providing the same general functionality, the connection shall be classified as nonconforming and the appropriate documentation processed as discussed below. This documentation is part of the permit process.

1435.05 Managed Access Highway Classes

The principal objective of the managed access classification system is to maintain the safety and capacity of existing highways. This is accomplished by establishing access management criteria, which is to be adhered to in the planning and regional approval of access connections to the state highway system.

The classification system for state managed access highways consists of five classes. The classes are organized from Class 1, the most restrictive class for higher speeds and volumes, to Class 5, the least restrictive class for lower speeds and volumes. In general, most state highways outside the incorporated limits of a city or town have been designated as Class 1 or Class 2 highways, with only the most urban and lowest-speed state highways within an incorporated town or city designated as Class 5. Figure 1435-2 shows the five classes of highways, with a brief description of each class. WSDOT keeps a record of the assigned managed access classifications, by route and milepost, in the Access Control Tracking System database: www.wsdot.wa.gov/eesc/design/access/

One of the goals of the state law is to restrict or keep access connections to a minimum in order to help preserve the safety, operation, and functional integrity of the state highway. On Class 1 highways mobility is the primary function, while on Class 5 highways access needs have priority over mobility needs. Class 2 highways also favor mobility, while Class 3 and Class 4 highways generally achieve a balance between mobility and access.

The most notable distinction between the five highway classes is the minimum spacing requirements of access connections. Minimum distances between access points on the same side of the highway are shown in Figure 1435-2.

In all five highway classes, access connections are to be located and designed to minimize interference with transit facilities and high occupancy vehicle (HOV) facilities on state highways where such facilities exist or are proposed in state, regional, metropolitan, or local transportation plans. In these cases, if reasonable access is available to the local road/street system, access is to be provided to the local road/street system rather than directly to the state highway. The functional characteristics and the legal requirements for each class are as follows:

(1) Class 1

(a) **Functional Characteristics**. Class 1 highways provide for high-speed and/or high-volume traffic movements for interstate, interregional, and intercity (and some intracity) travel needs. Service to abutting land is subordinate to providing service to major traffic movements.

Highways in Class 1 are typically distinguished by a highly-controlled, limited number of (public and private) access points, restrictive medians with limited median openings on multilane facilities, and infrequent traffic signals.

(b) **Legal Requirements**

1. It is the intent that Class 1 highways be designed to have a posted speed limit of 50 to 65 mph. Spacing of intersecting streets, roads, and highways is planned with a minimum spacing of 1 mile. Spacing of ½ mile may be allowed, but only when no reasonable alternative access exists.
2. Private access connections to the state highway are not allowed, except when the property has no other reasonable access to the local road/street system. When a private access connection must be provided, the following conditions apply:
   - The access connection continues until such time other reasonable access to a highway with a less restrictive access control class or access to the local road/street system becomes available and is allowed.
   - The minimum distance to another access point (public or private) is 1320 feet along the same side of the highway. Nonconforming access connection permits may be issued to provide access connections to parcels whose highway frontage, topography, or location otherwise precludes issuance of a conforming access connection permit; however, variance permits are not allowed.

- No more than one access connection may be provided to an individual parcel or to contiguous parcels under the same ownership.
- All private access connections are for right turns only on multilane facilities, unless special conditions justify the exception and are documented by a traffic analysis in the access connection permit application that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.
- Additional access connections to the state highway are not allowed for newly created parcels resulting from property divisions. All access for these parcels must be provided by an internal road/street network. Access to the state highway will be at existing permitted locations or at revised locations.

3. Restrictive medians are provided on multilane facilities to separate opposing traffic movements and to prevent unauthorized turning movements.

(2) Class 2

(a) **Functional Characteristics**. Class 2 highways provide for medium-to-high-speed and medium-to-high-volume traffic movements over medium and long distances for interregional, intercity, and intracity travel needs. Direct access service to abutting land is subordinate to providing service to traffic movements.

Highways in Class 2 are typically distinguished by existing or planned restrictive medians on multilane facilities and by large minimum distances between (public and private) access points.

(b) **Legal Requirements**

1. It is the intent that Class 2 highways be designed to have a posted speed limit of 35 to 50 mph in urbanized areas and 45 to 55 mph in rural areas. Spacing of intersecting streets, roads, and highways is planned with a minimum spacing of ½ mile. Less than ½-mile intersection spacing may be allowed, but only when no reasonable alternative access exists.

   In urban areas and developing areas where higher volumes are present or growth that will require signalization is expected in the foreseeable future, it is imperative that the location of any public access point be planned carefully to ensure adequate signal progression. The addition of all new access points, public or private, that might require signalization will require an engineering analysis that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

2. Private access connections to the state highway system are allowed only when the property has no other reasonable access to the local road/street system or when access to the local road/street system will cause unacceptable traffic operational conditions or safety concerns on that system. When a private access connection must be provided, the following conditions apply:
   - The access connection continues until such time other reasonable access to a highway with a less restrictive access control class or acceptable access to the local road/street system becomes available and is allowed.

- The minimum distance to another (public or private) access point is 660 feet on the same side of the highway. Nonconforming access connection permits may be issued to provide access to parcels whose highway frontage, topography, or location precludes issuance of a conforming access connection permit.
- Only one access connection is allowed for an individual parcel or to contiguous parcels under the same ownership, unless the highway frontage exceeds 1320 feet and it can be shown that the additional access connection will not adversely affect the desired function of the state highway in accordance with the assigned managed access Class 2 or the safety or operation of the state highway.
- Variance permits may be allowed if there are special conditions and the exception can be justified to the satisfaction of the department by a traffic analysis in the access connection permit application that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.
- All private access connections are for right turns only on multilane facilities, unless there are special conditions and the exception can be justified to the satisfaction of the department by a traffic analysis in the access connection permit application that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43, and only if left-turn channelization is provided.
- Additional access connections to the state highway are not allowed for newly created parcels that result from property divisions. All access for these parcels must be provided by an internal road/street network. Access to the state highway will be at existing permitted locations or at revised locations.

3. On multilane facilities, restrictive medians are provided to separate opposing traffic movements and to prevent unauthorized turning movements. However, a nonrestrictive median or a two-way left-turn lane may be used when special conditions exist and main line volumes are below 20,000 average daily traffic (ADT).

(3) Class 3

(a) **Functional Characteristics**. Class 3 highways provide for moderate travel speeds and moderate traffic volumes for medium and short travel distances for intercity, intracity, and intercommunity travel needs. There is a reasonable balance between access and mobility needs for highways in this class. This class is to be used primarily where the existing level of development of the adjoining land is less intensive than maximum buildout and where the probability of significant land use change and increased traffic demand is high.

Highways in Class 3 are typically distinguished by planned restrictive medians on multilane facilities and by meeting minimum distances between (public and private) access points. Two-way left-turn lanes may be used where special conditions justify them and main line traffic volumes are below 25,000 ADT. Development of properties with internal road/street networks and joint access connections are encouraged.

(b) **Legal Requirements**

1. It is the intent that Class 3 highways be designed to have a posted speed limit of 30 to 40 mph in urbanized areas and 45 to 55 mph in rural areas. In rural areas, spacing of intersecting streets, roads, and highways is planned with a minimum spacing of ½ mile. Less than ½-mile intersection spacing may be allowed, but only when no reasonable alternative access exists.

   In urban areas and developing areas where higher volumes are present or growth that will require signalization is expected in the foreseeable future, it is imperative that the location of any public access point be planned carefully to ensure adequate signal progression. Where feasible, major intersecting roadways that might ultimately require signalization are planned with a minimum of ½-mile spacing. The addition of all new access points, public or private, that may require signalization will require an engineering analysis that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

2. Private Access Connections
   - No more than one access connection may be provided to an individual parcel or to contiguous parcels under the same ownership, unless it can be shown that additional access connections will not adversely affect the desired function of the state highway in accordance with the assigned managed access Class 3 and will not adversely affect the safety or operation of the state highway.
   - The minimum distance to another (public or private) access point is 330 feet on the same side of the highway. Nonconforming access connection permits may be issued to provide access to parcels whose highway frontage, topography, or location precludes issuance of a conforming access connection permit.
   - Variance permits may be allowed if there are special conditions and the exception can be justified to the satisfaction of the department by a traffic analysis in the access connection permit application that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

(4) Class 4

(a) **Functional Characteristics**. Class 4 highways provide for moderate travel speeds and moderate traffic volumes for medium and short travel distances for intercity, intracity, and intercommunity travel needs. There is a reasonable balance between direct access and mobility needs for highways in this class. This class is to be used primarily where the existing level of development of the adjoining land is more intensive and where the probability of major land use changes is less than on Class 3 highway segments.

Highways in Class 4 are typically distinguished by existing or planned nonrestrictive medians. Restrictive medians may be used to mitigate unfavorable operational conditions such as turning, weaving, and crossing conflicts. Minimum access connection spacing requirements apply if adjoining properties are redeveloped.

(b) **Legal Requirements**

1. It is the intent that Class 4 highways be designed to have a posted speed limit of 30 to 35 mph in urbanized areas and 35 to 45 mph in rural areas. In rural areas, spacing of intersecting streets, roads, and highways is planned with a minimum spacing of ½ mile. Less than ½-mile intersection spacing may be allowed, but only when no reasonable alternative access exists.

   In urban areas and developing areas where higher volumes are present or growth that will require signalization is expected in the foreseeable future, it is imperative that the location of any public access point be planned carefully to ensure adequate signal progression. Where feasible, major intersecting roadways that might ultimately require signalization are planned with a minimum of ½-mile spacing. The addition of all new access points, public or private, that may require signalization will require an engineering analysis that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

2. Private Access Connections:
   - No more than one access connection may be provided to an individual parcel or to contiguous parcels under the same ownership, unless it can be shown that additional access connections will not adversely affect the desired function of the state highway in accordance with the assigned managed access Class 4 and will not adversely affect the safety or operation of the state highway.
   - The minimum distance to another (public or private) access point is 250 feet on the same side of the highway. Nonconforming access connection permits may be issued to provide access connections to parcels whose highway frontage, topography, or location precludes issuance of a conforming access connection permit.
   - Variance permits may be allowed if there are special conditions and the exception can be justified to the satisfaction of the department by a traffic analysis in the access connection permit application that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

(5) Class 5

(a) **Functional Characteristics**. Class 5 highways provide for moderate travel speeds and moderate traffic volumes for primarily short travel distances for intracity and intracommunity trips and for access to state highways of a higher class. Access needs generally may be higher than the need for through-traffic mobility without compromising the public health, welfare, or safety. These highways will normally have nonrestrictive medians.

(b) **Legal Requirements**

1. It is the intent that Class 5 highways be designed to have a posted speed limit of 25 to 35 mph. In rural areas, spacing of intersecting streets, roads, and highways is planned with a minimum spacing of ¼ mile. Less than ¼-mile spacing may be allowed where no reasonable alternative exists. In urban areas and developing areas where higher volumes are present or growth

that will require signalization is expected in the foreseeable future, it is imperative that the location of any public access point be planned carefully to ensure adequate signal progression. Where feasible, major intersecting roadways that might ultimately require signalization are planned with a minimum of ¼-mile spacing. The addition of all new access points, public or private, that might require signalization will require an engineering analysis that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

2. Private Access Connections
   - No more than one access connection may be provided to an individual parcel or to contiguous parcels under the same ownership, unless it can be shown that additional access connections will not adversely affect the desired function of the state highway in accordance with the assigned managed access Class 5 and will not adversely affect the safety or operation of the state highway.
   - The minimum distance to another (public or private) access point is 125 feet on the same side of the highway. Nonconforming access connection permits may be issued to provide access to parcels whose highway frontage, topography, or location precludes issuance of a conforming access connection permit.
   - Variance permits may be allowed if there are special conditions and the exception can be justified to the satisfaction of the department by a traffic analysis in the access connection permit application that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

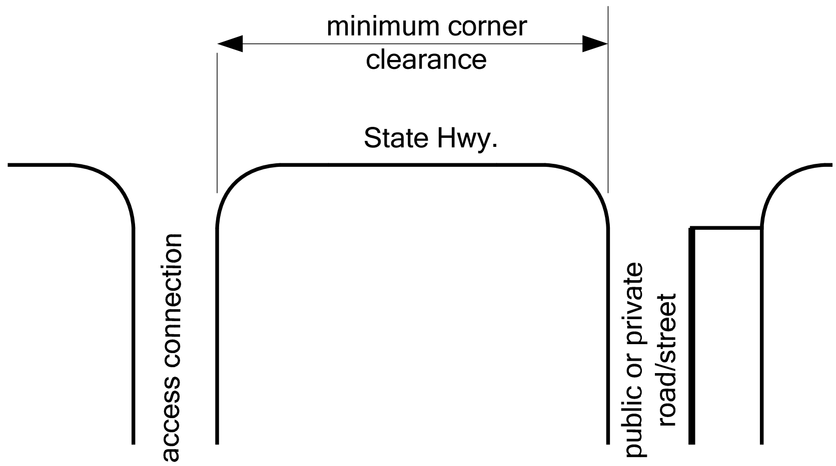
(6) Changes in Managed Access Classification

WSDOT, RTPOs, MPOs, or other entities such as a city, town, or county may initiate a review of managed access classifications per the process identified by WAC 468-52. In all cases, WSDOT shall consult with the RTPOs, MPOs, and local agencies and take into consideration comments received during the review process. For city streets that are designated as state highways, the department will obtain concurrence in the final classification assignment from the city or town.

The modified highway classification list shall be submitted to Headquarters for approval by the State Design Engineer (SDE) or designee. WSDOT Regions shall notify the RTPOs, MPOs, and local governmental entities in writing of the final determination of the reclassification.

1435.06 Corner Clearance Criteria

In addition to the five access control classes, there are also corner clearance criteria that must be used for access connections near intersections (see Figure 1435-1).



WITH RESTRICTIVE MEDIAN		
Position	**Access Allowed**	**Minimum (ft)**
Approaching Intersection	Right In/Right Out	115
Approaching Intersection	Right In Only	75
Departing Intersection	Right In/Right Out	230*
Departing Intersection	Right Out Only	100
WITHOUT RESTRICTIVE MEDIAN		
Position	**Access Allowed**	**Minimum (ft)**
Approaching Intersection	Full Access**	230*
Approaching Intersection	Right In Only	100
Departing Intersection	Full Access	230*
Departing Intersection	Right Out Only	100

* 125 ft may be used for Class 5 facilities with a posted speed of 35 mph or less.
** Full Access = All four movements (Right in/out; Left in/out)

Minimum Corner Clearance:
Distance From Access Connection to Public Road or Street
Figure 1435-1

Corner clearance spacing must meet or exceed the minimum access point spacing requirements of the applicable managed access highway class. A single access connection may be placed closer to the intersection, in compliance with the permit application process specified in WAC 468-51 and in accordance with the following criteria:

(a) The minimum corner clearance criteria in Figure 1435-1 may be used where access point spacing cannot be obtained due to property size and where a joint use access connection cannot be secured or where it is determined by WSDOT not to be feasible because of conflicting land use or conflicting traffic volumes or operational characteristics.

(b) Some local agencies have adopted corner clearance as a design element in their design standards (these standards are to meet or exceed WSDOT standards). Coordinate with the local agency regarding corner clearance of an access connection on or near an intersecting local road or street.

(c) When a joint-use access connection or an alternate road/street system access (meeting or exceeding the minimum corner clearance requirements) becomes available, the permit holder must close the permitted access connection, unless the permit holder shows to WSDOT's satisfaction that such closure is not feasible.

1435.07 Access Connection Categories

Whenever an access connection permit is issued on a managed access state highway, the permit must also specify one of four access connection categories: Category I to Category IV. Categories I through III are based on the maximum vehicular usage of the access connection. Category IV specifies temporary use, usually for less than a year. Access connection permits must specify the category and the maximum vehicular usage of the access connection in the permit.

All access connections are determined by WSDOT to be in one of the following categories (per WAC 468-51-040).

(1) Category I

"Category I – minimum connection" provides connection to the state highway system for up to ten single-family residences, a duplex, or a small multifamily complex of up to ten dwelling units that use a common access connection. The category also applies to permanent access connections to agricultural and forestlands, including field entrances; access connections for the operation, maintenance, and repair of utilities; and access connections serving other low-volume traffic generators expected to have average weekday vehicle trip ends (AWDVTE) of 100 or less.

(2) Category II

"Category II – minor connection" provides connection to the state highway system for medium-volume traffic generators expected to have an AWDVTE of 1500 or less, but not included in Category I.

(3) Category III

"Category III – major connection" provides connection to the state highway system for high-volume traffic generators expected to have an AWDVTE exceeding 1500.

(4) Category IV

"Category IV – temporary connection" provides a temporary, time-limited connection to the state highway system for a specific property for a specific use with a specific traffic volume. Such uses include, but are not limited to, logging, forestland clearing, temporary agricultural uses, temporary construction, and temporary emergency access. The department reserves the right to remove any temporary access connection at its sole discretion and at the expense of the property owner after the expiration of the permit. Further, a temporary access connection permit does not bind the department, in any way, to the future issuance of a permanent access connection permit at the temporary access connection location.

1435.08 Access Connection Permit

RCW 47.50 requires all access connections to be permitted. This can be accomplished by the permitting process (see 1435.09) or by the connection being "grandfathered" (in place prior to July 1, 1990).

All new access connections to state highways, as well as alterations and improvements to existing access connections, require an access connection permit. Every owner of property that abuts a managed access state highway has the right to reasonable access, but not a particular means of access. This right may be restricted with respect to the highway if reasonable access can be provided by way of another local road/street.

When a new private road or street is to be constructed, approval by the permitting authority is required for intersection design, spacing, and construction work on the right of way. However, if an access connection permit is issued, it will be rendered null and void if and when the road or street is duly established as a local road or street by the local governmental entity.

It is the responsibility of the applicant or permit holder to obtain all necessary local, state, and federal approvals and permits (which includes all environmental permits and documentation). The access connection permit only allows the applicant permission to connect to the state highway. It is also the responsibility of the applicant to acquire any and all property rights necessary to provide continuity from the applicant's property to the state highway.

The alteration or closure of any existing access connection caused by changes to the character, intensity of development, or use of the property served by the access connection or the construction of any new access connection must not begin before an access connection permit is obtained.

If a property owner or permit holder who has a valid access connection permit wishes to change the character, use, or intensity of the property or development served by the access connection, the permitting authority must be contacted to determine whether an upgraded access connection permit will be required.

The applicant must obtain design approval as shown in Chapter 330, Figures 330-2a and 2b.

1435.09 Permitting and Design Documentation

An access connection permit is obtained from the department by submitting the appropriate application form, including the fee, plans, traffic data, and access connection information, to the department for review. All access connection and roadway design documents for Category II and III permits must bear the seal and signature of a professional engineer registered in Washington State.

The permitting process begins with the application. Upon submittal of the application with all the attached requirements, it is reviewed and either denied or accepted. If denied, the department must notify the applicant in writing stating the reasons, and the applicant will have thirty (30) days to submit a revised application. Once the application is approved and the permit is issued, the applicant may begin construction.

The Access Manager in each Region keeps a record of all access points, including those that are permitted and those that are grandfathered (see 1435.10). A permit for a grandfathered access point is not required but may be issued for record-keeping reasons.

(1) Conforming Access Connection Permit

Conforming access connection permits may be issued for access connections that conform to the functional characteristics and all legal requirements for the designated class of the highway.

(2) Nonconforming Access Connection Permit

Nonconforming access connection permits may be issued for short-term access connections pending the availability of a future joint-use access connection or local road/street system access:

- For location and spacing not meeting requirements.
- For Category I through IV permits.
- After an analysis and determination by the department that a conforming access connection cannot be made at the time of permit application submittal.
- After a finding that the denial of an access connection will leave the property without a reasonable means of access to the local road/street system.

In such instances, the permit is to be noted as being a nonconforming access connection permit and may contain the following specific restrictions and provisions:

- Limits on the maximum vehicular use of the access connection
- The future availability of alternate means of reasonable access for which a conforming access connection permit can be obtained
- The removal of the nonconforming access connection at the time the conforming access is available
- The properties to be served by the access connection
- Other conditions as necessary to carry out the provisions of RCW 47.50

(3) Variance Access Connection Permit

Variance access connection is a special nonconforming or additional access connection permit issued for long-term use where future local road/street system access is not foreseeable:

- For location and spacing not meeting requirements or for an access connection that exceeds the number allowed for the class.
- After an engineering study demonstrates, to the satisfaction of the department, that the access connection will not adversely affect the safety, maintenance, or operation of the highway in accordance with its assigned managed access class.

In such instances, the permit is to be noted as being a variance access connection permit and may contain the following specific restrictions and provisions:

- Limits on the maximum vehicular use of the access connection
- The properties to be served by the access connection
- Other conditions as necessary to carry out the provisions of RCW 47.50

This permit will remain valid until modified or revoked by the permitting authority, unless an upgraded permit is required due to changes in property site use (see 1435.09(1)).

A variance access connection permit must not be issued for an access connection that does not conform to minimum corner clearance requirements (see 1435.06).

(4) Design Exceptions and Deviations

(a) **Outside Incorporated City Limits**. A deviation request will be required for nonconforming access connections if corner clearance criteria are not met. If a deviation is needed, the HQ Design Office is to be involved early in the process.

A Design Exception (DE) may be allowed for a single-family residence if the corner clearance criteria are not met. Such an access will be outside the corner radius and as close as feasible to the property line farthest away from the intersection. If two or more residences are served by the same driveway not meeting the corner clearance criteria, then a deviation request will be required.

For WSDOT projects, a short memo is retained in the Design Documentation Package (DDP) stating that the approved nonconforming permit satisfies the requirement of the DE. The DE is recorded in the Design Variance Inventory System (DVIS). Any deviations will be included in the DDP as well.

For non-WSDOT projects, the Region Development Services Office or Local Programs Office is responsible for entering DEs into the DVIS.

(b) **Within Incorporated Cities**. In accordance with RCW 35.78.030 and RCW 47.50, incorporated cities and towns have jurisdiction over access permitting on streets designated as state highways. Accesses located within incorporated cities and towns are regulated by the city or town and no deviation by WSDOT will be required. Document decisions made on these accesses in the DDP.

1435.10 Other Considerations

(1) Changes in Property Site Use With Permitted Access Connection

The access connection permit is issued to the permit holder for a particular type of land use generating specific projected traffic volumes at the final stage of proposed development. Any changes made in the use, intensity of development, type of traffic, or traffic flow require the permit holder, an assignee, or the property owner to contact the department to determine whether further analysis is needed because the change is significant and will require a new permit and modifications to the access connection (WAC 468-51-110).

A significant change is one that will cause a change in the category of the access connection permit or one that causes an operational, safety, or maintenance problem on the state highway system based on objective engineering criteria or available accident data. Such data will be provided to the property owner and/or permit holder and tenant upon written request (WAC 468-51-110).

(2) Existing Access Connections

(a) **Closure of Grandfathered Access Connections**. Any access connections that were in existence and in active use on July 1, 1990, are grandfathered.

The grandfathered access connection may continue unless:

- There are changes from the 1990 AWDVTE.
- There are changes from the 1990 established use.
- The department determines that the access connection does not provide minimum acceptable levels of highway safety and mobility based on accident and/or traffic data or accepted traffic engineering criteria; a copy of which must be provided to the property owner, permit holder, and/or tenant upon written request (WAC 468-51-130).

(b) **Department Construction Projects**

1. Notification

   The department must notify affected property owners, permit holders, business owners, and emergency services in writing, where appropriate, whenever the department's work program requires the modification, relocation, or replacement of their access connections. In addition to written notification, the department will facilitate, where appropriate, a process that may include, but is not limited to, public notices, meetings, or hearings, as well as individual meetings.

2. Modifications – Considerations

   When the number, location, or design of existing access connections to the state highway is being modified by a department construction project, the resulting modified access connections must provide the same general functionality for the existing property use as they did before the modification, taking into consideration the existing site design, normal vehicle types, and traffic circulation requirements. These are evaluated on an individual basis. It is important to remember that the intent is not to damage the property owner by removing nonconforming access connections, but to eliminate access connections that are both nonconforming and not needed.

   The permitting authority evaluates each property individually to make a determination about which category of access connection and which design template (see Chapter 920) will be reasonable. If it is a commercial parcel, determine whether the business can function with one access connection. Each parcel, or contiguous parcels under the same ownership being used for the same purpose, is only allowed one access connection. If the business cannot function properly with only one access connection, a variance permit may be issued for additional access connections. If the property is residential, only one access connection is allowed; however, certain circumstances might require an additional access connection (see 1435.09(4)).

3. Costs – Replacement of or Modifications to Existing Access Connections

   The costs of modifying or replacing the access points are borne by the department if the department construction project caused the replacement or modification. Modification of the connection may require a change to the existing permit.

(3) Work by Permit Holder's Contractor

The department requires that work done by the owner's contractor be accomplished at the completion of the department's contract or be scheduled so as not to interfere with the department's contractor. The department may require a surety bond prior to construction of the access connection in accordance with WAC 468-51-070.

1435.11 Preconstruction Conference

All new access connections, including alterations and improvements to existing access connections to the highway, require an access connection permit. The permitting authority may require a preconstruction conference prior to any work being performed on the access. The preconstruction conference must be attended by those necessary to ensure compliance with the terms and provisions of the permit. Details regarding the individual access connections will be included in the construction permit. This may include access connection widths, drainage requirements, surfacing requirements, mailbox locations, and other information (WAC 468-51-090).

1435.12 Adjudicative Proceedings

As listed below, any person who has standing to challenge any of the following departmental actions may request an adjudicative proceeding (an appeal to an Administrative Law Judge) within thirty (30) days of the department's written decision (WAC 468-51-150).

- Denial of an access connection permit application pursuant to WAC 468-51-080
- Permit conditions pursuant to WAC 468-51-150
- Permit modifications pursuant to WAC 468-51-120
- Permit revocation pursuant to WAC 468-51-120
- Closure of permitted access connection pursuant to WAC 468-51-120
- Closure of grandfathered access connection pursuant to WAC 468-51-130

An appeal of a decision by the department can only be requested if the administrative fee has been paid. If the fee has not been paid, the permit application is considered incomplete and an adjudicative proceeding cannot be requested.

Following is a brief summary of the adjudicative proceeding process. For the purpose of this summary, the responsibilities of the department are separated into those actions required of the Region and those actions required of Headquarters. The summary is written as if the appealable condition was a denial of an access connection request.

1. The Region receives an access connection permit application, with fee.
2. The Region processes the application and makes a determination that the access connection request will be denied.
3. The Region sends the applicant a written letter denying the access connection. Included in this letter is notification that the applicant has thirty (30) days to request an adjudicative proceeding if the applicant disagrees with the Region's denial decision. The Region must notify affected property owners, permit holders, business owners, tenants, lessees, and emergency services, as appropriate.

4. The applicant requests, within thirty (30) days, an adjudicative proceeding.
5. The Region reviews its initial denial decision and determines whether there is any additional information presented that justifies reversing the original decision.
6. If the Region determines that the original denial decision will stand, the Region then forwards copies of all applicable permit documentation to the Access and Hearings Manager (AHM) at Headquarters for review and processing.
7. The AHM reviews the permit application and sends the permit documentation and appeal request to the Office of the Attorney General (AG).
8. If the initial findings of the AG agree with the Region's denial decision, the AG's Office sends the applicant a written letter, with the AG's signature, informing the applicant that a hearing will be scheduled for the applicant to appeal in person the department's decision to deny access.
9. The Region reserves a location and obtains a court reporter, and Headquarters obtains an Administrative Law Judge (ALJ) to conduct the proceeding. The AG, by written letter, notifies the applicant of the time and place for the hearing. The AG's Office has ninety (90) days from receipt of the applicant's appeal to approve or deny the appeal application, schedule a hearing, or decide not to conduct a hearing. The actual hearing date can be set beyond this ninety-day (90-day) review period.
10. The AG's Office leads the department's presentation and works with the Region regarding who will testify and what displays and other information will be presented to the ALJ. The AHM will typically not attend these proceedings.
11. After hearing all the facts, the ALJ issues a decision, usually within a few weeks after the proceedings. However, the ALJ has ninety (90) days in which to serve a written Initial Order stating the decision.
12. The ALJ's decision is final unless the applicant, or the department through the AHM, decides to appeal the ALJ's decision to the State Design Engineer. This second appeal must occur within twenty (20) days of the ALJ's written decision.
13. If appealed to the State Design Engineer, the State Design Engineer has ninety (90) days to review the Initial Order and all the facts and supporting documentation and issue a Final Order. The review by the State Design Engineer does not require the applicable parties to be present and may involve only a review of the material submitted at the adjudicative proceeding.
14. The State Design Engineer's decision is final unless appealed within thirty (30) days to the Washington State Superior Court.

The above represents a general timeline if all appeals are pursued. Based on the noted timelines, it can take nearly a year before a Final Order is issued. If appealed to Superior Court, up to an additional 18 months can be added to the process. In any case, contact the Region Development Services Engineer for further guidance and direction if an appeal might be forthcoming.

1435.13 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

Class	Nonconforming[1]	Variance[2]	Conforming[3]	Access Point Spacing**	Limitations[4]
Class 1 Mobility is the primary function	Yes*	No	No	1320 ft	• One access only to contiguous parcels under same ownership • Private access connection is not allowed unless no other reasonable access exists (must use local road/street system if possible)
Class 2 Mobility is favored over access	Yes*	Yes*	No	660 ft	• One access connection only to contiguous parcels under same ownership unless frontage > 1320 ft • Private access connection not allowed unless no other reasonable access exists (must use local road/street system if possible)
Class 3 Balance between mobility and access in areas with less than maximum buildout	Yes	Yes	Yes	330 ft	• One access connection only to contiguous parcels under same ownership • Joint access connection for subdivisions preferred; private connection allowed, with justification
Class 4 Balance between mobility and access in areas with less than maximum buildout	Yes	Yes	Yes	250 ft	One access connection only to contiguous parcels under same ownership, except with justification
Class 5 Access needs may have priority over mobility	Yes	Yes	Yes	125 ft	More than one access connection per ownership, with justification

Notes:

* The access connection continues only until such time other reasonable access to a highway with a less restrictive class or acceptable access to the local road/street system becomes available and is allowed.

** Minimum, on the same side of the highway.

[1] See 1435.09(2).

[2] See 1435.09(3).

[3] See 1435.09(1).

[4] Unless grandfathered (see 1435.08).

Managed Access Highway Class Description

Figure 1435-2

A

B

C

D

G

H

N

O

P

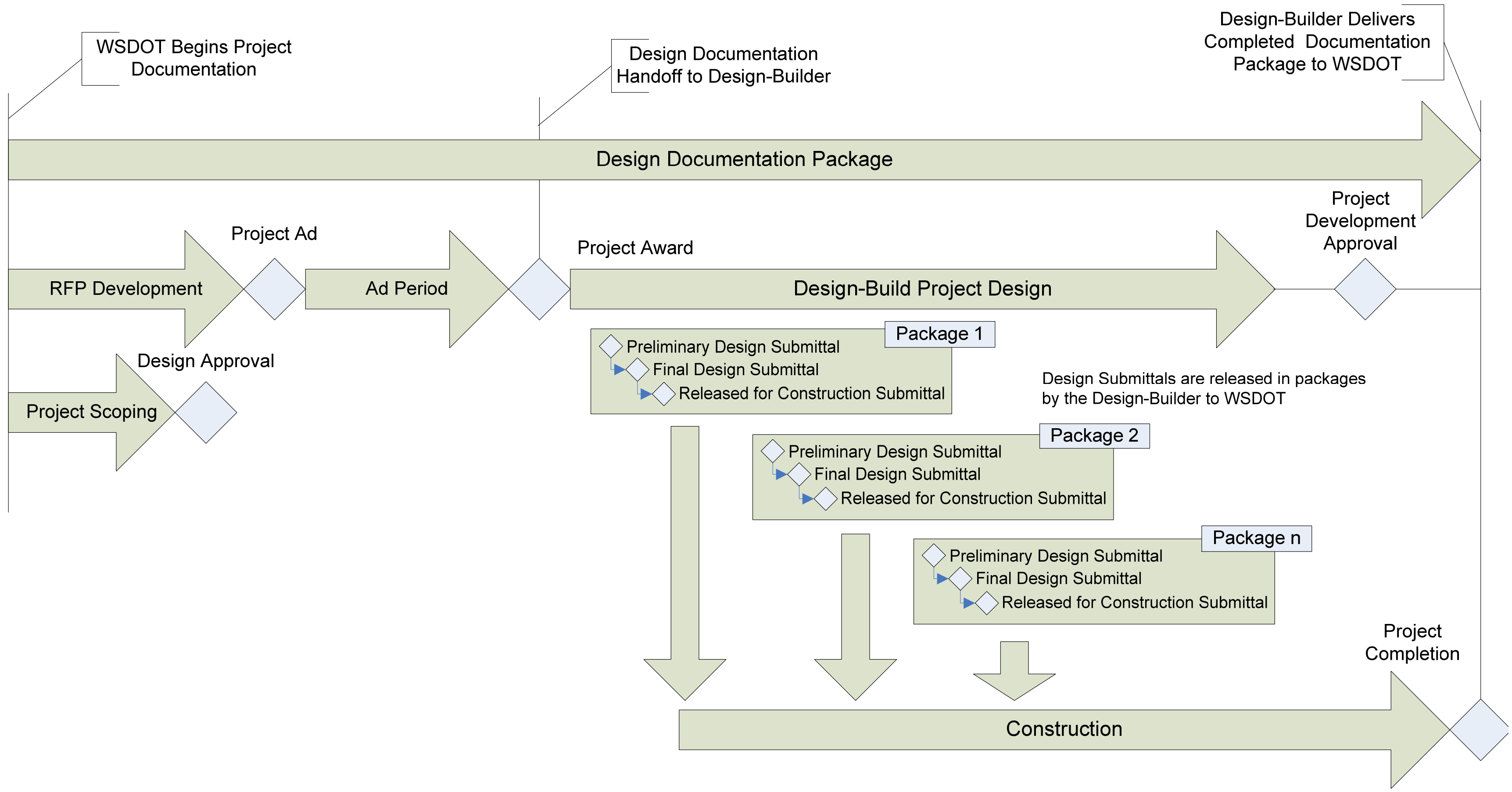
S

T

U

V

W



Notes:

The Design Documentation Package (DDP) is started by WSDOT during scoping/pre-RFP design. The design-builder completes the DDP as the project proceeds.

The design-builder shall refer to the RFP for specific review and approval processes. The RFP will specify procedures for design submittals, including notifications to WSDOT and the time allowed for reviews.

WSDOT will review design submittals for conformance with requirements of the contract.

Design Documentation Sequence for Typical Design-Build Project
Figure 110-1

Chapter 141 Project Development Roles and Responsibilities for Projects With Structures

141.01 General

This chapter presents the project development process used by WSDOT, the Regions, and the Headquarters (HQ) Bridge and Structures Office to determine the roles and responsibilities for projects with structures during the project development phase of a project. This chapter complements the Project Management Online Guide: www.wsdot.wa.gov/Projects/ProjectMgmt

For design procedures, see Division 11 chapters and the *Bridge Design Manual*.

The primary objective of this process is to provide a consistent means of selecting a bridge design team to perform all or part of the structural design work, whether it be a consultant or the HQ Bridge and Structures Office.

If the local agency will be requesting any services from WSDOT, the local agency will contact WSDOT's Local Programs Engineer, who will help define the level of WSDOT's involvement in design and construction.

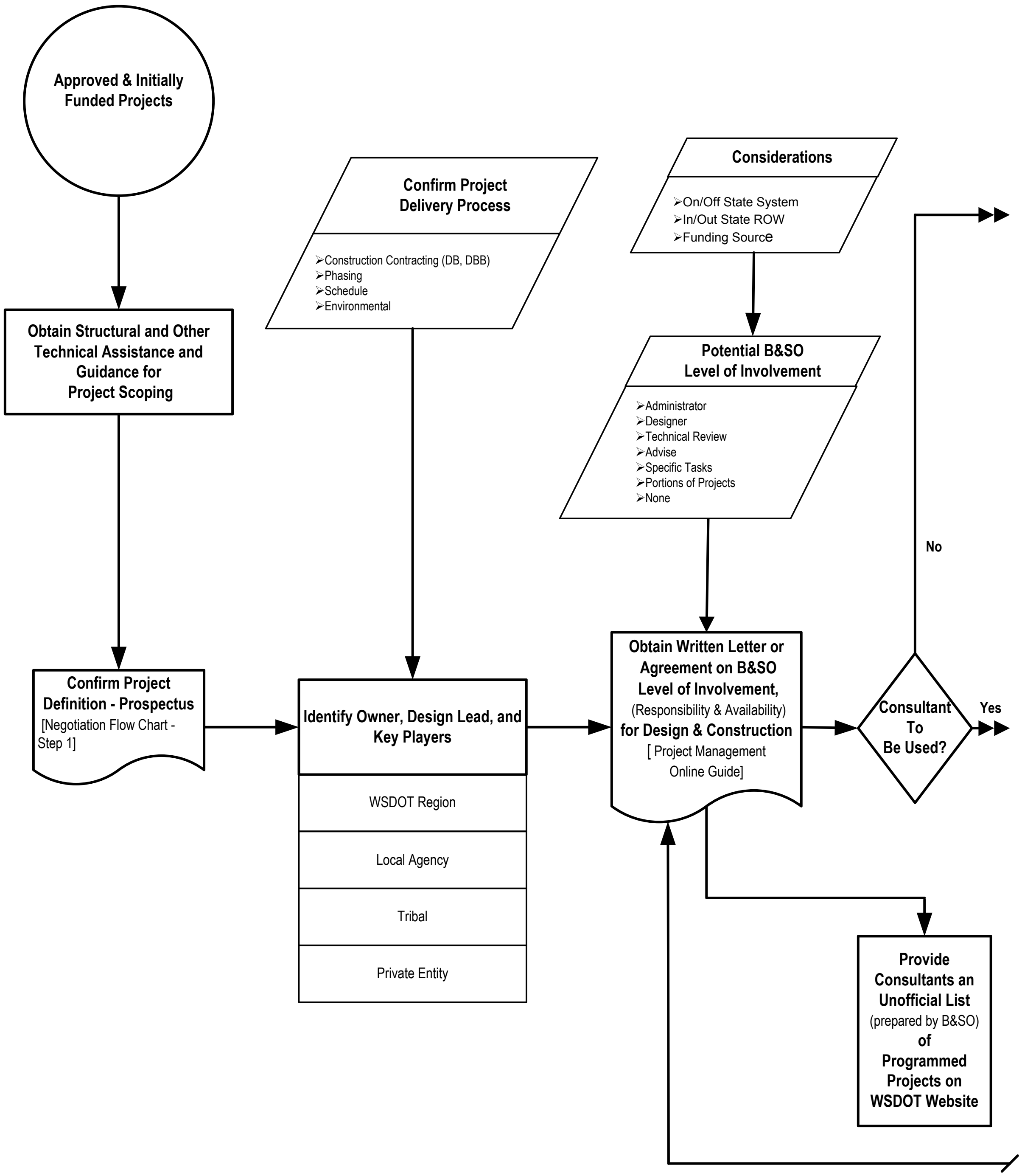
141.02 Procedures

The flow diagram (see Figure 141-1) begins at the left with the initial approval and funding of the project and ends at the right with the start of the project delivery process.

After a project is programmed, WSDOT is tasked with confirming the project scope and defining the structural team's level of involvement in design and construction. If a consultant is not used, all bridge design work will be performed by the HQ Bridge and Structures Office. If a consultant is used, the Region and the HQ Bridge and Structures Office will determine the level of involvement and responsibility for the design.

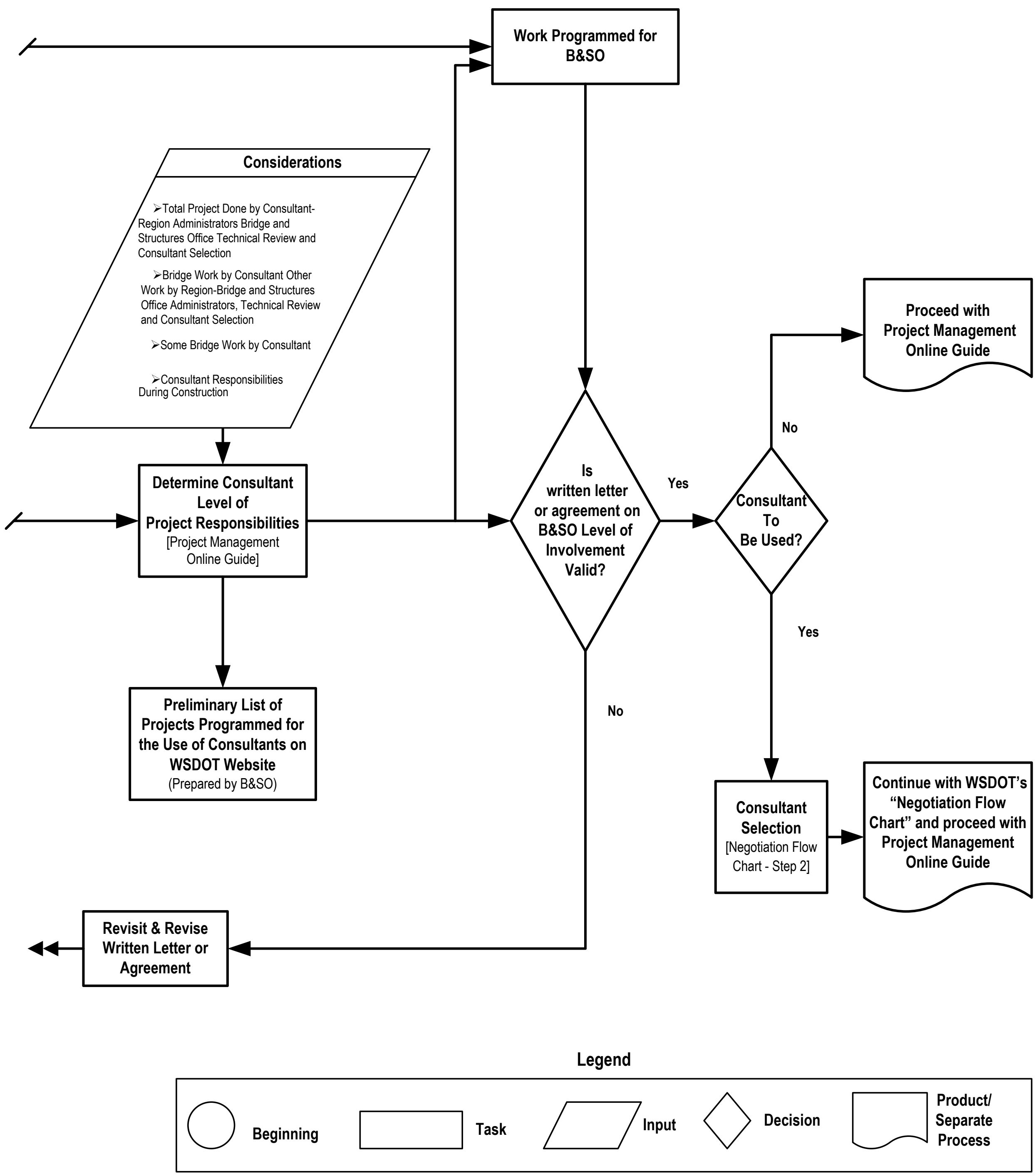
Agreements defining the level of involvement and responsibility will be developed and executed between the Region office responsible for project development and the HQ Bridge and Structures Office, and the appropriate project delivery process will be implemented.

More information on this process and the desired outcomes is available on the HQ Bridge and Structures Office's home page: www.wsdot.wa.gov/eesc/bridge/



FHWA - Federal Highway Administration
WSDOT - Washington State Department of Transportation
DB - Design Build
DBB - Design Bid Build
B&SO - Bridge & Structures Office
ROW - Right of way

Determination of the Roles and Responsibilities for Projects With Structures (Project Development Phase)
Figure 141-1



Determination of the Roles and Responsibilities for Projects With Structures (Project Development Phase)
Figure 141-1 (continued)

Chapter 210 Public Involvement and Hearings

210.01 General

WSDOT strives to involve the public in transportation decision making and make transportation decisions based on the public's best interests.

One of the best ways to achieve WSDOT's goals is to collaborate with the public, community groups, and various agencies. These participants often have differing, sometimes conflicting, perspectives and interests. In addition, many participants and organizations are not able to spend the time and effort required to fully engage in transportation decision making. Despite these challenges, active collaboration:

- Gives us access to important information and ideas that might otherwise be overlooked.
- Puts WSDOT in a position to help solve problems and resolve conflicts.
- Creates a sense of community.
- Fosters greater acceptance of projects.
- Helps build and sustain a credible and trusting relationship between WSDOT and the public.
- Ultimately leads to transportation improvements that better meet public needs and desires.

Public involvement techniques are used to collaborate with the public when making decisions about a transportation project or issue. Examples include more formal techniques like public hearings, direct mail, and presentations to city councils and legislators; and less formal but equally important techniques, like telephone and e-mail discussions, meetings with community groups, media relations, project Internet pages, and more.

Law requires that many types of capital transportation projects undergo a formal public hearing process. The primary focus of this chapter is the legal procedures for public hearings. The basics of public involvement plans are briefly discussed and supplemented with referrals to WSDOT's communications resources to further guide their development and implementation.

210.02 References

(1) Federal/State Laws and Codes

USC Title 23 – Highways, Sec. 128, Public Hearings

USC Title 23 – Highways, Sec. 771.111, Early coordination, public involvement, and project development

23 CFR 200.7 – FHWA Title VI Policy

23 CFR 200.9(b)(4) – Develop procedures for the collection of statistical data of participants and beneficiaries of state highway programs

23 CFR 200.9(b)(12) – Develop Title VI information for dissemination to the general public

23 CFR 450.212 – Public involvement

28 CFR Part 35 – Nondiscrimination on the basis of disability in state and local government services

49 CFR Part 27 – Nondiscrimination on the basis of disability in programs or activities receiving federal financial assistance

Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 36, Appendix A)

Civil Rights Restoration Act of 1987

Title VI of the Civil Rights Act of 1964

Section 504 of the Rehabilitation Act of 1973, as amended

Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 13166 – Improving Access to Services for Persons with Limited English Proficiency

RCW 47.50, Highway Access Management

RCW 47.52, Limited Access Facilities

(2) Design Guidance

Design Manual, Chapter 220, for environmental references and Division 14 chapters for access control and right of way references

Environmental Procedures Manual, M 31-11
www.wsdot.wa.gov/fasc/EngineeringPublications/Manuals/EPM/EPM.htm

WSDOT HQ Access and Hearings Engineer, (360) 705-7251, and Internet page:
www.wsdot.wa.gov/EESC/Design/Access/default.htm

(3) Supporting Information

Improving the Effectiveness of Public Meetings and Hearings, Federal Highway Administration (FHWA) Guidebook:
www.ntl.bts.gov/card_view.cfm?docid=4020

Public Involvement Techniques for Transportation Decision-Making, FHWA September 1996; provides tools and techniques for effective public involvement:
www.fhwa.dot.gov/reports/pittd/cover.htm

Relocation brochures:
www.wsdot.wa.gov/realestate/

WSDOT *Communications Manual* for public involvement:
wwwi.wsdot.wa.gov/Communications/

WSDOT Context Sensitive Solutions Internet site and national context sensitive site:
www.wsdot.wa.gov/biz/csd/ExecutiveOrder.htm
www.contextsensitivesolutions.org/

210.03 Definitions

affidavit of publication A notarized written declaration stating that a ***notice of hearing*** (or a ***notice of opportunity for a hearing***) was published in the legally prescribed manner.

affidavit of service by mailing A notarized written declaration stating that the limited access hearing packet was mailed at least 15 days prior to the hearing and entered into the record at the hearing.

auxiliary aids and services (1) Qualified interpreters, notetakers, transcription services, written materials, telephone handset amplifiers, assistive listening devices, assistive listening systems, telephones compatible with hearing aids, open and closed captioning, telecommunications devices for deaf persons (TDDs), videotext displays, or other effective methods of making aurally delivered materials available to individuals with hearing limitations; (2) Qualified readers, taped texts, audio recordings, Brailled materials, large print materials, or other effective methods of making visually delivered materials available to individuals with visual impairments; (3) Acquisition or modification of equipment or devices; (4) Other similar services and actions; and (5) Providing and disseminating information, written materials, and notices in languages other than English, where appropriate.

context sensitive solutions (CSS) A collaborative, interdisciplinary approach used to develop a transportation project that fits its physical surroundings and is responsive to the community's scenic, aesthetic, social, economic, historic, and environmental values and resources, while maintaining safety and mobility. CSS is an approach that considers the total context within which a transportation improvement project will exist (see 210.02 and 210.04(2)).

court reporter A person with a license to write and issue official accounts of judicial or legislative proceedings.

Findings and Order A document containing the findings and conclusions of a limited access hearing approved by the Environmental and Engineering Programs Director (see 210.09(12) and (13)).

hearing An assembly to which the public is invited to attend and participate. Types of hearings include:

- ***administrative appeal hearing*** A formal process whereby a property owner may appeal WSDOT's implementation of access management legislation. The appeal is heard by an administrative law judge (ALJ), who renders a decision. (See Chapter 1435 for administrative appeal hearing procedures.)
- ***combined hearing*** A hearing that is held when there are public benefits to be gained by combining environmental, corridor, design, and/or limited access subjects.

- ***corridor hearing*** A formal or informal hearing that presents the corridor alternatives to the public for review and comment before a commitment is made to any one route or location. This type of hearing is beneficial on existing corridors with multiple improvement projects programmed over a long duration.
- ***design hearing*** A formal or informal hearing that presents the design alternatives to the public for review and comment before the selection of a preferred alternative.
- ***environmental hearing*** A formal or informal hearing documenting that social, economic, and environmental impacts have been considered and that public opinion has been solicited.
- ***limited access hearing*** A formal hearing that gives local public officials, owners of abutting properties, and other interested persons an opportunity to be heard about the limitation of access to the highway system.
- ***formal hearing format*** A hearing that is conducted by a moderator using a formal agenda, overseen by a hearing examiner, and recorded by a court reporter, as required by law. Limited access hearings require the use of the formal hearing format (see 210.05(3)).
- ***informal hearing format*** A hearing where oral comments are recorded by a court reporter, as required by law. An informal hearing often uses the "open house" format (see 210.04(1)(a)). A formal agenda and participation by a hearing examiner are optional.

hearing agenda Used with formal hearings; an outline of the actual public hearing elements. (See 210.05(9)(a) for contents.)

Hearing Coordinator The Access and Hearings Manager within the HQ Access and Hearings Unit, (360) 705-7251.

hearing examiner An administrative law judge from the Office of Administrative Hearings, or a WSDOT designee, appointed to moderate a hearing.

hearing script A written document of text to be presented orally by department representatives at the hearing.

hearing summary Documentation prepared by the Region and approved by Headquarters that summarizes environmental, corridor, and design hearings. (See 210.05(10) for content requirements.)

hearing transcript A document prepared by the court reporter that transcribes verbatim all oral statements made during the hearing, including public comments. This document becomes part of the official hearing record.

NEPA National Environmental Policy Act.

notice of appearance A form provided by WSDOT for anyone wanting to receive a copy of the Findings and Order and the adopted *Limited Access Plan* (see 210.09(3) and (8)).

notice of hearing (or ***hearing notice)*** A published advertisement that a public hearing will be held.

notice of opportunity for a hearing An advertised offer to hold a public hearing.

order of hearing An official establishment of the hearing date by the State Design Engineer.

prehearing packet A concise, organized collection of all necessary prehearing data, prepared by the Region and approved by the HQ Access and Hearings Engineer prior to the hearing (see 210.05(4) and Figure 210-3).

project management plan A formal, approved document that defines how the project is executed, monitored, and controlled. It may be in summary or detailed form and may be composed of one or more subsidiary management plans and other planning documents. For further information, see the Project Management Online Guide: 🖱 www.wsdot.wa.gov/Projects/ProjectMgmt/Process.htm

public involvement plan A plan to collaboratively involve the public in decision making, tailored to the specific needs and conditions of the project, the people, and the communities it serves. It is often part of a broader communications plan.

relocation assistance program The purpose of the program, as defined in the *Right of Way Manual*, is to establish uniform procedures for relocation assistance that will assure legal entitlements and provide fair, equitable, and consistent treatment to persons displaced by WSDOT-administered projects.

résumé An official notification of action taken by WSDOT following adoption of a Findings and Order (see 210.09(14)).

SEPA State Environmental Policy Act.

study plan A term associated with environmental procedures, proposing an outline or "road map" of the environmental process to be followed during the development of a project that requires complex NEPA documentation. (See 210.06 and the *Environmental Procedures Manual*.)

210.04 Public Involvement

Developing and implementing an effective plan for collaboration with the public is critical to the success of WSDOT's project delivery effort. It provides an opportunity to understand and achieve diverse community and transportation goals. Transportation projects with high visibility or community issues or effects often attract the attention of a broad range of interested people. These types of projects will best benefit from early public involvement, which can influence the project's success and community acceptance.

Developing a profile (through demographic analysis) of the affected community is critical to achieving successful public involvement. This will enable the agency to tailor its outreach efforts toward the abilities/needs of the community. Individuals from minority and ethnic groups and low-income households, who are traditionally underserved by transportation, often find participation difficult. While these groups form a growing portion of the population, particularly in urban areas, historically they have experienced barriers to participation in the public decision-making process and are therefore underrepresented. These barriers arise from both the historical nature of the public involvement process and from cultural, linguistic, and economic differences. For example, a community made up of largely senior citizens (with limited mobility/automobile usage) may mean:

- Meetings/open houses are planned in locations easily accessible to them, such as senior centers and neighborhood community centers.
- Meetings are scheduled in the mornings or midday to accommodate individuals who prefer not to leave home after dark.

- Meetings are scheduled in the evenings to accommodate persons who work during the day.

A project's affected area might consist of a population that might be limited in speaking/understanding English. This may entail:

- Developing/disseminating materials in other languages, as appropriate.
- Having a certified translator on hand at the meetings.

Conducting a demographic profile should be the first order of business when developing a public involvement plan.

Effective public involvement must begin with clearly defined, project-related goals that focus on specific issues, specific kinds of input needed, and specific people or groups that need to be involved. The more detailed a public involvement plan, the greater its chances of obtaining information the agency can use in decision making. Extra effort may be needed to elicit involvement from people unaccustomed to participating, because they often have different needs and perspectives than those who traditionally participate in transportation decision making. They not only may have greater difficulty getting to jobs, schools, recreation, and shopping than the population at large, but also they are often unaware of transportation proposals that could dramatically change their lives. Many lack experience with public involvement, even though they may have important, unspoken issues that should be heard.

Current policies provide general guidelines that allow considerable flexibility. NEPA and SEPA environmental policies and procedures are intended to provide relevant environmental information to public officials, agencies, and citizens, and allow public input to be considered before decisions are made. There are also various other laws, regulations, and policies that emphasize this, including 23 CFR, Title VI of the Civil Rights Act, the Americans with Disabilities Act, and Executive Orders 12898 and 13166.

WSDOT's collaborative process with the public should be open, honest, strategic, consistent, inclusive, and continual. Initiating a project in an atmosphere of collaboration and partnership can go a long way toward providing equal opportunities for all parties (whether they are local, state, tribal, private, nonprofit, or federal) to participate in a project vision. This collaboration requires an intensive communications effort that is initiated during project visioning and extends through construction and eventual operation of the facility.

Department specialists in public communications, environmental procedures, traffic engineering, real estate services, and limited access control are routinely involved with public outreach efforts and project hearings. Depending on the scale and complexity of a project, the Region is encouraged to engage the participation of interdisciplinary experts when developing a public involvement plan and communicating project details. Agency representatives convey WSDOT's image to the public; therefore, they should be confident, well-informed, conscientious of their roles, and skillful communicators.

(1) Public Involvement Plan

The Region develops a public involvement plan for its own use and guidance. To engage the public, share the decision-making process, identify issues, and resolve concerns, the Region communicates with the affected community through group presentations, open house meetings, newspaper articles, fliers, and other methods. The public involvement plan includes methods that will elicit the best participation from the community, including traditionally underrepresented groups.

Developing an effective public involvement plan is a strategic effort. WSDOT must identify audiences, messages, strategies, and techniques that will meet the unique needs of a proposed transportation project, as well as the needs of the public.

The ultimate goal of the public involvement plan is to allow members of the public opportunities throughout the process to learn about the project, provide information and options, collaborate, and provide input intended to influence WSDOT decisions. The plan will outline ways to identify and involve the communities affected by the project; provide them with accessible information through reader-friendly documents, graphics, plans, and summaries; and involve them in decision making.

An effective public involvement plan:

- Is tailored to the project.
- Encourages interactive communication.
- Demonstrates to residents that their input is valued and utilized.
- Includes all affected communities.
- Identifies and resolves issues early in the project development process.
- Ensures public access to relevant and comprehensible information.
- Informs the public of the purpose, need for, and benefits of the proposed action.
- Informs the public about the process that will be used to make decisions.
- Gains public support.
- Provides equal opportunity, regardless of disability, race, national origin, color, gender, or income.

The Region Communications and Environmental offices can provide expertise in developing a public involvement plan tailored to a specific project. The HQ Access and Hearings Unit specializes in procedures for public hearings. The Real Estate Services Office can provide expertise regarding acquisition, relocation assistance, and other related programs. Enlisting the support of these groups is essential to the success of WSDOT projects.

WSDOT recognizes local, state, federal, and tribal staff and elected officials as active sponsors of proposed projects. Those officials might help develop and implement the public involvement plan. Early and continued contact with these resources is key to the success of a project.

The public involvement plan might include the following:

- Objectives
- Strategies
- Tactics (or a list of proposed activities)
- Proposed time schedule to accomplish each project

- Methods to track public comments
- Methods used to consider comments during the decision-making process, including follow-up procedures
- Personnel, time, and funds needed to carry out the plan
- Identification of the project partners and stakeholders

Early use of demographics can help identify the public to be involved. After identification, a variety of methods can be chosen to encourage the most effective public involvement. The public involved (affected directly or indirectly) might include any or all of the following:

- Adjacent property owners and tenants
- Indian tribes
- Low-income groups
- Minority groups
- Cooperating and participating agencies
- Local, state, and federal government staff and elected officials
- Community groups, such as clubs, civic groups, business groups, environmental groups, labor unions, disability advocacy groups, and churches
- Commuters and the traveling public
- Emergency and utility service providers
- Adjacent billboard owners and clients
- The general public and others known to be affected
- Others expressing interest

The following are examples of common outreach methods:

- Public meetings and open house meetings
- Drop-in information centers or booths
- Advisory committee meetings
- Design workshops
- Meetings with public officials
- Individual (one-on-one) meetings
- Meetings with community groups
- Project Internet pages
- WSDOT project e-mail alert lists
- Surveys
- Questionnaires
- Telephone hot lines
- Using established media relations and contacts
- Internet blogs
- Direct mail
- Individual e-mails and letters
- Advisory committees and groups
- Public hearings

(a) **Public Meetings and Open Houses**. Public meetings range from large informational workshops to small groups using one-on-one meetings with individuals. They are less formal than hearings. The Region evaluates the desired outcome from a meeting and how the input will be tracked, and then plans accordingly.

- Open house meetings can be effective for introducing a project to the public and stimulating an exchange of ideas.
- Small meetings are useful for gaining information from community groups, underrepresented groups, neighborhood groups, and advisory committees.
- Workshop formats, where large groups are organized into small discussion groups, serve to maximize the participation of all attendees while discouraging domination by a few groups or individuals.

(b) **Follow-Up Procedures**. Effective public involvement is an ongoing collaborative exchange, and it is necessary to provide follow-up information several times during a large project to maintain a continuing exchange of information.

At significant stages, the Region provides a wide range of general information about the project. Follow-up information conveys, as accurately as possible, how public input was considered during development of the project.

It may become necessary to revise the public involvement plan as the project evolves, conditions change, oppositional groups emerge, or new issues arise. Sometimes innovative methods must be used to ensure the inclusion of affected community members. This is especially important for underrepresented groups such as minority and low-income groups and in communities where a significant percentage of the affected population does not speak English. Consider the need for translators, interpreters, and providing written information in languages other than English. Reference to information on limited English proficiency is provided in 210.04(2)(d). A resident advisory committee can often help identify community issues and concerns as well as recommend effective methods for public involvement.

(2) Public Involvement References

There are a number of publications, references, and training courses available to assist the Region in developing public involvement plans for their projects. The following are recommended references:

(a) **WSDOT Project Management Online Guide**. A project's public involvement plan is an essential element of the overall project management plan. The *WSDOT Project Management Online Guide* is an Internet resource intended to support delivery of transportation projects through effective project management and task planning. The guide includes best practices, tools, templates, and examples to enhance the internal and external communication processes. The process, tools, and templates can be found at: www.wsdot.wa.gov/Projects/ProjectMgmt

(b) **WSDOT Communications Intranet Page**. The *WSDOT Communications Intranet Page* provides guidance for effective communications. This resource includes a "*Communications Manual*," key messaging, and WSDOT's communications philosophy, and is an excellent resource for developing a public involvement plan: wwwi.wsdot.wa.gov/communications/

(c) **Context Sensitive Solutions and Community Involvement**. A proposed transportation project must consider both its physical aspects as a facility serving specific transportation objectives and its effects on the aesthetic, social, economic, and environmental values within a larger community setting. Context Sensitive Solutions is a collaborative, interdisciplinary approach that involves the community in the development of a project. WSDOT's philosophy encourages collaboration and consensus-building as highly advantageous to all parties to help avoid delays and other costly obstacles to project implementation. WSDOT endorses the Context Sensitive Solutions approach for all projects, large and small, from early planning through construction and eventual operation of the facility. For further information, see WSDOT Executive Order E-1028.01 on Context Sensitive Solutions:
www.wsdot.wa.gov/biz/csd/ExecutiveOrder.htm
wwwi.wsdot.wa.gov/docs/

Additionally, the following WSDOT HQ Design, Highways and Local Programs, and Environment Internet pages offer an excellent array of publications, training, and resources for public involvement:
www.wsdot.wa.gov/eesc/design/Urban/Default.htm
www.wsdot.wa.gov/TA/Operations/LocalPlanning/contextsensitivesolutions.html
www.wsdot.wa.gov/TA/Operations/LocalPlanning/Research.html
www.wsdot.wa.gov/Environment/EJ/

(d) **Federal Highway Administration References**

Improving the Effectiveness of Public Meetings and Hearings, FHWA Guidebook. Provides a variety of techniques and processes based on the practical community involvement experience of its authors:
www.ntl.bts.gov/card_view.cfm?docid=4020

Public Involvement Techniques for Transportation Decision-Making, FHWA September 1996, provides tools and techniques for effective public involvement:
www.fhwa.dot.gov/reports/pittd/cover.htm

How to Engage Low-Literacy and Limited-English-Proficiency Populations in Transportation Decision Making, FHWA 2006, provides tools and techniques for identifying and including these populations:
www.fhwa.dot.gov/hep/lowlim/index.htm

23 CFR 630, Subpart J, Final Rule on Work Zone Safety and Mobility, Work Zone Public Information and Outreach Strategies. The following Internet guide is designed to help transportation agencies plan and implement effective public information and outreach campaigns to mitigate the effects of road construction work zones:
www.ops.fhwa.dot.gov/wz/info_and_outreach/index.htm

(3) Legal Compliance Statements

All public announcements shall include the required statements relative to the Americans with Disabilities Act (ADA) and Title VI legislation. The Region Communications Office and the WSDOT Communications Office Intranet page can provide the current version of both of these statements for legal compliance.

(a) **ADA Compliance**. The ADA and Section 504 of the Rehabilitation Act require WSDOT to inform the general public of its obligation to ensure that programs and activities are accessible to and usable by persons with disabilities. For publications, the notice must provide a way to obtain the materials in alternative formats (such as Braille or taped). For public meetings and hearings, the notice must inform the public that reasonable accommodations can be made for a variety of needs.

The public meeting/hearing facility must always meet minimum ADA accessibility standards (such as ramps for wheelchair access, wide corridors, and accessible rest rooms). Additionally, WSDOT must provide, upon request, reasonable accommodations to afford equal access to information, meetings, etc., to persons with disabilities. Reasonable accommodations can include services and auxiliary aids (such as qualified interpreters, transcription services, assistive listening devices for persons who are deaf or hard of hearing, or additional lighting for persons with visual impairments.) The WSDOT Office of Equal Opportunity can provide assistance for reasonable accommodation provisions.

(b) **Title VI**. Title VI of the Civil Rights Act of 1964 requires that WSDOT inform the general public of its obligation to ensure that no person shall, on the grounds of race, color, national origin and/or sex, be excluded from participation in, be denied the benefits of, or be otherwise discriminated against under any of its federally funded programs and activities.

210.05 Public Hearings

By state and federal law, certain capital transportation projects propose actions that require a public hearing. The remainder of this chapter provides guidance on public hearing procedures.

The common types of public hearings associated with WSDOT projects include environmental, design, corridor, and limited access hearings, which are discussed in subsequent sections. The guidance in this chapter discusses project actions that trigger a hearing and the procedures for effectively planning, conducting, and completing the hearing process.

While there are several different types of public hearings, they follow similar steps for planning and preparation of project materials and information. These steps facilitate efficient reviews and approvals required for the hearing to proceed as planned. Special attention to the scheduling of deliverables and notifications leading up to the hearing help the process progress smoothly.

Public hearing formats are either formal or informal. Limited access hearings are always conducted as formal hearings. An informal process can be used for most other hearings.

Hearings are often conducted in accordance with NEPA/SEPA procedures for public involvement during the environmental documentation phase of the project. The Region reviews the requirements for hearings during the early stages of project development and before completion of the draft environmental documents.

(1) General Information for Hearings

Preparing for and conducting a successful public hearing requires considerable coordination and effort. You can best do this by establishing a support team to identify and carry out the tasks and arrangements. It is crucial to identify and schedule tasks and deliverables well in advance of a public hearing. A project team might enlist the support of Region specialists from Communications, Environmental, Government Relations, Right of Way, Real Estate, and Traffic offices, as well as the HQ Hearing Coordinator, HQ NEPA Policy staff, Office of Equal Opportunity, and others involved with the project. The following figures and narrative help identify whether a public hearing is required and how to prepare.

(2) Selecting the Hearing Type

By law, certain project actions or proposed conditions require that specific types of public hearings are conducted. Figure 210-1 identifies project conditions and their associated hearing requirements. If one or more of the conditions in Figure 210-1 occurs, a notice of opportunity for a hearing is required by federal and state law (USC Title 23 §771.111 and RCW 47.52) and by WSDOT policy. Consult the Hearing Coordinator in the HQ Access and Hearings Unit, as well as project environmental specialists, for hearing requirements.

(3) Selecting the Hearing Format

The types of public hearing formats used by WSDOT are known as formal and informal. Hearing formats are different than hearing types. In some cases the hearing type will dictate the required format, such as with limited access hearings. The following text and Figure 210-2 provide guidance on formats.

(a) **Formal Hearings**. A formal hearing is conducted by a moderator using a formal agenda, overseen by a hearing examiner, and recorded by a court reporter, as required by law. Limited access hearings and administrative appeal hearings require the use of the formal hearing format. For projects that require a formal public hearing, it is common for WSDOT to hold a public open house preceding the hearing.

The following are required for all formal hearings:

- Hearing notice with a fixed time and date (see 210.05(5) and (6))
- Fixed agenda and script
- Hearing examiner
- Hearing moderator (may be the hearing examiner)
- Court reporter
- Specified comment period
- Hearing summary (see 210.05(10))

In addition to providing oral comments, people can write opinions on comment forms available at or after the hearing and submit them before the announced deadline.

(b) **Informal Hearings**. An informal hearing is also known as an open format hearing. Individual oral comments are recorded by a court reporter. The presence of a hearing examiner and a formal agenda are optional.

These events are usually scheduled for substantial portions of an afternoon or evening so people can drop by at their convenience and fully participate. Activities usually include attending a presentation, viewing exhibits, talking to project staff, and submitting written or oral comments.

The following items are features of an open format (or informal) hearing:

- Open format hearings can be scheduled to accommodate people's work schedules.
- Brief presentations about the project and hearing process are advertised at preset times in the hearing notice. Presentations can be live, videotaped, or computerized.
- Agency or technical staff is present to answer questions and provide details of the project.
- Information is presented buffet-style, allowing participants access to specific information.
- Graphics, maps, photos, models, videos, and related documents are frequently used.
- People have the opportunity to clarify their comments by reviewing materials and asking questions before commenting.
- People can comment formally before a court reporter, or they can write opinions on comment forms and submit them before the announced deadline.

(4) Hearing Preparation

When Region staff has determined that a formal or informal public hearing will be held, they should contact the HQ Hearing Coordinator to discuss preliminary details. The HQ Hearing Coordinator specializes in assisting with preparations for the hearing and will usually attend. Other WSDOT groups involved with the project and tasked with developing and implementing the public involvement plan can assist with hearing preparations and provide assistance at the hearing.

The figures in this chapter can be used as checklists to identify important milestones and work products needed. Important elements include setting an initial target date for the hearing and agreement on staff roles and responsibilities at the hearing.

(a) **Setting the Hearing Date and Other Arrangements**. The State Design Engineer sets the hearing date at the recommendation of the HQ Hearing Coordinator. This is known as the order of hearing. Final arrangements for the hearing date can be handled by telephone or brief check-in meetings between the HQ Hearing Coordinator and the Region.

The Region proposes a hearing date based on the following considerations:

- Convenient for community participation. Contact local community and government representatives to avoid possible conflict with local activities. Consider times and locations that are most appropriate for the community.
- For corridor and design hearings, at least 30 days after circulation of the draft environmental impact statement (DEIS) or the published notice of availability of any other environmental document.

- In most cases, more than 45 days after submittal of the prehearing packet.

The Region makes other arrangements as follows:

- Reviews the location of the hearing hall to ensure it is easily accessed by public transportation (whenever possible), convenient for community participation, and ADA accessible.
- Arranges for a court reporter.
- Requests that the HQ Hearing Coordinator provide a hearing examiner for all limited access hearings and for other hearings, if desired.
- Develops a hearing agenda for all limited access hearings and for other types of hearings, if desired.
- If requested in response to the hearing notice, provides communication auxiliary aids and other reasonable accommodations required for persons with disabilities. Examples include interpreters for persons who are deaf; audio equipment for persons who are hard of hearing; language interpreters; and the use of guide animals and Braille or taped information for persons with visual impairments.
- All public hearings and meetings require the development of procedures for the collection of statistical data (race, color, sex, and national origin) of participants in, and beneficiaries of, state highway programs such as relocatees, impacted citizens, and affected communities. Public Involvement Forms should be available for meeting attendees to complete. The Public Involvement Form requests attendees to provide information on their race, ethnicity, national origin, and gender. The form is available in English, Spanish, Korean, Russian, Vietnamese, Tagalog, and Traditional and Simplified Chinese at: www.wsdot.wa.gov/oeo/titlevi.htm
- If demographics indicate that 5% or 1000 persons or more in the affected project area speak a language other than English, vital documents, advertisements, notices, newspapers, mailing notices, and other written and verbal media and informational materials may need to be translated into other languages to ensure that social impacts to communities and people are recognized and considered throughout the transportation planning and decision-making process. In addition, language interpreters may need to be present during the hearings or public meetings to ensure that individuals and minority communities are included throughout the process.

(b) **Developing the Prehearing Packet**. The Region prepares a prehearing packet, which is an assemblage of organized project information containing public notices, prepared news releases, exhibits, and handouts to be used at the hearing. The project team members and specialists enlisted to support the public involvement and hearing processes typically coordinate to produce the prehearing packet elements. Much of the information needed in the prehearing packet will come from the project's public involvement plan.

You should prepare a prehearing packet at least 45 days in advance of the public hearing and send it to the HQ Access and Hearings Unit. The HQ Hearing Coordinator reviews and concurs with the Region's plans, and recommends the State Design Engineer's approval of the hearing date. Headquarters concurrence with the prehearing packet typically requires two weeks after receipt of the information.

The following information is included in the prehearing packet:

1. **Project Background Information and Exhibits**. A project vicinity map and pertinent plans and exhibits for the hearing. The prehearing packet also contains a brief written narrative of the project. Usually, this narrative is already prepared and available in Project File documents, public involvement plans, or on a project Internet page.
2. **Proposed Hearing Type, Format, and Logistics**. The prehearing packet identifies the type of hearing required. A hearing support team provides various planning details and helps with arrangements (date, time, place, and announcements). A public open house is often scheduled on the same day, preceding a formal hearing, to provide opportunity for involvement by the community.
3. **News Release**. The Region Communications Office can assist in preparing announcements for the hearing and other public events.
4. **Legal Hearing Notice**. Notices must contain certain legal statements provided by the HQ Access and Hearings Unit. (See 210.05(5) and (6) for guidance on notices.)
5. **List of Newspapers and Other Media Sources**. The media listing used to announce the hearing. The Region Communications Office has developed relations with reporters and media outlets, including minority publications and media, and is accustomed to working these issues. Enlist the office's support for hearing preparations.
6. **List of Legislators and Government Agencies Involved**. Special notice is sent to local officials and legislators announcing public hearings. At formal hearings, the moderator and agenda typically identify those officials so they can interact with the public. The HQ Government Relations Office can assist with identifying and notifying legislators and key legislative staff within the project area.
7. **The Hearing Agenda and Script**. These are required for formal hearings and are prepared by the Region. The HQ Access and Hearings Unit can provide sample agendas and scripts to support the Region in its hearing preparations.

   Figure 210-3 provides a checklist of prehearing packet contents, including additional items needed for limited access hearings.

(5) Public Hearing Notices – Purpose and Content

There are two types of public notices for hearings: notice of hearing and notice of opportunity for a hearing. Consult the HQ Hearing Coordinator for specific project hearing requirements and implementation strategies.

(a) **Notice of Hearing**. A notice of hearing is prepared and published when a hearing is required by law and cannot be waived.

(b) **Notice of Opportunity for a Hearing**. In select cases, a notice of opportunity for a hearing is prepared and published in order to gauge the public's interest in having a particular hearing. This kind of notice is only used if the requirements for a hearing can be legally waived. In these cases, documentation is required as set forth in 210.05(7).

(c) **Content Requirements**. The HQ Access and Hearings Unit provides sample notices to the Region upon request. Public notices include statements that are required by state and federal statutes. Some important elements of a notice include the following:

- A map or graphic identifying project location and limits.
- For a notice of opportunity for a hearing, include the procedures for requesting a hearing and the deadline, and note the existence of the relocation assistance program for persons or businesses displaced by the project.
- For an environmental, corridor, design, or combined corridor-design hearing, or for a notice of opportunity for a hearing, announce the availability of the environmental document and accessible locations.
- Project impacts to wetlands; flood plains; prime and unique farmlands; Section 4(f), 6(f), or 106 properties; endangered species or related habitats; or affected communities.
- Information on any associated prehearing presentation(s).
- Americans with Disabilities Act and Title VI legislation statements.

(6) Publishing Hearing Notices – Procedure

To advertise a legal notice of hearing or a notice of opportunity for a hearing, use the following procedure for appropriate media coverage and timing requirements:

1. **Headquarters Concurrence**. As part of the prehearing packet, the Region transmits the proposed notice and a list of the newspapers in which the notice will appear to the HQ Hearing Coordinator for concurrence prior to advertisement.
2. **Region Distribution of Hearing Notice**. Upon receiving Headquarters concurrence, the Region distributes copies of the hearing notice and news release as follows:
   - Send a copy of the hearing notice and a summary project description to appropriate legislators and local officials one week before the first publication of a hearing notice. Provide the HQ Government Relations Office with a copy of all materials that will be distributed to legislators, along with a list of legislative recipients.
   - Advertise the hearing notice in the appropriate newspapers within one week following the mailing to legislators. The advertisement must be published in a newspaper with general circulation in the vicinity of the proposed project or with a substantial circulation in the area concerned, such as foreign language and local newspapers. If affected limited-English-proficient populations have been identified, other foreign language newspapers may be appropriate as well. The legal notices section may be used or, preferably, a paid display advertisement in a prominent section of the newspaper, such as the local news section. With either type of advertisement, request that the newspaper provide an affidavit of publication.
   - Distribute the project news release to all appropriate news media about three days before the first publication of a hearing notice, using newspapers publishing the formal advertisement of the notice.
   - Additional methods may also be used to better reach interested or affected groups or individuals, including notifications distributed via project e-mail lists, ads in local community news media, direct mail, fliers, posters, and telephone calls.

- For corridor and design hearings, the first notice publication must occur at least 30 days before the date of the hearing. The second publication must be 5 to 12 days before the date of the hearing (see Figure 210-4). The first notice for a corridor or design hearing shall not be advertised prior to public availability of the draft environmental document.
- For limited access and environmental hearings, the notice must be published at least 15 days prior to the hearing. The timing of additional publications is optional (see Figure 210-5).
- For a notice of opportunity for a hearing, the notice must be published once each week for two consecutive weeks. The deadline for requesting a hearing must be at least 21 days after the first date of publication and at least 14 days after the second date of publication.
- A copy of the published hearing notice is sent to the HQ Hearing Coordinator at the time of publication.

3. **Headquarters Distribution of Hearing Notice**. The HQ Hearing Coordinator sends a copy of the notice of hearing to the Transportation Commission, Attorney General's Office, HQ Communications Office, and FHWA (if applicable).

   For a summary of the procedure and timing requirements, see Figure 210-4 (for environmental, corridor, and design hearings) or Figure 210-5 (for limited access hearings).

(7) No Hearing Interest – Procedure and Documentation

As described in 210.05(5), in select cases the Region can satisfy certain project hearing requirements by advertising a notice of opportunity for a hearing. This procedure can be beneficial, particularly with limited access hearings in cases where very few abutting property owners are affected. If no hearing requests are received after issuing the notice of opportunity, the following procedures and documentation are required to waive a hearing:

(a) **Corridor or Design Hearing**. If no requests are received for a corridor or design hearing, the Region transmits a package (the notice of opportunity for a hearing, the affidavit of publication of the notice, and a letter stating that there were no requests for a hearing) to the HQ Access and Hearings Unit.

(b) **Limited Access Hearing**. When a notice of opportunity for a hearing is used to fulfill the requirements for a limited access hearing and there are no requests for a hearing, the following steps are taken:

- The Region must secure signed hearing waivers from every abutting property owner whose access rights will be affected by the project, as well as the affected local agency. The HQ Access and Hearings Unit can supply a sample waiver to the Region.
- The Project Engineer must contact every affected property owner of record (not tenant) and the local agency to explain the proposed project. This explanation must include information on access features, right of way acquisition (if any), and the right to a hearing. Property owners must also be advised that signing the waiver will not affect their right to fair compensation for their property, or their access rights or relocation benefits.

- The Region transmits the original signed waivers to the HQ Access and Hearings Unit, along with the affidavit of publication of the notice of opportunity for a limited access hearing and a recommendation for approval of the Right of Way Plan. Once the completed package is received by the HQ Access and Hearings Unit, it is submitted to the State Design Engineer for review and approval.

(c) **Environmental Hearing**. Environmental hearings cannot use the process of waivers to satisfy project hearing requirements.

(8) Prehearing Briefs and Readiness

After publication of a hearing notice, the Region should expect to receive public requests for information and project briefings, including requests for information in languages other than English.

(a) **Presentation of Material for Inspection and Copying**. The information outlined in the hearing notice and other engineering and environmental studies, as well as information intended to be presented at the hearing, must be made available for public review and copying throughout the period between the first advertisement and the approval of the hearing summary or Findings and Order. The information may also need to be available in languages other than English if demographics indicate. The information need not be in final form, but must include every item currently included in the hearing presentation. The environmental documents must also be available for public review.

These materials are made available in the general locality of the project. The Region reviews the variables (the locations of the Project Office and project site; the interested individuals; and the probability of requests for review) and selects a mutually convenient site for the presentation of the information. In accordance with RCW 42.56, Public Records, a record should be kept for future evidence, stating who came in, when, and what data they reviewed and copied.

(b) **Hearing Briefing**. On controversial projects, the HQ Hearing Coordinator arranges for a briefing (held before the hearing) for those interested in the project. Attendants typically include appropriate Headquarters, Region, and FHWA personnel, with special notice to the Secretary of Transportation. Region personnel present the briefing.

(c) **Prehearing Presentation**. The Region is encouraged to give an informal presentation to the public for discussion of the project prior to the hearing. A prehearing presentation is informal, with ample opportunity for exchange of information between WSDOT and the public. Providing community members with opportunities to talk about their concerns in advance of the hearing promotes positive public relationships, and can make the actual hearing proceed more smoothly. Prehearing presentations can be open house meetings, drop-in centers, workshops, or other formats identified in the public involvement plan.

The prehearing presentation is usually held about one week before the hearing for more controversial projects; modified as needed.

Include the date, time, and place in the hearing notice and ensure it is mailed in time to give adequate notice of the prehearing presentation.

(9) Conducting the Hearing

The hearing is facilitated by the Regional Administrator or a designee. Normally, a hearing examiner is used when significant controversy or considerable public involvement is anticipated. A hearing examiner is required for limited access hearings.

A verbatim transcript of the proceedings is made by a court reporter.

Hearings are generally more informative and gain more public participation when an informal format is used, where people's views and opinions are openly sought in a casual and personal way. The informal hearing format may be used for all hearings except limited access hearings. At least one court reporter is required to take individual testimony. Use displays, exhibits, maps, and tables, and have knowledgeable staff available to answer specific questions about the proposed project.

It is the responsibility of the hearing moderator and other department representatives to be responsive to all reasonable and appropriate questions. If a question or proposal is presented at the limited access hearing that can only be answered at a later date, the Region shall reserve an exhibit to respond to the comment in the Findings and Order. The hearing moderator must not allow any person to be harassed or subjected to unreasonable cross-examination.

(a) **Hearing Agenda Items**. For all limited access hearings, and for other formal hearings, the Region prepares a hearing agenda to ensure all significant items are addressed. A hearing agenda includes:

1. **Opening Statement:**
   - Highway and project name
   - Purpose of hearing
   - Description of how the hearing will be conducted
   - Introduction of elected officials
   - Federal/State/County/City relationship
   - Statutory requirements being fulfilled by the hearing
   - Status of the project with regard to NEPA/SEPA documents
   - Description of information available for review and copying
   - For environmental, corridor, or design hearings, notice that written statements and other exhibits can be submitted during the open record period following the hearing
   - Statement that all who want to receive written notification of WSDOT's action as a result of the hearing may add their names to the interest list or file a notice of appearance for limited access hearings
2. **Project History**. Present a brief project history, including purpose and need for the project, public involvement program, future hearing opportunities, and hearings held.
3. **Presentation of Plans**. Develop alternatives that include comparable levels of detail, and present them equally. Include the no-action alternative. Refer to any supporting studies that are publicly available.

Identify a preliminary preferred alternative, if selected by WSDOT, for more detailed development. When a preliminary preferred alternative has been identified, stress that it is subject to revision and reevaluation based on public comments, additional studies, and other information that may become available.

4. **Environmental, Social, and Economic Discussion**. Discuss all positive and negative environmental, social, and economic effects (or summarize the major effects), and refer to the environmental documentation.
5. **Statements, Plans, or Counterproposals From the Public**. Accept public views or statements regarding the proposal presented, the alternatives, and the social, economic, and environmental effects identified. Avoid evaluating the views presented while conducting the hearing.
6. **Relocation Assistance Program**. Explain the relocation assistance program and relocation assistance payments available. At all hearings, the relocation assistance brochure must be available for free distribution, including (if appropriate) brochures in languages other than English. Real Estate Services personnel should be available.

   If the project does not require any relocations, the relocation assistance discussion may be omitted. Make a simple statement to the effect that relocation assistance is provided, but currently no relocations have been identified for the project. The relocation brochure and personnel should still be available to the public at the hearing.
7. **Acquisition**. Discuss right of way acquisition, estimated cost, and currently proposed construction schedules and critical activities that may involve or affect the public.
8. **Closing**. Summarize the hearing and announce proposed future actions.
9. **Adjournment**. Adjourn the hearing with sincere gratitude for the public's valuable participation.

(10) Hearing Summary and Adoption

Upon completion of a public hearing, a documentation and approval procedure leads to official adoption of the hearing proceedings. After the hearing, a summary is prepared by the Region. There are two types of summary documents used, depending on the type of hearing. For environmental, corridor, and design hearings, a hearing summary is produced. Following a limited access hearing, a Findings and Order document is prepared. Each of these packages is comprised of documentation assembled by the Region and approved by Headquarters.

(a) **Hearing Summary Contents**. The hearing summary includes the following elements:

1. Hearing transcript.
2. Copy of the affidavit of publication of the hearing notice.
3. Hearing material:
   - Copies of the letters received before and after the hearing
   - Copies or photographs of, or references to, every exhibit used in the hearing

4. Summary and analyses of all oral and written comments. Include consideration of the positive and negative social, economic, and environmental aspects of these comments.

(b) **Limited Access Hearing Findings and Order**. Following a limited access hearing, the "summary" document is labeled the Findings and Order. Refer to 210.09(12) for the process description and required documentation for Findings and Order documents.

(c) **Adoption and Approval**. For specific hearing types, see subsequent sections in this chapter related to adoption procedures.

Figure 210-6 identifies the Headquarters approval authority for hearing summary and Findings and Order documents.

210.06 Environmental Hearing

Early coordination with appropriate agencies and the public may help to determine the appropriate level of environmental documentation, the scope of the document, the level of analysis, and related environmental disciplines to be analyzed.

Environmental documents address the positive and negative social, economic, and environmental project effects, as described in Chapter 220 and the *Environmental Procedures Manual*. The project environmental documentation is the first step in the environmental hearing procedure. Each step of the hearing procedure is dovetailed into the environmental process and is important in achieving the appropriate project documentation. Corridor and design hearings are not normally required for Environmental Assessments, SEPA Checklists, and categorically excluded projects, but the opportunity for an environmental hearing might be required or advisable for controversial proposals. When an environmental hearing is not required, an informational meeting may serve as a useful forum for public involvement in the environmental process. Consult with Region environmental staff and the HQ Hearing Coordinator for specific project requirements.

Projects requiring an Environmental Impact Statement (EIS) must use an evaluation process called *scoping* in the NEPA and SEPA requirements. This process helps the project proponents identify the significant issues and possible alternatives analyzed and documented in the Draft EIS, and must follow the public involvement plan included in the environmental study plan for the project.

After the project has been thoroughly analyzed through the environmental evaluation process and discussed within the community using informal public involvement methods, a hearing is held to present and gather testimony. The hearing is timed to fall within the comment period for the Draft EIS.

For an environmental hearing, the hearing notice must be published at least 15 days prior to the hearing. The timing of additional publications is optional (see Figure 210-4).

Responses to comments on the Draft EIS must be addressed in the Final EIS.

(1) Environmental Hearing Summary

The environmental hearing summary includes the items outlined in 210.05(10).

(2) Adoption of Environmental Hearing

Chapter 220 and the *Environmental Procedures Manual* provide guidance on NEPA and SEPA procedures, documentation requirements, and approvals.

210.07 Corridor Hearing

A corridor hearing is a public hearing that:

- Is held before WSDOT is committed to a preferred alternative establishing the final route corridor.
- Is held to ensure that opportunity is afforded for effective participation by interested persons in the process of determining the need for and location of a state highway.
- Provides the public an opportunity to present views on the social, economic, and environmental effects of the proposed alternative highway corridors.

A corridor hearing is required if any of the following project actions would occur:

- Proposed route on new location
- Substantial social, economic, or environmental impacts
- Significant change in layout or function of connecting roads or streets

When a corridor hearing is held, the Region must provide enough design detail on the proposed alignment(s) within the corridor(s) that an informed presentation can be made at the hearing. Justification to abandon an existing corridor must also be presented.

For general procedures and notification requirements, see 210.05 and Figure 210-4.

(1) Corridor Hearing Summary

After the hearing, the Region:

- Reviews the hearing transcript.
- Responds to all questions or proposals submitted at or subsequent to the hearing.
- Compiles a corridor hearing summary.
- Transmits three copies (four copies for Interstate projects) to the HQ Access and Hearings Unit.

When appropriate, the hearing summary may be included in the FEIS. If not included, submit the complete corridor hearing summary to the HQ Access and Hearings Unit within approximately two months following the hearing.

The corridor hearing summary includes the items outlined in 210.05(10).

(2) Adoption of Corridor Hearing Summary

The HQ Access and Hearings Unit prepares a package that contains the corridor hearing summary and a formal description of the project, and forwards it to the Director of Environmental and Engineering Programs for adoption. The HQ Hearing Coordinator notifies the Region when adoption has occurred and returns an approved copy to the Region.

210.08 Design Hearing

A design hearing is a public hearing that:

- Is held after a route corridor is established and approved but before final design of a highway is engineered.
- Is held to ensure that an opportunity is afforded for the public to present their views on each proposed design alternative, including the social, economic, and environmental effects of those designs.

A design hearing is required if any of the following project actions will occur:

- Substantial social, economic, or environmental impacts
- Significant change in layout or function of connecting roads or streets
- Acquisition of a significant amount of right of way results in relocation of individuals, groups, or institutions

For general procedures and notification requirements, see 210.05 and Figure 210-4.

(1) Design Hearing Summary

The design hearing summary includes the elements outlined in 210.05(10).

Submit the complete hearing summary to the HQ Access and Hearings Unit within approximately two months following the hearing.

If new studies or additional data are required subsequent to the hearing, the Region compiles the information in coordination with the HQ Design Office.

(2) Adoption of Design Hearing Summary

After the hearing, the Region reviews the hearing transcript, responds to all questions or proposals submitted at or subsequent to the hearing, compiles a hearing summary, and transmits three copies (four copies for Interstate projects) to the HQ Access and Hearings Unit. When appropriate, the design hearing summary may be included in the final environmental document. The HQ Access and Hearings Unit prepares a formal document that identifies and describes the project and submits it to the State Design Engineer for approval. One approved copy is returned to the Region. The HQ Hearing Coordinator notifies the Region that adoption has occurred.

On Interstate projects, the State Design Engineer (or designee) submits the approved design hearing summary to the FHWA for federal approval. If possible, this submittal is timed to coincide with the submittal of the Design Decision Summary to the FHWA.

(3) Public Notification of Action Taken

The Region prepares a formal response to individuals who had unresolved questions at the hearing. The Region keeps the public advised regarding the result of the hearing process, such as project adoption or revision to the plan. A project newsletter sent to those on the interest list is an effective method of notification. Project news items can be sent via e-mail, as well as by more traditional methods.

210.09 Limited Access Hearing

Limited access hearings are required by law (per RCW 47.52) whenever limited access is established or revised on new or existing highways. Decisions concerning limited access hearings are made on a project-by-project basis by the State Design Engineer based on information that includes the recommendations submitted by the Region (see Chapters 1410, 1420, 1430, and 1435).

Limited access hearing procedures generally follow those identified in 210.05; however, several unique products and notifications are also prepared. These include Limited Access Hearing Plans and notifications sent to abutting property owners and local jurisdictions. (See 210.09(4) and Figure 210-3 for a listing of these products.) Figure 210-5 presents a summary of the limited access hearing procedures.

Prior to the limited access hearing (RCW 47.52.131), discussions with the local jurisdictions shall be held on the merits of the Limited Access Report and the Limited Access Hearing Plan(s). These are required exhibits for the limited access hearing. (See Chapter 1430 for guidance on Limited Access Reports.)

The following information applies only to limited access hearings and procedures for approval of the Findings and Order.

(1) Hearing Examiner

The HQ Access and Hearings Unit hires an administrative law judge from the Office of Administrative Hearings to conduct the limited access hearing.

(2) Order of Hearing

The order of hearing officially establishes the hearing date. The State Design Engineer approves the order of hearing. The HQ Hearing Coordinator then notifies the Region, the Attorney General's Office, and the hearing examiner of the official hearing date.

(3) Limited Access Hearing Plan

The Region prepares a Limited Access Hearing Plan to be used as an exhibit at the formal hearing and forwards it to the HQ Plans Engineer for review and approval approximately 45 days before the hearing. This is a Phase 2 Plan (see Chapter 1410). The HQ Plans Engineer schedules the approval of the Limited Access Hearing Plan on the State Design Engineer's calendar.

(4) Limited Access Hearing Information to Abutters

The Region prepares an information packet that must be mailed to abutters, and other entities as specified below, at least 15 days prior to the hearing (concurrent with advertisement of the hearing notice). These items are elements of the prehearing packet as described in 210.05(4)(b) and in Figure 210-3. If some of the limited access hearing packets are returned as undeliverable, the Region must make every effort to communicate with the property owners.

The limited access hearing packet for abutters contains the following:

- Limited Access Hearing Plan
- Limited access hearing notice
- Notice of appearance

The Region also sends the limited access hearing packet to the following:

- The county and/or city
- The owners of property listed on the county tax rolls as abutting the section of highway, road, or street being considered at the hearing as a limited access facility
- Local agencies and public officials who have requested a notice of hearing or who, by the nature of their functions, objectives, or responsibilities, are interested in or affected by the proposal
- Every agency, organization, official, or individual on the interest list

The limited access hearing packet is also sent, when applicable, to the following:

- State resource, recreation, and planning agencies
- Tribal governments
- Appropriate representatives of the Department of the Interior and the Department of Housing and Urban Development
- Other federal agencies
- Public advisory groups

(5) Affidavit of Service by Mailing

The Region prepares an affidavit of service by mailing. This affidavit states that the limited access hearing packet was mailed at least 15 days prior to the hearing and that it will be entered into the record at the hearing.

(6) Limited Access Hearing Plan Revisions

The Limited Access Hearing Plan cannot be revised after the State Design Engineer (or designee) approves the plan without rescheduling the hearing. If significant revisions to the plan become necessary during the period between the approval and the hearing, the revisions can be made and must be entered into the record as a revised (red and green) plan at the hearing.

(7) Limited Access Hearing Notice

The limited access hearing notice must be published at least 15 calendar days before the hearing. This is a legal requirement and the hearing must be rescheduled if the advertising deadline is not met. Publication and notice requirements are the same as those required in 210.05, except that the statutory abutter mailing must be mailed after notification to the appropriate legislators.

(8) Notice of Appearance

The HQ Hearing Coordinator transmits the notice of appearance form to the Region. Anyone wanting to receive a copy of the Findings and Order and the adopted Right of Way and Limited Access Plan must complete a notice of appearance form and return it to WSDOT either at the hearing or by mail.

(9) Reproduction of Plans

The HQ Hearing Coordinator submits the hearing plans for reproduction at least 24 days prior to the hearing. The reproduced plans are sent to the Region at least 17 days before the hearing, for mailing to the abutters at least 15 days before the hearing.

(10) Limited Access Hearing Exhibits

The Region retains the limited access hearing exhibits until preparation of the draft Findings and Order is complete. The Region then submits all the original hearing exhibits and three copies to the HQ Access and Hearings Unit as part of the Findings and Order package. Any exhibits submitted directly to Headquarters are sent to the Region for inclusion with the Region's submittal.

(11) Limited Access Hearing Transcript

The court reporter furnishes the original limited access hearing transcript to the Region. The Region forwards the transcript to the hearing examiner, or presiding authority, for signature certifying that the transcript is complete. The signed original and three copies are returned to the Region for inclusion in the Findings and Order package.

(12) Findings and Order

The Findings and Order is a document containing the findings and conclusions of a limited access hearing, based entirely on the evidence in the hearing record. The Region reviews a copy of the transcript from the court reporter and prepares a Findings and Order package. The package is sent to the HQ Access and Hearings Unit.

The Findings and Order package contains the following:

- The draft Findings and Order
- Draft responses to comments (reserved exhibits)
- A draft Findings and Order Plan (as modified from the Hearing Plan)
- All limited access hearing exhibits (originals and three copies)
- The limited access hearing transcript (original and three copies)
- The notice of appearance forms
- Estimate of the number of copies of the final Findings and Order Plan and text the Region will need for the mailing

(13) Adoption of Findings and Order

The Environmental and Engineering Programs Director adopts the Findings and Order based on the evidence introduced at the hearing and any supplemental exhibits.

Following adoption of the Findings and Order, the HQ Plans Branch makes the necessary revisions to the Limited Access Hearing Plan, which then becomes the Findings and Order Plan.

The HQ Access and Hearings Unit arranges for reproduction of the Findings and Order Plan and the Findings and Order text and transmits them to the Region.

The Region mails a copy of the Findings and Order Plan and the Findings and Order text to all parties filing a notice of appearance and to all local governmental agencies involved. Subsequent to this mailing, the Region prepares an affidavit of service by mailing and transmits it to the HQ Access and Hearings Unit.

At the time of mailing, but before publication of the résumé, the Region notifies the appropriate legislators of WSDOT's action.

(14) Résumé

The résumé is an official notification of action taken by WSDOT following adoption of a Findings and Order. The HQ Access and Hearings Unit provides the résumé to the Region. The Region must publish the résumé once each week for two consecutive weeks, not to begin until at least ten days after the mailing of the Findings and Order.

(15) Final Establishment of Access Control

When the Findings and Order is adopted, the Findings and Order Plan becomes a Phase 4 Plan (see Chapter 1410). The establishment of access control becomes final 30 days from the date the Findings and Order is mailed by the Region, as documented by the affidavit of service by mailing.

(16) Appeal Process

An appeal from the county or city must be in the form of a written disapproval, submitted to the Secretary of Transportation, requesting a hearing before a board of review.

An appeal from abutting property owners must be filed in the Superior Court of the state of Washington, in the county where the limited access facility is to be located, and shall affect only those specific ownerships. The plan is final for all other ownerships.

210.10 Combined Hearings

A combined hearing often alleviates the need to schedule separate hearings to discuss similar information. A combined hearing is desirable when the timing for circulation of the draft environmental document is simultaneous with the timing for corridor and design hearings and when all alternative designs are available for each alternative corridor.

When deciding whether to combine hearings, consider:

- Whether there is controversy.
- Whether alternative corridors are proposed.
- The nature of the environmental concerns.
- The benefits to the public of a combined hearing.

210.11 Administrative Appeal Hearing

Administrative appeal hearings apply only to managed access highways, are conducted as formal hearings, and are initiated by a property owner seeking to appeal a decision made to restrict or remove an access connection. This is also known as an adjudicative proceeding, and the procedure is presented in Chapter 1435.

210.12 Follow-Up Hearing

A new hearing or the opportunity for a hearing is required for any previously held hearing when any one of the following occurs (USC 23, §771.111):

- Major actions (such as adoption of Findings and Order and approval of hearing summaries) did not occur within three years following the date the last hearing was held or the opportunity for a hearing was afforded
- A substantial change occurs in the area affected by the proposal (due to unanticipated development, for example)
- A substantial change occurs in a proposal for which an opportunity for a hearing was previously advertised or a hearing was held
- A significant social, economic, or environmental effect is identified that was not considered at earlier hearings

210.13 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

Proposed Project Actions or Conditions	Types of Hearings[1]					
	Environmental	Design	Corridor	Limited Access	Combined	Follow-Up
Proposed route on new location			X	X		
Substantial social, economic, or environmental impacts	X	X	X	X		
Significant change in layout or function of connecting roads or streets		X	X	X		
Acquisition of significant amount of right of way results in relocation of individuals, groups, or institutions	X	X				
Significant adverse impact on abutting real property	X					
An EIS is required or a hearing is requested for an EA	X					
Significant public interest or controversy	X					
Regulatory agencies have hearing requirements that could be consolidated into one hearing process	X					
Limited access control is established or revised				X		
If several hearings are required, consider efficiency of combining					X	
Major actions not taken within 3 years after date last hearing was held						X[2]
An unusually long time has elapsed since the last hearing or the opportunity for a hearing						X
Substantial change in proposal since prior hearing						X
Significant social, economic, or environmental effect is identified and was not considered at prior hearing						X

Notes:

[1] This table presents a list of project actions that correspond to required public hearings. The list is intended as a guide and is not all-inclusive. In cases where several types of hearings are anticipated for a project, a combined hearing may be an effective method. Consult with Region and Headquarters environmental staff, the designated Assistant State Design Engineer, and the HQ Access and Hearings Unit to identify specific hearing requirements and strategies.

[2] Posthearing major actions include: FHWA approvals (for Interstate projects); adoption of hearing summaries and Findings and Order; and public notification of action taken, such as publishing a résumé.

Types of Public Hearings
Figure 210-1

Hearing Type	Hearing Format	
	Formal	**Informal**
Limited Access	Required	Not allowed
Environmental	Either format acceptable	
Design	Either format acceptable	
Corridor	Either format acceptable	
Combined	Format depends on type*	
Follow-up	Format depends on type*	

Notes:

Check with the HQ Hearing Coordinator to identify specific hearing type and appropriate hearing format.

* If a combined or follow-up hearing includes a limited access hearing, then that portion of the hearing must adhere to the formal format.

Public Hearing Formats
Figure 210-2

Prehearing Packet Items	All Hearings	Additional Items for Limited Access Hearings
Brief project description; purpose and public benefit; history; known public perceptions; and support or opposition	X	
Proposed hearing type	X	
Hearing arrangements: proposed date, time, and place	X	
Proposed hearing format: formal or informal	X	[1]
Notice of whether an open house event will precede the hearing	X	
Vicinity map	X	
Plans for corridor and design alternatives with descriptions	X	
News release	X	
Legal notice of hearing	X	X[2]
List of newspapers and other media sources that will cover the news release and hearing notice	X	
List of legislators and government agencies involved	X	
Hearing agenda	[3]	X[3]
Hearing script	[3]	X[3]
Limited Access Report (Chapter 1430)		X
Limited Access Hearing Plan(s) (Chapter 1430)		X
List of abutting property owners		X
Notice of appearance form		X

Notes:

The prehearing packet is prepared by the Region and transmitted to the HQ Access and Hearings Unit for review, concurrence, and processing. This information is assembled in advance of the hearing to facilitate timely announcements and a smooth-flowing event. The HQ Hearing Coordinator requires the prehearing packet 45 days (or sooner) in advance of the proposed hearing date.

[1] Limited access hearings are required by law to be formal.

[2] For a limited access hearing, each abutting property owner affected by the project must receive the hearing notice, along with the notice of appearance form and specific Limited Access Hearing Plan(s) showing their parcel(s). Indicate in the prehearing packet the number of affected property owners to whom the packets will be mailed.

[3] A hearing agenda and hearing script are required for a limited access hearing. Any formal hearing requires a fixed agenda and a script. It is recognized that the script may be in draft format at the time of submittal of the prehearing packet. The HQ Hearing Coordinator can assist in its completion and can provide sample scripts and agendas.

Prehearing Packet Checklist

Figure 210-3

Sequence for Corridor, Design, and Environmental Hearings	
Preparatory Work	
Consult with HQ Hearing Coordinator and environmental specialists to determine specific requirements for a hearing or a notice of opportunity for a hearing.	[see 210.05 & Figure 210-1]
Assemble support team; identify and schedule tasks and deliverables.	[see 210.05(4)]
Prepare prehearing packet (news releases, legal notices, exhibits).	[see 210.05(4)(b) & Fig. 210-3]
♦ **Minimum 45 Days Prior to Hearing – Transmit Prehearing Packet to HQ** HQ Hearing Coordinator reviews and concurs; schedules hearing.	[see 210.05(4)(b)]
Public Notifications and News Releases	[see 210.05(5) & (6)]
♦ **35–40 Days Prior to Hearing** (1 week prior to first public ad) Send notice to legislators and local officials.	
♦ **33–35 Days Prior to Hearing** (about 3 days before advertisement) Send letter with news release to media.	
♦ **30 Days Prior to Hearing** Draft EIS becomes available and its open comment period begins.	
Corridor and Design Hearings ♦ **30 Days Prior to Hearing – Publish First Notice** Advertise at least 30 days in advance, but not prior to public availability of draft environmental document. ♦ **5–12 Days Prior to Hearing – Publish Second Notice**	
Environmental Hearings ♦ **15 Days Prior to Hearing – Publish First Notice** Advertise at least 15 days in advance; timing of additional notices optional. (If done in combination with design or corridor hearing, use 30-day advance notice.)	
Prehearing Briefings	[see 210.05(8)]
♦ **5–12 Days Prior to Hearing** Region confers with local jurisdictions; conducts hearing briefings and presentations; and makes hearing materials and information available for public inspection and copying.	
Conduct the Hearing	[see 210.05(9)]
Conduct environmental, corridor, or design hearing.	
Posthearing Actions	
Court reporter provides hearing transcript to Region (usually within 2 weeks).	
♦ **2 Months After Hearing – Prepare Hearing Summary and send to HQ** Region addresses public comments from hearing and throughout comment; period prepares hearing summary and transmits to HQ Hearing Coordinator for processing.	[see 210.05(10)]
HQ Hearing Coordinator transmits hearing summary package to HQ approval authority for approval.	[see Figure 210-6]
HQ Hearing Coordinator notifies Region of adoption and returns a copy of approved hearing summary to Region.	

Notes:

Important timing requirements are marked ♦

* If the advertisement is a notice of opportunity for a hearing, requests must be received within 21 days after the first advertisement. If there are no requests, see 210.05(7).

Sequence for Corridor, Design, and Environmental Hearings
Figure 210-4

Sequence for Limited Access Hearing	
Preparatory Work	
Consult with HQ Access and Hearings Unit. Determine requirements for a limited access hearing or a notice of opportunity for a hearing.	[see 210.05 & Fig. 210-1]
Assemble support team; identify and schedule tasks and deliverables.	[see 210.05(4)]
Prepare Limited Access Report and Limited Access Hearing Plan(s).	[see Chapters 1410 & 1430]
Prepare prehearing packet (legal notice, exhibits, information packets for abutting property owners).	[see 210.05(4)(b) & Fig. 210-3]
♦ **Minimum 45 Days Prior to Hearing – Transmit Prehearing Packet to HQ – Transmit Limited Access Report and Hearing Plans for Approval** HQ Hearing Coordinator reviews and concurs; schedules hearing. Transmits Limited Access Report and Limited Access Hearing Plan.	[see 210.05(4)(b) & 210.09]
♦ **45 Days Prior to Hearing** HQ actions: Calendar order of hearing & Limited Access Hearing Plan approved	[see 210.09(2)&(3)]
♦ **24 Days Prior to Hearing – HQ Reproduction of Plans** HQ action: Approved Limited Access Hearing Plan(s) are reproduced in number sufficient for mailing to abutters and other handout needs; one set to be used as hearing exhibit.	[see 210.09(9)]
Notifications, News Releases, Confer With Local Agencies	
♦ **35–40 Days Prior to Hearing** Send notice to legislators and local officials (1 week prior to first public ad).	[see 210.05(6)]
♦ **33–35 Days Prior to Hearing** Send letter with news release to media (about 3 days before advertisement).	[see 210.05(6)]
♦ **15 Days Prior to Hearing – Publish First Notice*** Advertise at least 15 days in advance; timing of additional notices optional.	[see 210.05(6)]
♦ **15 Days Prior to Hearing – Send Hearing Packets to Abutters** (Hearing notice, *Limited Access Plan*, and notice of appearance form).	[see 210.05(4)]
♦ **15 Days Prior to Hearing – Confer With Local Jurisdictions**	[see 210.05(8)]
Conduct the Hearing	[see 210.05(6)]
Using agenda and script, conduct formal limited access hearing.	
Posthearing Actions	
Court reporter provides limited access hearing transcript to Region.	[see 210.09(11)]
Region prepares Findings and Order document and transmits to HQ Hearing Coordinator.	[see 210.09(12)]
Environmental and Engineering Programs Director adopts Findings and Order.	[see 210.09(13)]
Limited Access Hearing Plan becomes Findings and Order Plan.	[see 210.09(15)]
Findings and Order reproduced and mailed to abutters and local jurisdictions.	[see 210.09(13)]
HQ provides résumé to Region and Region publishes.	[see 210.09(14)]

Notes:

Important timing requirements are marked ♦

* If the advertisement is a notice of opportunity for a hearing, requests must be received within 21 days after the first advertisement. If there are no requests, see 210.05(7).

Sequence for Limited Access Hearing
Figure 210-5

Hearing Summary Document	WSDOT HQ Approval Authority
Limited access hearing Findings and Order	Director, Environmental and Engineering Programs
Corridor hearing summary	Director, Environmental and Engineering Programs
Environmental hearing summary	Director, HQ Environmental Services Office[1]
Design hearing summary	State Design Engineer

Note:

[1] If the environmental hearing summary is included in the Final Environmental Document (FEIS, EA), the HQ Environmental Services Office Director approves the summary. If the summary is separate from the Final Environmental Document, the State Design Engineer approves.

Hearing Summary Approvals
Figure 210-6

Chapter 220 Project Environmental Documentation

220.01 Introduction

The term "environmental documentation" refers to the documents produced for a project to satisfy the requirements contained in the National Environmental Policy Act (NEPA) and the State Environmental Policy Act (SEPA). The *Environmental Procedures Manual* provides detailed instructions on how to determine what level of documentation is required and how to prepare the documents. This section provides a summary of the relevant provisions in the *Environmental Procedures Manual*.

The purpose of the environmental document is to provide decision-makers, agencies, and the public with information on a project's environmental impacts, alternatives to the proposed action, and mitigation measures to reduce unavoidable impacts. Final environmental documents identify and evaluate the project to be constructed. Because projects vary in their level of environmental impacts, the rules on environmental documentation allow for different levels of documentation. As a project's impacts increase, so does the level of documentation.

The Region Environmental Office and the Environmental Documentation Section of the Headquarters (HQ) Environmental Services Office routinely provide environmental documentation assistance to designers and Project Engineers.

220.02 References

(1) Federal/State Laws and Codes

42 USC Chapter 55, National Environmental Policy Act of 1969 (NEPA)

23 CFR 771, Environmental Impact and Related Procedures

23 CFR 771.135 Section 4(f) (49 USC 303), Policy on Lands, Wildlife and Waterfowl Refuges, and Historic Sites

36 CFR 800, Protection of Historic and Cultural Properties

40 CFR Parts 1500-1508, Council for Environmental Quality Regulations for Implementing NEPA

RCW 43.21C, State Environmental Policy Act (SEPA)

WAC 197-11, SEPA Rules

WAC 468-12, WSDOT SEPA Rules

(2) Design Guidance

Environmental Procedures Manual, M 31-11, WSDOT

220.03 Definitions/Acronyms

Categorical Exclusion (CE) (NEPA) or ***Categorical Exemption (CE)*** (SEPA) Actions that do not individually or cumulatively have a significant effect on the environment.

DCE Documented Categorical Exclusion (NEPA)

Determination of Nonsignificance (DNS) (SEPA) The written decision by the Region Administrator that a proposal will not have a significant impact and no EIS is required.

Determination of Significance (DS) (SEPA) A written decision by the Region Administrator that a proposal could have a significant adverse impact and that an EIS is required.

Environmental Assessment (EA) (NEPA) A document prepared for federally funded, permitted, or licensed projects that are not categorical exclusions (CE) but do not appear to be of sufficient magnitude to require an EIS. The EA provides enough analysis to determine whether an EIS or a FONSI should be prepared.

Environmental Classification Summary (ECS) A form used to evaluate and classify projects for the construction program. The ECS supports a decision of a documented CE.

Environmental Impact Statement (EIS) A detailed written statement of a proposed course of action, project alternatives, and the possible impacts of the proposal.

Environmental Review Summary (ERS) Part of the Project Summary document, it identifies environmental permits and approvals. The ERS is prepared in the Region and is required for Design Approval.

Finding of No Significant Impact (FONSI) (NEPA) A federal document indicating that a proposal will not significantly affect the environment and that an EIS is not required.

NEPA National Environmental Policy Act

ROD Record of Decision

SEPA State Environmental Policy Act

220.04 Determining the Environmental Documentation

The Environmental Review Summary (ERS) provides the first indication of what form the environmental documentation will take. The ERS is prepared as part of the Project Summary, which is prepared during the scoping phase of all projects in the construction program. The Project Summary includes three components:

- Project Definition
- Design Decisions Summary
- Environmental Review Summary

The ERS form is found in the Project Summary database in each Region. The *Environmental Procedures Manual* has detailed instructions on how to prepare the ERS. The process for classifying projects and determining the environmental document is similar for NEPA and SEPA and generally is as follows:

- Once the project has been sufficiently developed to assess any environmental impacts, the Region completes the ERS based on the best information available at the scoping phase of development.
- The Region Environmental Manager then concurs with the classification by signing the ERS and returning the completed form to the Region Design Office for inclusion in the Project Summary package.
- For NEPA, if a project has been determined to be a Categorical Exclusion (CE), the NEPA environmental review process is considered complete. If it is determined that a Documented Categorical Exclusion (DCE), Environmental Assessment (EA), or Environmental Impact Statement (EIS) is required, the Region evaluates the project schedule and arranges for preparation of the appropriate document.
- For SEPA, the signing and submittal of the ERS completes the environmental classification process. On projects that are categorized as exempt from SEPA, the environmental process is complete, unless the project requires consultation under the Endangered Species Act. On projects that do not meet the criteria for a SEPA Categorical Exemption (WAC 197-11-800 and WAC 468-12) and require a SEPA checklist (WAC 197-11-960) or an EIS, those documents are prepared as necessary prior to Project Development Approval.

The ERS allows environmental staff to consider at this early stage potential impacts and mitigations and required permits. For many projects, the WSDOT Environmental GIS Workbench coupled with a site visit provides sufficient information to fill out the ERS (see the *Environmental Procedures Manual*).

For most WSDOT projects, the Federal Highway Administration (FHWA) is the lead agency for NEPA. Other federal lead agencies on WSDOT projects are the Federal Aviation Administration, Federal Railroad Administration, and the Federal Transit Administration (FTA).

220.05 Identifying the Project Classification

Based on the environmental considerations identified during preparation of the ERS, WSDOT projects are classified for NEPA/SEPA purposes to determine the type of environmental documentation that will be required. Projects with a federal nexus (using federal funds, involving federal lands, or requiring federal approvals or permits) are subject to NEPA and SEPA. Projects that are state funded only, with no federal nexus including federal permits, follow SEPA guidelines. Since many WSDOT projects are prepared with the intent of obtaining federal funding, NEPA guidelines are usually followed. The *Environmental Procedures Manual* provides detailed definitions of the classes of projects and lists the types of work typically found in each class; FHWA/federal agency concurrence requirements; and procedures for classifying and, if necessary, reclassifying the type of environmental documentation for projects.

Projects subject to NEPA are classified as Class I, II, or III. Class I projects require preparation of an EIS because the action is likely to have significant adverse environmental impacts. Class II projects are Categorical Exclusions or Documented Categorical Exclusions that meet the definitions contained in 40 CFR 1508.4 and 23 CFR 771.117. These are actions that are not likely to cause significant adverse environmental impacts. Class III projects require an Environmental Assessment (EA) because the significance of the impact on the environment is not clearly established.

SEPA has a similar, but not identical, system. SEPA recognizes projects that are categorically exempt, projects that require an EIS, and projects that do not require an EIS. WSDOT projects that are CEs under NEPA (Class II) may not be categorically exempt under SEPA.

If the project is not exempt under SEPA, WSDOT must issue a threshold determination and then prepare a SEPA Checklist or EIS. The threshold determination may be a determination of nonsignificance (DNS) or a determination of significance (DS) requiring an EIS. WSDOT may adopt a NEPA EA FONSI to satisfy the requirements for a DNS.

220.06 Environmental Impact Statements – Class I Projects

Class I projects are actions that are likely to have significant impact on the environment because of their effects on land use, planned growth, development patterns, traffic volumes, travel patterns, transportation services and natural resources, or because they are apt to create substantial public controversy. An EIS may follow an EA if significant impacts are discovered during preparation of an EA. The *Environmental Procedures Manual* has details on EIS documents and procedures. WSDOT typically prepares a joint NEPA/SEPA EIS to satisfy both statutes.

Examples of projects that usually require an EIS, as referenced in 23 CFR 771.115, are as follows:

- New controlled-access freeway
- Highway projects of four or more lanes in a new location
- New construction or extension of fixed rail transit facilities (for example, rapid rail, light rail, commuter rail, automated guideway transit)
- New construction or extension of a separate roadway for buses or high-occupancy vehicles not located within an existing highway facility
- Construction of a new ferry terminal or large-scale changes to existing terminal facilities

Although examples are given, it is important to remember that it is the size and significance of the potential impacts that determine the need for an EIS, not the size of the project. "Significance" is not always clearly defined but is generally determined by the impact's "context" and "intensity." Having a significant impact in just one area is sufficient to warrant preparation of an EIS.

Only about 3% of WSDOT's projects go through the EIS process. Typically these are the larger, more complicated projects often in urban areas or involving new right of way and important natural or cultural resources. The process takes from two to five years or longer depending on the issues and stakeholders. EISs are expensive because of the amount of information produced, the level of design required, the frequency of redesign to address issues that are discovered, and the higher level of agency and public involvement. WSDOT has prepared an EIS "Reader-Friendly Tool Kit" to simplify the content of EISs and to improve them as a communication tool to inform the public and decision-makers. Both federal and state initiatives exist to streamline the EIS process and reduce the costs.

220.07 Categorical Exclusions – Class II Projects

The FHWA NEPA Regulations identify project types that qualify as CEs (23 CFR 771.117). In general, CEs are actions that, based on past experience with similar projects, do not have significant environmental impacts. CEs are subject to reevaluation by FHWA where there are unusual circumstances, such as new environmental impacts; controversy on environmental grounds; unforeseen impacts to cultural, historic, or recreational resources (Section 4(f) or Section 106); or inconsistencies with federal, state, or local laws.

CEs are defined further by two subcategories: CEs not requiring FHWA concurrence and Documented Categorical Exclusions (DCEs). Projects defined as CEs not requiring FHWA concurrence must meet the requirements of the *Memorandum of Understanding Between WSDOT and FHWA on Programmatic Categorical Exclusion Approvals*, signed May 25, 1999 (see the *Environmental Procedures Manual*). This may include preparation of a Biological Assessment (BA) to document effects to endangered and threatened species. If a "no effects" determination is the outcome of the BA, then the only NEPA documentation required is a signed ERS that is included in the Project Summary package sent to HQ Systems Analysis and Program Development. No other NEPA documentation or approval by FHWA is required.

For DCEs, additional environmental documentation is required and FHWA approval must be obtained before the Project File can be approved. All environmental documentation must be completed before finalizing the PS&E package and going to ad. The ERS is then renamed the Environmental Classification Summary (ECS), signed by the Region Environmental Manager, and sent with federal permits and/or documentation to FHWA for approval.

After obligation of project design funds, detailed environmental studies for CE documentation may be required for DCE projects to determine the environmental, economic, and social impacts. WSDOT then finalizes the ECS and submits it to FHWA for final approval.

220.08 Environmental Assessments – Class III Projects

Under NEPA, when the significance of the impact of a proposed project on the environment is not clearly established, an Environmental Assessment (EA) is prepared to determine the extent of environmental impact and to determine whether an EIS is needed. WSDOT may adopt the EA to satisfy requirements for a SEPA DNS, but the EA will not satisfy the EIS requirement under SEPA. No EIS is required when the EA supports a NEPA Finding of No Significant Impact (FONSI). Issuance of a FONSI (normally by the FHWA) is the final step in the EA process. (See Section 411.04 of the *Environmental Procedures Manual* for details on EA documentation and procedures.)

220.09 Reevaluations

Both NEPA and SEPA allow for reevaluating the project classification or environmental document. In general, reevaluations are required when there are substantial changes to the scope of a project, such that the project is likely to have significant adverse environmental impacts, or there is new information that increases the likelihood that a project will have significant adverse environmental impacts. Reevaluations are also required if project construction has not begun within five years of completing the NEPA process.

Because FHWA must concur with the NEPA classification, any major change in a project classification for a project involving federal funds requires the processing of a revised ECS form. Minor changes may be handled informally, if FHWA concurs.

For SEPA, when the scope of a project is changed, a revised ERS is normally required, with some exceptions. As part of that revision process, the environmental classification needs to be reassessed. The decision on whether or not to revise the ERS is made by the Region Environmental Office in coordination with the Region Program Management Office. For many minor scope changes, a new ERS is not required. A note to the file or a follow-up memo is then prepared to document the revision.

In some cases, new circumstances may cause a change in the environmental classification but not a change in scope. Document any changes in classification with a note to the file or a follow-up memo.

220.10 Commitment File

As an initial part of project development, the Region establishes a project commitment file. Establishment of this file generally coincides with preparation of the environmental document or might be at later stages as required. The file consists of proposed mitigating measures, commitments made to resource or other agencies with permitting authority, and other documented commitments made on the project. Also included in the file are design and environmental commitments. Other commitment types (ROW, Maintenance, etc.) may be added at the Region's discretion.

The Region continues to maintain the commitment file as a project progresses through its development process. Whenever commitments are made, they are incorporated into project documents and transferred from one phase of the project to the next. Commitments are normally included or identified in the following documents or actions:

- Environmental documents and consultations
- Design Documentation Package (DDP)
- Environmental permits
- MOUs/Letters to stakeholders
- Right of way plans
- Access plans
- Findings and Order from access hearings
- Contract document

- Preconstruction conference
- Change orders
- End of project report
- Maintenance

To organize and track commitments made during the development and implementation of a project, WSDOT has established a Commitment Tracking System (CTS). This system provides easy access and retrieval of commitment information. Reports from the system establish the commitment record for the Project File. When a commitment is made, log it in the CTS. The entry requires sufficient detail necessary to document the commitment, including references to correspondence, agreement numbers, etc. A commitment may be revised when WSDOT and the organization or individual involved agree to the revision.

When commitments are completed, the CTS is updated with the date the commitment was finished and appropriate comments. Commitments requiring ongoing maintenance need to be formally passed off to Maintenance and Operations for incorporation into the Maintenance Program.

220.11 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

Chapter 240 Environmental Permits and Approvals

240.01 Introduction

WSDOT projects are subject to a variety of federal, state, and local environmental permits and approvals. The *Environmental Procedures Manual* provides detailed guidance on the applicability of each permit and approval. Because the facts of each project vary and the environmental regulations are complex, reliance on either the *Design Manual* or the *Environmental Procedures Manual* is insufficient. Consult the Region and Headquarters (HQ) Environmental offices.

240.02 Permits and Approvals

The Environmental Review Summary (ERS) prepared as part of the Project Summary identifies some of the most common environmental permits that might be required based on the information known at that stage. As the project design develops, additional permits and approvals can be identified. Conducting project site visits for engineering and environmental features may reduce project delays due to late discoveries. Coordinate with the Region and HQ Environmental offices.

Figures 240-1a through 1e provide a comprehensive list of the environmental permits and approvals required by WSDOT projects. For each permit or approval, the responsible agency is identified, the conditions that trigger the permit are listed, the relevant sections of the *Environmental Procedures Manual* are provided, and the statutory authority is cited.

The conditions that trigger a permit or approval are discussed in detail in the *Environmental Procedures Manual*. The permit triggers are subject to interpretation and change as new regulations are developed or court decisions are rendered that alter their applicability. Determining which permits and approvals apply and how they apply is dependent on the facts of each project. Consult the Environmental Office at each stage of the project design to review the permits and approvals that might be required based on the project design.

Permit or Approval	Responsible Agency	Conditions Requiring	Environmental Procedures	Statutory Authority
National Environmental Policy Act (NEPA)	FHWA and WSDOT	Activities that require federal permits, approvals, or funding trigger NEPA procedural and documentation requirements.	320, 410-480	42 USC 4321 23 CFR 771 40 CFR 1500-1508
State Environmental Policy Act (SEPA)	Ecology	Any activity not categorically exempt triggers SEPA procedural and documentation requirements.	410-480	RCW 43.21C WAC 197-11, WAC 468-12
Corps of Engineers Section 404 Individual Permits (Uses Joint Aquatic Resource Permits Application [JARPA])	COE	Any discharging, dredging, or placing of fill material in waters of the U.S. and adjacent wetlands	431, 432, 437, 452, 510	Section 404 of the Clean Water Act (CWA); 33 USC 1344, 33 CFR 330.5 and 330.6
Corps of Engineers Section 404 Nationwide Permits (NWP) (Uses JARPA)	COE	NWP information is presented in a 2002 special public notice issued by the COE. A total of 44 NWPs for a range of activities in waters of the US are described in the public notice.	431, 432, 437, 452, 510	Section 404 of the CWA; 33 USC 1344, 33 CFR 330.5 and 330.6
Water Quality 401 Certification (Uses JARPA)	Ecology Headquarters, Shorelands and Environmental Assistance Program, Coordination Section; U.S. EPA on Tribal and Federal land	Any activity requiring a federal permit for discharging into waters must receive certification from the state that the discharge complies with that state's water quality standards.	431, 432, 437, 452, 453	33 USC 1341, 33 CFR 320.4; RCW 90.48, WAC 173-225
Coastal Zone Management (CZM) Certification (Uses JARPA)	Ecology Headquarters, Shorelands and Environmental Assistance Program	Any activity requiring a federal permit/license must certify that the activity will comply with the State's Coastal Zone Management Program (Shoreline Management Act).	431, 432, 437, 452, 520	16 USC 1456, 33 CFR 320.3, RCW 90.58
Coast Guard Section 9 Bridge Permit (Uses JARPA)	U.S. Coast Guard	Any work on bridges and causeways in navigable waters or waters that are susceptible to improvement for transporting interstate or foreign commerce, or waters that are used by boats 21 feet or more in length.	431, 432, 452, 453	Section 9 of the Rivers and Harbors Act; 33 USC 401; 33 CFR 114 and 115; Federal Aid Highway Act of 1987. Section 123(b)
Corps of Engineers Section 10 Permit (Uses JARPA)	COE	Any obstruction, alteration, or improvement of any navigable water, including rechanneling, piers, wharfs, dolphins, bulkheads, and buoys.	431, 432, 452	Section 10 of the Rivers and Harbors Act; 33 USC 401; 33 CFR 330.5 and 330.6
Threatened and Endangered Species	USFWS and NMFS	Projects affecting critical habitat of species listed under the ESA may be subject to water quality and wetland permits listed in Section 431.06 and Section 437.06.	436, 447, 510, 520	16 USC 1531-1543

Permits and Approvals
Figure 240-1a

Permit or Approval	Responsible Agency	Conditions Requiring	Environmental Procedures	Statutory Authority
Historic Preservations Act - Section 106	OAHP SHPO	Potential impacts to historic or archaeological properties trigger Section 106 procedural and documentation requirements.	411, 456	16 USC 470 Sec.106 36 CFR 800 RCW 43.51.750
Land and Water Conservations Act - Section 6(f)	FHWA and Affected Agency (WSDOT)	Use of lands purchased with LWCA funds triggers Section 6(f) procedural and documentation requirements.	411, 455	LWCA, 16 USC
U.S. Dept of Transportation Act - Section 4(f)	FHWA and Affected Agency (WSDOT)	Use of park and recreation lands, wildlife and waterfowl refuges, and historic sites of national, state, or local significance triggers Section 4(f) procedural and documentation requirements.	411, 455	49 USC 1651 Sec. 4 (f) 23 CFR 138
Wild and Scenic Rivers	FHWA and Affected Agency	No specific permits are required for projects in wild and/or scenic river corridors, but water quality permits may apply.	453	16 USC 1271
Farmland Conversion	NRCS Counties/Cities	NRCS Form AD1006 approval may be required if project entails conversion of farmlands. Local grading permits may also be required.	454	7 USC 4201 7 CFR 650
Airport/Highway Clearance	FAA (Federal)	Airspace intrusion by a highway facility (i.e. proposed construction in the vicinity of public use or military airports) may require FAA notification.	460	FHPM 6-1-1-2 FAA Regs. Part .77
(NPDES Municipal Stormwater Discharge General Permit	Ecology	WSDOT projects that discharge stormwater. There are four geographical areas covered by separate general permits that are based on watershed boundaries: Island, Snohomish, South Puget Sound, and Cedar/Green.	431, 433	33 USC 1342, RCW 90.48, WAC 173-226
NPDES Stormwater Construction Permit	Ecology	WSDOT construction activities disturbing more than 5 acres.	431, 433	33 USC 1342, RCW 90.48, WAC 173-226
NPDES Sand and Gravel General Permit	Ecology	Discharges of process water and stormwater associated with sand and gravel operations and rock quarries.	431, 433	33 USC 1342, RCW 90.48; WAC 173-226
NPDES Stormwater Industrial Permit	Ecology	Ferry-related activities that discharge stormwater to waters of the state.	431, 433	33 USC 1342, RCW 90.48; WAC 173-226
Underground Injection Control	Ecology	Injection well that may contaminate drinking water.	433	40 CFR 144 RCW 43-21A.44 , WAC 173-218

Permits and Approvals
Figure 240-1b

Permit or Approval	Responsible Agency	Conditions Requiring	Environmental Procedures	Statutory Authority
Hazardous Waste Tracking Form	Ecology	A WAD tracking number from Ecology is required for transport, storage, or disposal of dangerous waste.	447	WAC 173-303
Water Quality Permit. Use of Herbicides to Control Noxious Weeds on WSDOT Properties and Projects within the State of Washington	Ecology, Environmental Coordination Section, Federal Permit Manager for WSDOT	Application of herbicides to waters of the state at WSDOT-owned or –managed sites to control noxious weeds.	431	RCW 90.48.445, and WAC 173-201A-110
Administrative Order # DE99WQ-003. WSDOT Use of Herbicides to Control Non-noxious Weeds on WSDOT Properties and Projects within the State of Washington	Ecology, Environmental Coordination Section, Federal Permit Manager for WSDOT	Approved methods of application must be followed and careful record keeping must be documented. WDFW must be consulted for identification of salmonid bearing waters and special seasonal timing restrictions. Restrictions and public notice requirements are placed on herbicide application within 0.5 mile of areas of potential public use.	431	RCW 90.48, and WAC 173-201A-110
Water Right Permit	Ecology, Water Resources Program	Any withdrawal of surface or groundwater for a WSDOT activity or project.	431, 433	RCW 90.03; 90.44; 90.54
State Waste Discharge (SWD) Permit	Ecology	Any activity that will discharge or dispose of municipal and industrial wastewater into groundwaters of the state, or discharge industrial wastewater to a NPDES-permitted wastewater treatment plant. SWD permits are different from NPDES permits because NPDES permits regulate discharges directly to water or stormwater systems.	433	RCW 90.48; WAC 173-226
Water System Project Approvals	Washington State Department of Health or County/City Department of Health	Any project in which there are two or more water service connections for human consumption and domestic use.	431, 433	RCW 43.20A; WAC 246-290 through 293
Hydraulic Project Approval (HPA)	WDFW	Any project that will use, cross, divert, obstruct, or change the natural flow or bed of any of the salt or fresh waters of the state. Regulated activities include culvert work, stream realignment, and bridge replacement.	431, 432, 436, 447, 452, 453, 510, 520	RCW 75.20.100; WAC 220-110;

Permits and Approvals
Figure 240-1c

Permit or Approval	Responsible Agency	Conditions Requiring	Environmental Procedures	Statutory Authority
Fish Habitat Enhancement Project Application	WDFW	Streamlined process for projects designed to enhance fish habitat. Application is in addition to JARPA.	436	
Aquatic Resource Use Authorization (Uses JARPA)	DNR	Included in JARPA.	436, 437, 520	RCW 79.90 WAC 332-30
Easements	DNR	Any activity that fills, crosses over, bridges, or is on the beds of navigable waters of the state.	436, 437, 520	RCW 47.12
Monument Removal	DNR	Removal or destruction of a monument.	451	
Operating Permit for Surface Mining	DNR, USFS, BLM	Surface mining (pit and quarry sites); more than 3 acres disturbed at one time or pit walls more than 30 feet high and steeper than 1:1; pit site reclamation (WDNR). Borrow pits on federal land may require a permit or easement from the land-management agency.	420, 510	RCW 78.44
Forest Practices Application	DNR	Road construction, pits, pesticide use, and other specified activities on public or private forest land (i.e., land capable of supporting merchantable timber).	455	RCW 76.09 WAC 222
Shoreline Substantial Development Permit (Uses JARPA)	Counties or Cities	Qualified activities within shoreline jurisdiction – lakes/reservoirs 20 acres or greater, streams with 20 cfs annual flow, marine water, and all areas landward for 200 feet of OHWM.	431, 432, 437, 452, 520	RCW 90.48, WAC 173-10 through 173-28
Flood Plain Development Permit (Uses JARPA)	Counties or Cities	Any structure or activity that may adversely affect the flood regime of a stream within the flood zone.	432	RCW 86.16; WAC 173-158
Critical Areas Ordinance (Uses JARPA)	Counties and Cities	Any activity involving critical areas as regulated by the local jurisdiction. Critical areas include wetlands, critical recharge areas to aquifers, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas.	420, 431, 436, 437, 451, 520	RCW 36.70A

Permits and Approvals
Figure 240-1d

Permit or Approval	Responsible Agency	Conditions Requiring	Environmental Procedures	Statutory Authority
Clearing, Grading, and Building Permits	Counties / Cities	Clearing and grading of land for development with impacts outside WSDOT right of way (includes connecting streets, frontage roads, etc.). Construction of any building for human habitation.	420, 451, 454, 460, 520	RCW 36.21.080
Temporary Air Pollution	Ecology, Local Clean Air Agencies, Fire Protection Agencies	Pollutants above allowed levels for temporary periods; includes building demolition and brush burning. Regulations may limit the type, size, or timing of brush burning.	425	RCW 70.94
New Source Construction	Ecology, Local Clean Air Agencies	Air pollution from a point source (e.g., asphalt plants, rock crushers).	425	RCW 70.94.152
Noise Variance	Counties / Cities	Construction and maintenance activities during nighttime hours may require a variance from local noise ordinances. Daytime noise from construction is usually exempt.	446	WAC 173-60
Archaeological Resources Protection Permit	Tribes Federal Landowners, (e.g. BLM, COE, NPS)	Excavation or removal of archaeological resources from tribal or federal land.	456	43 CFR 7.6 – 7.11

BLM – Bureau of Land Management
CFR – Code of Federal Regulations
COE – Corps of Engineers
CWA – Clean Water Act
CZMA – Coastal Zone Management Act
DNR – Department of Natural Resources
DOE – Department of Ecology
EPA – Environmental Protection Agency
ESA – Endangered Species Act
FERC – Federal Energy Regulatory Commission
LWCA – Land and Water Conservation Act
NMFS – National Marine Fisheries Service
NPDES – National Pollution Discharge Elimination System
NPS – National Park Service
NRCS – Natural Resources Conservation Service
OAHP – Office of Archaeology and Historic Preservation
OHWM – Ordinary High Water Mark
RCW – Revised Code of Washington
SHPO – State Historic Preservation Officer
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
WAC – Washington Administrative Code
WAD – EPA, Washington State waste ID tracking number
WDFW – Washington State Department of Fish and Wildlife

Permits and Approvals
Figure 240-1e

240.03 Project Types and Permits

Understanding and anticipating what permits and approvals may be required for a particular project type will assist the designer in project delivery. This section provides information on what project types are likely to trigger which permits. The purpose of this section is to inform designers of the potential for permits and does not substitute for the information developed in the Environmental Review Summary prepared during the Project Summary or more specific permit information developed during design. The intent is to provide a familiar and reasonably quick method for gauging the relative complexity of the permit process. Designers are encouraged to use the expertise in the Region Environmental Office and the HQ Environmental Services Office.

To make the evaluation familiar, this chapter uses the design matrices developed in Chapter 325 as a template. The project types and definitions are found in Chapter 325, with the exception of some additional project types for bridge work. These additional bridge projects are defined below. Rather than identify levels of design for each project type, the matrices identify permits and approvals. While every project is unique to some degree, there are common facts associated with project types that allow for a level of predictability. As the project type gets more complex, the predictability of which environmental permits and approvals may be triggered decreases.

Figures 240-2 through 240-7 present certain project types combined with assumptions on environmental conditions to generate probabilities about required permits and approvals. The probabilities cannot be substituted for a fact-based analysis of the project and the applicability of any particular environmental permit or approval. Contact the Region or HQ Environmental Office before decisions are made about whether a permit or approval applies. Coordination with the HQ Bridge and Structures Office and the HQ Environmental Services Office is recommended for bridge projects.

The probabilities for needing a permit are divided into low, medium, and high. A low probability generally means that the thresholds for triggering an environmental permit or approval may not be reached under the assumptions behind the project type. A medium probability means that there is the potential to trigger the application of the permit or approval. A high probability means that there is a likelihood of triggering the permit or approval.

The assumptions underlying the project types and probabilities are shown as endnotes following the matrices (Figure 240-7). Some general assumptions were made regarding the project types; for main line projects on the Interstate, National Highway System main line (except Interstate), or non-National Highway System, all bridgework is assumed to be over water. For interchange projects on the Interstate and non-Interstate, all bridgework is assumed to be over roads (see Chapter 325).

The environmental permits and approvals selected for inclusion in the matrices represent the ones that are most frequently triggered. The other permits and approvals listed in Figures 240-1a through 1e are more limited in their application and often require very specific fact situations. They are discussed in more detail in the *Environmental Procedures Manual.*

The additional bridge projects are as follows:

- **Bridge Replacement (Obsolete, Structural)**. Projects to replace or rehabilitate state-owned bridges when continued maintenance and preservation strategies can no longer accommodate safe, continuous movement of people and goods. Includes new or replacement bridge (on or over, main line, interchange ramp, or water body), and repair or replacement of reinforced concrete, steel, and/or timber bridges. Obsolete replacement typically includes bridges that have a narrow width or low vertical clearance or a restrictive waterway opening. Structural replacement is a replacement of a bridge that has a structural deficiency in a superstructure or substructure element.
- **Existing Bridge Widening**. Widening an existing bridge for an existing highway.
- **Bridge Deck Rehabilitation**. Structures preservation projects that repair delaminated concrete bridge deck and add a protective overlay that will provide a sound, smooth surface; prevent further corrosion of the reinforcing steel; and preserve operational and structural capacity. The goal is to ensure safe, long-lasting riding surfaces on all reinforced concrete bridges.
- **Bridge Scour Countermeasures**. Measures undertaken to reduce the risk of bridge foundation scour damage and stream bank erosive forces that increase the potential of bridge collapse due to flooding and long-term waterway changes. The goal is to maintain the structural integrity of the roadway prism and highway structures. Bridge scour repair can include repair to the streambed around a bridge column or repairs to stream banks near a bridge. This category typically involves an in-depth engineering and environmental review for site and/or reach processes. Extensive documentation and permitting are typically needed. Early and close coordination with the permit agency representatives through the Region Environmental Office is essential. Close coordination with the HQ Bridge Preservation Office, Hydraulics Branch, and Environmental Services Office (watershed, permit program) are useful to ensure that a one-WSDOT project approach is established early in the design phase.
- **Steel Bridge Painting**. Measures undertaken to preserve the load-carrying capacity of steel bridges by maintaining properly functioning paint systems to provide protection against corrosion. These measures include high-pressure washing and spot abrasive blasting to prepare steel surfaces for painting. This category typically involves discharge of wastewater into waters of the state and the decisions surrounding the need for full or partial containment of the wash water and blast media used for preparing the steel surfaces. Early and close coordination with the Bridge Management Engineer is necessary. A thorough review of the *Standard Specifications'* current Water Quality Implementing Agreement (WQIA) and available Programmatic Permits, such as the General Hydraulic Project Approval (GHPA) and National Pollution Discharge Elimination System (NPDES) permits, is also recommended. Early project scoping for determination of wildlife usage is another factor for early coordination with all departments.

- **Bridge Seismic Retrofit**. Seismic retrofit of a bridge element (typically bridge columns). Measures undertaken to reduce the vulnerability of existing Washington State-owned bridges in the high to moderate seismic risk areas to earthquake damage that could cause collapse, excessive repair costs, or lengthy closures to traffic. This includes Phase 1 repairs (prevent span separation), Phase 2 repairs (retrofit single-column supports), and Final Phase (retrofit multiple-column supports).
- **Special Bridge Repair (Electrical/Mechanical Retrofit)**. Rehabilitating a major portion of an existing bridge to include electrical and mechanical repairs, such as for a movable bridge, a bridge over navigable water, or sign support structures.
- **Other Bridge Structures**. Major repair or replacement of Sign Bridges, Cantilever Sign Supports, Bridge-Mounted Sign Supports, Tunnels, and High Mast Light Standard.
- **New Special Structures**. Measures taken to build a new floating, movable, suspension, or cable stayed bridge for new or existing roadway.

⇩ Project Type / Permit or Approval(***) ⇨	Section 404 Individual Permits	Section 404 Nationwide Permits (NWP)	Water Quality 401 Certification[1]	Coastal Zone Management (CZM) Certification[2]	Threatened and Endangered Species	Hydraulic Project Approval (HPA)	Shoreline Substantial Development Permit	Flood Plain Development Permit	Aquatic Resource Use Authorization	NPDES Municipal Stormwater Permit[3]	NPDES Stormwater Construction Permit	NPDES Industrial Discharge Permit	State Waste Discharge (SWD) Permit[4]	Section 9 Bridge Permit[5]	Section 10 Permit[6]	Section 106	Section 4(f) 6(f)	Critical/Sensitive Areas Ordinances[7]	Noise Variance
(1-1) Preventive Maintenance																			
Pavement Restoration																			
(1-2) Diamond Grinding	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(1-3) Milling with HMA Inlays	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(1-4) Nonstructural Overlay	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
Pavement Rehab./Resurf.																			
(1-5) HMA Structural Overlays	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(1-6) PCCP Overlays	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(1-7) Dowel Bar Retrofit	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
Bridge Rehabilitation																			
(1-8) Bridge Widening	M	M	M	M	M	H	H	M	L	L	L	L	L	M	M	M	L	M	L**
(1-8a) Existing Bridge Replacement	M/H	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	H	M	M	M
(1-8b) Bridge Deck Rehabilitation	M	L	L	H	M	M	H	L	L	H	L	L	L	M	L	M	L	L	M
(1-8c) Bridge Scour Countermeasures	M	H	H	H	H	H	H	L	M	L	L	L	L	M	M	M	L	H	L
(1-8d) Steel Bridge Painting	L	L	H	H	M	H	L	L	L	L	L	L*	L	M	L	L	L	L	M**
(1-8e) Bridge Seismic Retrofit	L	M	M	M	M	H	L	L	L	L	L	L	L	M	L	L	L	L	L
(1-8f) Special Bridge Repair	L	M	M	M	M	M	L	L	L	L	L	L	L	M	L	L	L	L	M
Safety																			
(1-9) Median Barrier	L	M	M	L	L	L	L	L	L	H	M	L	L	L	L	L	L	L	L
(1-10) Guardrail Upgrades	L	M	M	L	L	L	M	L	L	H	M	L	L	L	L	L	L	L	L
(1-11) Bridge Rail Upgrades	L	L	L	H	L	L	H	L	L	H	L	L	L	L	L	M	L	L	L
Reconstruction																			
(1-12) New/Reconstruction	M/H	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	H	M	M	M

Note: For explanation of matrices, see Figure 240-7.

Project Environmental Matrix 1:
Permit Probabilities for Interstate Routes (Main Line)
Figure 240-2

⇩ Project Type / Permit or Approval ⇨	Section 404 Individual Permits	Section 404 Nationwide Permits (NWP)	Water Quality 401 Certification[1]	Coastal Zone Management (CZM) Certification[2]	Threatened and Endangered Species	Hydraulic Project Approval (HPA)	Shoreline Substantial Development Permit	Flood Plain Development Permit	Aquatic Resource Use Authorization	NPDES Municipal Stormwater Permit[3]	NPDES Stormwater Construction Permit	NPDES Industrial Discharge Permit	State Waste Discharge (SWD) Permit[4]	Section 9 Bridge Permit[5]	Section 10 Permit[6]	Section 106	Section 4(f) 6(f)	Critical/Sensitive Areas Ordinances[7]	Noise Permit
(2-1) Preventive Maintenance																			
Pavement Restoration																			
(2-2) Diamond Grinding	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
(2-3) Milling with HMA Inlays	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
(2-4) Nonstructural Overlay	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
Pavement Rehab./Resurf.																			
(2-5) HMA Structural Overlays	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
(2-6) PCCP Overlays	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
(2-7) Dowel Bar Retrofit	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
Bridge Rehabilitation																			
(2-8) Bridge Deck Rehabilitation	M	L	L	H	M	M	H	L	L	H	L	L	L	M	L	M	L	L	M**
(2-8a) Steel Bridge Painting	L	L	H	H	M	H	L	L	L	L	L	H	L	M	L	L	L	L	L
(2-8b) Bridge Seismic Retrofit	L	M	M	M	M	H	L	L	L	L	L	L	L	M	L	L	L	L	L
Safety																			
(2-9) Guard Rail Upgrades	L	M	M	L	L	L	M	L	L	H	M	L	L	L	L	M	L	L	L
(2-10) Bridge Rail Upgrades	L	L	L	M	L	L	M	L	L	H	M	L	L	L	L	M	L	L	L
Reconstruction																			
(2-11) New/Reconstruction	M/H	H	H	H	H	H	H	M	L	H	H	L	L	L	L	H	M	M	M

Note: For explanation of matrices, see Figure 240-7.

Project Environmental Matrix 2:
Permit Probabilities for Interstate Interchange Areas
Figure 240-3

⇩ Project Type / Permit or Approval ⇨	Section 404 Individual Permits	Section 404 Nationwide Permits (NWP)	Water Quality 401 Certification[1]	Coastal Zone Management (CZM) Certification[2]	Threatened and Endangered Species	Hydraulic Project Approval (HPA)	Shoreline Substantial Development Permit	Flood Plain Development Permit	Aquatic Resource Use Authorization	NPDES Municipal Stormwater Permit[3]	NPDES Stormwater Construction Permit	NPDES Industrial Discharge Permit	State Waste Discharge (SWD) Permit[4]	Section 9 Bridge Permit[5]	Section 10 Permit[6]	Section 106	Section 4(f) 6(F)	Critical/Sensitive Areas Ordinances[7]	Noise Permit
Preservation																			
Roadway																			
(3-1) Non-Interstate Freeway	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(3-2) HMA/PCCP/BST Overlays	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(3-3) Replace HMA w/ PCCP at I/S	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
Structures																			
(3-4) Bridge Replacement	H	H	H	H	H	H	H	H	M	H	H	L	L	M	M	M	M	M	L
(3-5) Bridge Deck Rehab.	M	L	L	H	M	M	H	L	L	H	L	L	L	M	L	M	L	L	M
(3-5a) Bridge Scour	M	H	H	H	H	H	H	L	M	L	L	L	L	M	M	M	L	H	L
(3-5b) Steel Bridge Painting	L	L	H	H	M	H	L	L	L	L	L	H	L	M	L	L	L	L	L
(3-5c) Bridge Seismic Retrofit	L	M	M	M	M	H	L	L	L	L	L	L	L	M	L	L	L	L	L
(3-5d) Special Bridge Repair	L	M	M	M	M	M	L	L	L	L	L	L	L	M	L	L	L	L	M
Improvements																			
Mobility																			
(3-6) Non-Interstate Freeway	M/H	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	M	M	M	M**
(3-7) Urban	M/H	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	M	M	M	M**
(3-8) Rural	M	H	H	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(3-9) HOV	M	M	M	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	M
(3-10) Bike/Ped. Connectivity	M	H	H	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	L
Safety																			
(3-11) Non-Interstate Freeway	L	L	L	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(3-12) Intersection	L	L	L	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(3-13) Corridor	L	L	L	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(3-14) Median Barrier	L	M	M	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(3-15) Guardrail Upgrades	L	M	M	L	L	L	M	L	L	H	M	L	L	L	L	M	L	L	L
(3-16) Bridge Rail Upgrades	L	L	L	M	L	L	M	L	L	H	M	L	L	L	L	M	L	L	L
(3-17) Risk: Roadside	L	H	H	L	L	L	M	M	L	H	M	L	L	L	L	M	L	L	L
(3-18) Risk: Sight Distance	L	L	L	L	L	L	M	M	L	H	M	L	L	L	L	M	L	L	L
(3-19) Risk: Roadway Width	L	H	H	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(3-20) Risk: Realignment	M	H	H	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	L
Economic Development																			
(3-21) Freight and Goods (Frost Free)	M	H	H	M	M	M	M	M	L	H	H	L	L	L	L	M	M	M	M
(3-22) Four-Lane Trunk System	M	H	H	M	M	M	M	M	M	H	H	L	L	L	L	H	H	H	M
(3-23) Rest Areas (New)	M	H	H	L	M	M	M	L	L	H	H	L	M	L	L	H	H	H	L
(3-24) Bridge Restrictions	M	H	H	H	M	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(3-25) Bike Routes (Shldrs)	L	M	M	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L

Note: For explanation of matrices, see Figure 240-7.

Project Environmental Matrix 3:
Permit Probabilities for NHS Routes, Non-Interstate (Main Line)
Figure 240-4

⇩ Project Type / Permit or Approval ⇨	Section 404 Individual Permits	Section 404 Nationwide Permits (NWP)	Water Quality 401 Certification[1]	Coastal Zone Management (CZM) Certification[2]	Threatened and Endangered Species	Hydraulic Project Approval (HPA)	Shoreline Substantial Development Permit	Flood Plain Development Permit	Aquatic Resource Use Authorization	NPDES Municipal Stormwater Permit[3]	NPDES Stormwater Construction Permit	NPDES Industrial Discharge Permit	State Waste Discharge (SWD) Permit[4]	Section 9 Bridge Permit[5]	Section 10 Permit[6]	Section 106	Section 4(f) 6(F)	Critical/Sensitive Areas Ordinances[7]	Noise Permit
Preservation																			
Roadway																			
(4-1) Non-Interstate Freeway	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
(4-2) HMA/PCCP/BST	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
Overlays Ramps	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	M
Structures																			
(4-3) Bridge Replacement	M	H	H	M	L	L	M	M	L	H	H	L	L	L	L	M	L	L	M
(4-4) Bridge Deck Rehab.	M	L	L	H	M	M	H	L	L	H	L	L	L	M	L	M	L	L	L
(4-5) Steel Bridge Painting	L	L	H	H	M	H	L	L	L	L	L	H	L	M	L	L	L	L	L
(4-6) Bridge Seismic Retrofit	L	M	M	M	M	H	L	L	L	L	L	L	L	M	L	L	L	L	L
Improvements																			
Mobility																			
(4-6) Non-Interstate Freeway	M/H	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	M	M	M	M**
(4-7) Urban	M/H	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	M	M	M	M**
(4-7) Rural	M	H	H	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
(4-8) HOV By Pass	M	H	H	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	M
(4-9) Bike/Ped. Connectivity	M	H	H	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
Safety																			
(4-10) Non-Interstate Freeway	L	L	L	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
(4-11) At Grade	L	L	L	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(4-12) Intersection	L	L	L	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(4-13) Guardrail Upgrades	L	M	M	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(4-14) Bridge Rail Upgrades	L	L	L	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(4-15) Risk: Roadside	L	H	H	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
(4-16) Risk: Sight Distance	L	L	L	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
(4-17) Risk: Roadway Width	L	H	H	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
(4-18) Risk: Realignment	M	H	H	L	L	L	L	M	L	H	M	L	L	L	L	M	L	L	L
Economic Development																			
(4-19) Four-Lane Trunk System	M	H	H	M	M	M	M	M	M	H	H	L	L	L	L	H	H	H	M

Note: For explanation of matrices, see Figure 240-7.

Project Environmental Matrix 4:
Permit Probabilities for Interchange Areas, NHS (Except Interstate) and Non-NHS
Figure 240-5

⇩ Project Type / Permit or Approval ⇨	Section 404 Individual Permits	Section 404 Nationwide Permits (NWP)	Water Quality 401 Certification[1]	Coastal Zone Management (CZM) Certification[2]	Threatened and Endangered Species	Hydraulic Project Approval (HPA)	Shoreline Substantial Development Permit	Flood Plain Development Permit	Aquatic Resource Use Authorization	NPDES Municipal Stormwater Permit[3]	NPDES Stormwater Construction Permit	NPDES Industrial Discharge Permit	State Waste Discharge (SWD) Permit[4]	Section 9 Bridge Permit[5]	Section 10 Permit[6]	Section 106	Section 4(f) 6(F)	Critical/Sensitive Areas Ordinances[7]	Noise Permit
Preservation																			
Roadway																			
(5-1) HMA/PCCP	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(5-2) BST	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(5-3) BST Routes/Basic Safety	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(5-4) Replace HMA with PCCP at I/S	L	L	L	L	L	L	M	L	L	H	L	L	L	L	L	L	L	L	
Structures																			
(5-5) Bridge Replacement	H	H	H	H	H	H	H	H	M	H	H	L	L	M	M	M	M	M	M
(5-6) Bridge Repl. (Multilane)	H	H	H	H	H	H	H	H	M	H	H	L	L	M	M	M	M	M	M
(5-7) Bridge Deck Rehab	M	L	L	H	M	M	H	L	L	H	L	L	L	M	L	M	L	L	M
(5-7a) Bridge Scour Countermeasures	M	H	H	H	H	H	H	L	M	L	L	L	L	M	M	M	L	H	L
(5-7b) Steel Bridge Painting	L	L	H	H	M	H	L	L	L	L	L	H	L	M	L	L	L	L	L
(5-7c) Bridge Seismic Retrofit	L	M	M	M	M	H	L	L	L	L	L	L	L	M	L	L	L	L	L
(5-7d) Special Bridge Repair	L	M	M	M	M	M	L	L	L	L	L	L	L	M	L	L	L	L	M
Improvements																			
Mobility																			
(5-8) Non-Interstate Freeway	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	M	M	M	M	M**
(5-9) Urban	H	H	H	M/H	H	H	M	M	H	H	L	L	L	L	M	M	M	M	M**
(5-10) Rural	M	H	H	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(5-11) HOV	M	M	M	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	M
(5-12) Bike/Ped. Connectivity	M	M	H	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	L
Safety																			
(5-13) Non-Interstate Freeway	L	L	L	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(5-14) Intersection	L	L	L	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(5-15) Corridor	L	L	L	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(5-16) Median Barrier	L	M	M	L	L	L	L	L	L	H	M	L	L	L	L	M	L	L	L
(5-17) Guardrail Upgrades	L	M	M	L	L	L	M	L	L	H	M	L	L	L	L	M	L	L	L
(5-18) Bridge Rail Upgrades	L	L	L	M	L	L	M	L	L	H	M	L	L	L	L	M	L	L	L
(5-19) Risk: Roadside	L	H	H	L	L	L	M	M	L	H	M	L	L	L	L	M	L	L	L
(5-20) Risk: Sight Distance	L	L	L	L	L	L	M	M	L	H	M	L	L	L	L	M	L	L	L
(5-21) Risk: Roadway Width	L	H	H	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L
(5-22) Risk: Realignment	M	H	H	L	M	M	M	M	L	H	M	L	L	L	L	M	L	L	L
Economic Development																			
(5-23) Freight and Goods (Frost Free)	M	H	H	M	M	M	M	M	L	H	H	L	L	L	L	M	M	M	M
(5-24) Rest Areas (New)	M	H	H	M	M	M	M	L	L	H	H	L	M	L	L	H	H	H	L
(5-25) Bridge Restrictions	M	H	H	H	M	L	M	L	L	H	L	L	L	L	L	L	L	L	M
(5-26) Bike Routes (Shldrs)	L	M	M	L	L	M	M	M	L	H	M	L	L	L	L	M	L	L	L

Note: For explanation of matrices, see Figure 240-7.

Project Environmental Matrix 5: Non-NHS Routes (Main Line)
Figure 240-6

NOTES

For Figures 240-2 through 240-6
For main line projects on the Interstate, National Highway System main line (except Interstate), or non-National Highway System, all bridgework is assumed to be over water. For interchange projects on the Interstate and non-Interstate, all bridgework is assumed to be over roads (see Chapter 325).

NEPA/SEPA Endnotes
(*) Programmatic permits may apply
(**) Night work may require variance
(***) NEPA/SEPA compliance is required on all projects. The level of documentation will correspond to the complexity of the project and the potential environmental impacts anticipated (see Region or HQ environmental staff).

Section 404 IP Endnotes
L = Low probability assumes the work is covered by an NWP.
M = Medium probability assumes the potential for impacts beyond the thresholds for an NWP.
H = High probability assumes a likelihood for impacts beyond the thresholds for an NWP.

Section 404 NWP Endnotes
L = Low probability assumes no work and/or fill below the OHWM or wetlands in waters of the U.S.
M = Medium probability assumes potential for work and/or fill below the OHWM in waters of the U.S. and/or minimal wetland fill.
H = High probability assumes likelihood for work and/or fill in waters of the U.S. below the OHWM or wetland fills below ⅓ acre (tidal) or ½ acre (nontidal).

Section 401 Endnotes
(1) Parallels probability of Section 404 IP/NWP. Includes reference to Corps/Ecology/Tribes Regional General Conditions.

CZM Endnotes
(2) Parallels probability of Section 401 within 15 coastal counties only and involving waters of the state subject to Shoreline Management Act.

ESA Endnotes
L = Low probability assumes either applicable programmatic BA or individual BA and No Effect Determination.
M = Medium probability assumes either applicable programmatic or individual BA and Not Likely to Adversely Affect Determination.
H = High probability assumes either applicable programmatic or individual BA and Adverse Effect Determination (Biological Opinion).

HPA Endnotes
L = Low probability assumes no work within or over waters of the state subject to HPA.
M = Medium probability assumes potential for limited work within or over waters of the state.
H = High probability assumes likelihood for work within or over waters of the state.

Shoreline Endnotes
L = Low probability assumes no work within shorelines of the state.
M = Medium probability assumes potential for work within shorelines of the state.
H = High probability assumes likelihood for work within shorelines of the state.

Endnotes for Project Environmental Matrices
Figure 240-7

Floodplain Endnotes

L = Low probability assumes no fill in the 100-year floodplain.
M = Medium probability assumes potential for fill in the 100-year floodplain.
H = High probability assumes likelihood for fill in the 100-year floodplain.

Aquatic Resource Use Authorization Endnotes (DNR)

L = Low probability assumes no new structures or use of aquatic lands. ("Use" is subject to interpretation by DNR.)
M = Medium probability assumes potential for new structures or use of aquatic lands.
H = High probability assumes likelihood for new structures or use of aquatic lands. May need to define USE and include Easement Over Navigable Water.

Section 402 NPDES Municipal Stormwater General Permit Endnotes

(3) Applies to construction, operation, and maintenance activities in four watersheds: Island/Snohomish, Cedar/Green, South Puget Sound, and Columbia Gorge.
L = Low probability assumes project exempt from NPDES Municipal Stormwater Permit.
H = High probability assumes project subject to NPDES Municipal Stormwater Permit.

Section 402 NPDES Stormwater Construction General Permit Endnotes

L = Low probability assumes ground disturbance of less that one acre.
M = Medium probability assumes ground disturbance of one acre or more.
H = High probability assumes likelihood of ground disturbance of one acre or more.

Section 402 NPDES Industrial Discharge General Permit Endnotes

L = Low probability assumes no bridge or ferry terminal washing over waters of the state.
M = Medium probability assumes potential for bridge or ferry terminal washing over waters of the state.
H = High probability assumes likelihood for bridge or ferry terminal washing over waters of the state.

State Waste Discharge Permit Endnotes

(4) Applies to discharges of commercial or industrial wastewater into waters of the state; does not cover stormwater discharges under NPDES program.
L = Low probability assumes SWD permit does not apply.
M = Medium probability assumes potential for SWD permit.

Section 9 Bridge Permit Endnotes

(5) Applies to work on bridges across navigable waters of the U.S.
L = Low probability assumes no bridgework.
M = Medium probability assumes potential for work on a bridge across navigable water.
H = High probability assumes likelihood for work on a bridge across navigable water.

Section 10 Permit Endnotes

(6) Applies to obstruction, alteration, or improvement of navigable waters of the U.S.
L = Low probability assumes no obstructions, alterations, or improvements to navigable waters.
M = Medium probability assumes potential for obstructions, alterations, or improvements to navigable waters.
H = High probability assumes likelihood for obstructions, alterations, or improvements to navigable waters.

Endnotes for Project Environmental Matrices

Figure 240-7 (continued)

Section 106 Endnotes

L = Low probability assumes no federal nexus and/or activities exempted per the statewide Programmatic Agreement on Section 106 signed by FHWA, WSDOT, OAHP and ACHP.

M = Medium probability assumes a federal nexus; therefore, Section 106 federal regulations apply.

H = High probability assumes a federal nexus and/or the likelihood for discovery of historic or culturally significant artifacts. (See 36 CFR Part 800, *Environmental Procedures Manual*, current DOT Policy, and the Section 106 Programmatic Agreement.)

Section 4(f)/6(f) Endnotes

L = Low probability assumes no use of or acquisition of new right of way.

M = Medium probability assumes potential use of or acquiring of new right of way.

H = High probability assumes likelihood for use of or acquiring of new right of way. Review triggers: www.wsdot.wa.gov/Environment/Compliance/Section4Fguidance.htm

Critical/Sensitive Areas Endnotes

(7) The mechanism for critical/sensitive areas review varies by jurisdiction.

L = Low probability assumes no work inside or outside of right of way in critical/sensitive areas.

M = Medium probability assumes potential for work inside or outside of right of way in critical/sensitive areas.

H = High probability assumes likelihood for work inside or outside of right of way in critical/sensitive areas.

Noise Variance Endnotes

L = Low probability assumes no night work.

M = Medium probability assumes potential for night work.

H = High probability assumes likelihood for night work.

Endnotes for Project Environmental Matrices

Figure 240-7 (continued)

240.04 Design Process and Permit Interaction

Environmental permits require information prepared during the design phase to demonstrate compliance with environmental rules, regulations, and policies. To avoid delays in project delivery, it is necessary for the designer to understand and anticipate this exchange of information. The timing of this exchange often affects design schedules, while the permit requirements can affect the design itself. In complex cases, the negotiations over permit conditions can result in iterative designs as issues are raised and resolved.

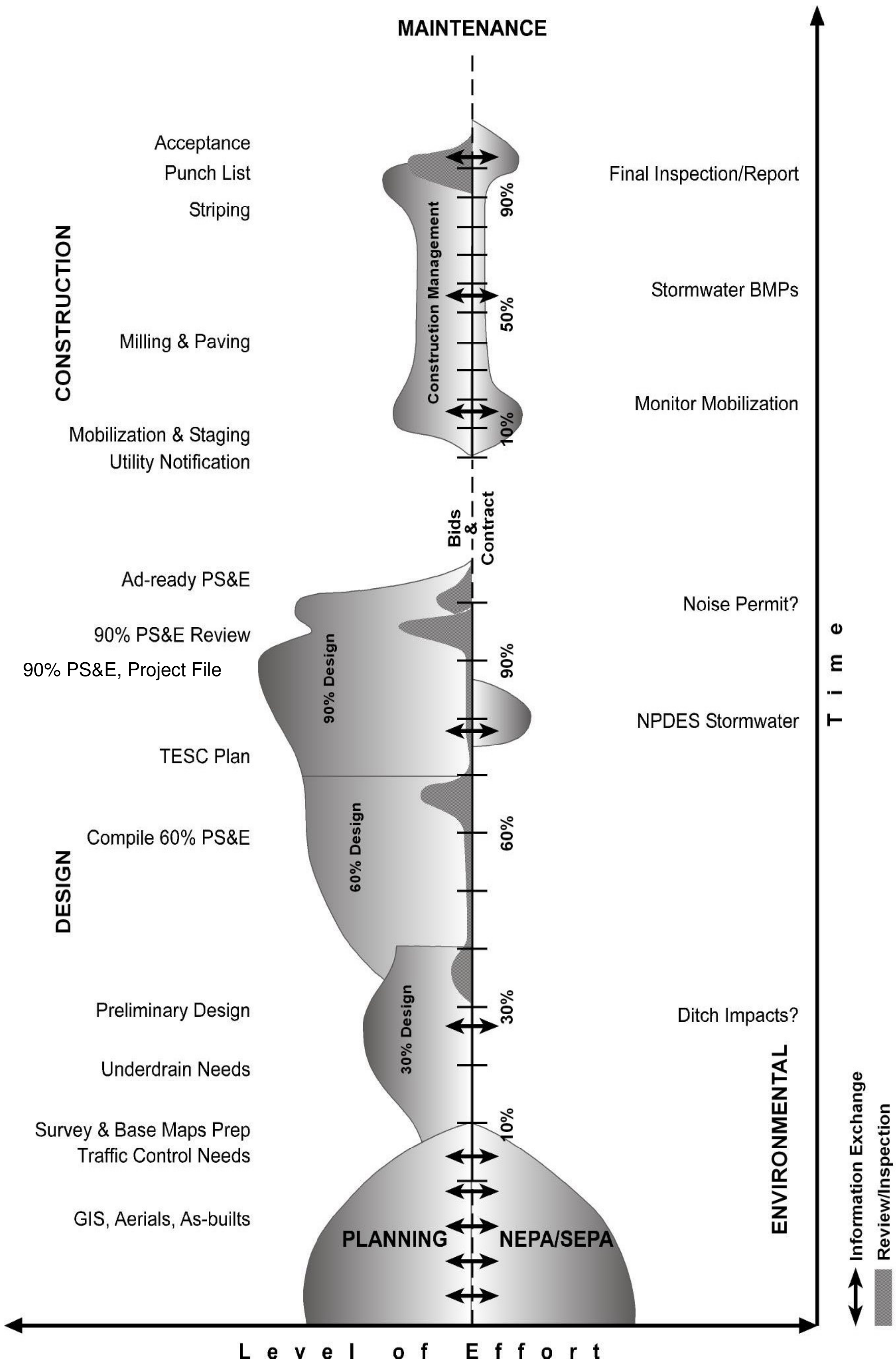
The permit process begins well in advance of the actual permit application. For some permits, WSDOT has already negotiated permit conditions through the use of programmatic and general permits. These permits typically apply to repetitive, relatively simple projects, and the permit conditions apply regardless of the actual facts of the project type. For complex projects, the negotiations with permit agencies often begin during the environmental documentation phase for compliance with NEPA and SEPA. The mitigation measures developed for the NEPA/SEPA documents are captured as permit conditions on the subsequent permits.

For many other project types, the permit process begins during the design phase. This section illustrates the interaction between design and permitting for two relatively uncomplicated projects. Figures 240-8 and 240-9 illustrate project timelines for two project types and the interaction of typical permits for those project types. The project types are an overlay project and a channelization project. The figures illustrate the level of effort over time for both design components and environmental permits.

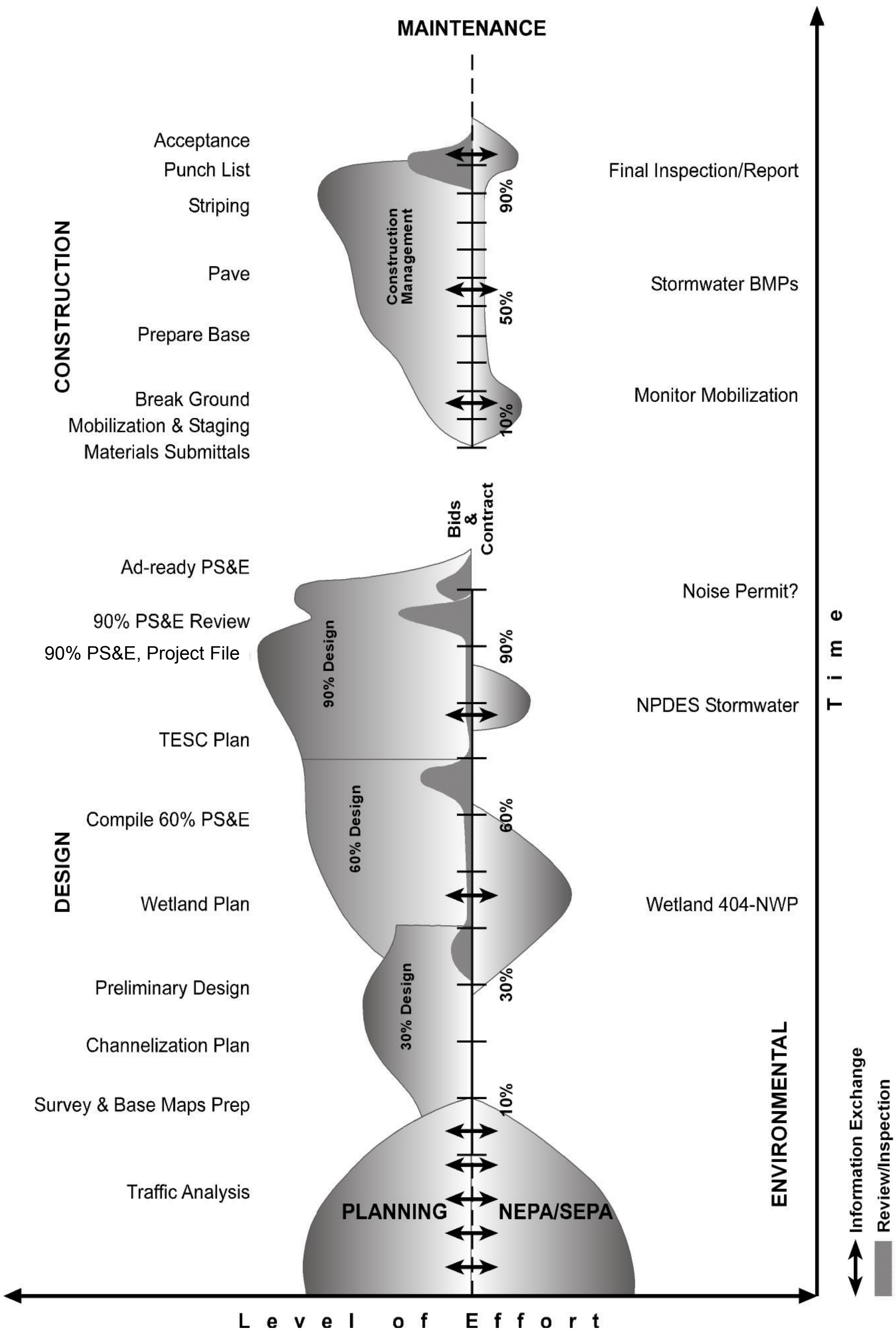
The overlay project assumes that only an NPDES Municipal Stormwater General Permit is required. Compliance with this permit is through application of the *Highway Runoff Manual* and the implementation of WSDOT's 1997 *Stormwater Management Plan*. The possibility for a noise variance exists because of the potential for night work.

The channelization project assumes minor amounts of new right of way are required. Because roadside ditches are often at the edge of the right of way, it was assumed that the potential for impacting wetlands exists. Usually the amount of fill is minor and the project may qualify for a Corps of Engineers Section 404 Nationwide Permit. A wetland mitigation plan is required to meet permit requirements, and the plan's elements have the potential to affect design, including stormwater facilities.

The interaction of design and permitting increases in complexity as the project type becomes more complex. More detailed analysis of environmental permits and their requirements is available in the *Environmental Procedures Manual* and through consultation with Region and HQ Environmental Office.



Environmental Interrelationship: HMA/PCCP/BST Main Line Overlay
Figure 240-8



Environmental Interrelationship: Safety Corridor Channelization Main Line
Figure 240-9

Chapter 315 Value Engineering

315.01 General

Value Engineering is a systematic process designed to focus on the major issues of a complex project or process. The process incorporates, to the extent possible, the values of the design engineer, construction engineer, maintenance engineer, contractor, state and federal approval agencies, local agencies, other stakeholders, and the public.

A Value Engineering study uses a multidisciplined team to develop recommendations for important design decisions.

The primary objective of a Value Engineering study is *value improvement*. The value improvements might relate to scope definition, functional design, constructibility, coordination (both internal and external), or the schedule for project development. Other possible value improvements are reduced environmental impacts, reduced public (traffic) inconvenience, or reduced project cost.

315.02 References

(1) Federal/State Laws and Codes

23 CFR Part 627, Value Engineering

(2) Supporting Information

Value Engineering for Highways, Study Workbook, U.S. Department of Transportation, FHWA

Value Standard and Body of Knowledge, SAVE International, The Value Society www.value-eng.org/about_vmstandard.php

WSDOT Value Engineering web site: www.wsdot.wa.gov/eesc/design/VE/

315.03 Definitions

Value Engineering (VE) A systematic application of recognized techniques by a multidisciplined team to identify the function of a product or service, establish a worth for that function, generate alternatives through the use of creative thinking, and provide the needed functions to accomplish the original purpose; thus assuring the lowest life cycle cost without sacrificing safety, necessary quality, or environmental attributes. Value Engineering is sometimes referred to as Value Analysis (VA) or Value Management (VM).

project The portion of a transportation facility that WSDOT proposes to construct, reconstruct, or improve, as described in the *State Highway System Plan* or applicable environmental documents. A project may consist of several contracts or phases over several years that are studied together as *one project*.

315.04 Procedure

The VE process uses the Eight-Phase Job Plan shown in Figure 315-1. Only Phases 1 and 7 are discussed in this chapter. A detailed discussion of Phases 2 through 6 can be found in the document *Value Standard and Body of Knowledge,* developed by SAVE International, The Value Society: www.value-eng.org/about_vmstandard.php

(1) Selection Phase

(a) **Project Selection**

Projects for VE studies may be selected from any of the categories identified in the Highway Construction Program, including *Preservation* or *Improvement* projects, depending on the size and/or complexity of the project. In addition to the cost, other issues adding to the complexity of the project design are considered in the selection process. These include critical constraints, difficult technical issues, expensive solutions, external influences, and complicated functional requirements.

A VE study is required for any NHS project with an estimated cost of $25 million or more (CFR 23 Part 627). This cost includes design, construction, right of way, and utilities. Other projects that should be considered for Value Engineering have a preliminary estimate exceeding $5 million and include one or more of the following:

- Projects with alternative solutions that vary the scope and cost
- New alignment or bypass sections
- Capacity improvements that widen an existing highway
- Major structures
- Interchanges on multilane facilities
- Projects with extensive or expensive environmental or geotechnical requirements
- Materials that are difficult to acquire or that require special efforts
- Inferior materials sources
- Major reconstruction
- Projects requiring major traffic control
- Projects with multiple stages

(b) **Statewide VE Study Plan**

On a biennial basis, the state VE Manager coordinates with the Region VE coordinators to prepare the Two-Year VE Study Plan, with specific projects scheduled quarterly. The VE Study Plan is the basis for determining the projected VE program needs, including team members, team leaders, and training. The Statewide VE Study Plan is a working document and close coordination is necessary between Headquarters (HQ) and the Regions to keep it updated.

The Region VE coordinator:

- Identifies potential projects for VE studies from the Project Summaries and the available planning documents for future work.
- Makes recommendations for the VE study timing.
- Presents a list of the identified projects to Region management to prioritize into a regional Two-Year VE Study Plan.

The State Design Engineer:

- Reviews the regional Two-Year VE Study Plan regarding the content and schedule of the plan.

The state VE Manager:

- Incorporates the regional Two-Year VE Study plans and the HQ Study plans to create the Statewide VE Study Plan.

(c) **VE Study Timing**

Selecting the project at the appropriate stage of development (the timing of the study) is very important to the success of the VE program. Value can be added by performing a VE study at any time during project development; however, the WSDOT VE program identifies three windows of opportunity for performing a VE study.

1. **Project Definition Stage**

   As soon as preliminary engineering information is available and the specific deficiencies or "drivers" are identified, the project scope and preliminary cost are under consideration. This is the best time to consider the various alternatives or design solutions, and there is the highest potential that the related recommendations of the VE team can be implemented. At the conclusion of the VE study, the project scope, preliminary cost, and major design decisions can be based on the recommendations.

   When conducting a study in the project definition stage, the VE study focuses on issues affecting project drivers. This stage often provides an opportunity for building consensus with stakeholders.

2. **Conceptual Design Stage**

   At the conceptual design stage, the project scope and preliminary cost have already been established and the major design decisions have been made. Some Plans, Specifications, and Estimates (PS&E) activities might have begun and coordination has been initiated with the various service units that will be involved with the design. At this stage, the established project scope, preliminary cost, and schedule will define the limits of the VE study, and there is still opportunity for the study to focus on the technical issues of the specific design elements.

3. **30% Development Stage**

   At the 30% development stage, most of the important project decisions have been made and the opportunity to affect the project design is limited. The VE study focuses on constructibility, construction sequencing, staging, traffic control, and any significant design issues that have been identified during design development.

(d) **Study Preparation**

To initiate a VE study, the project manager submits a Request for Value Engineering Study form (shown in Figure 315-2) to the Region VE coordinator at least one month before the proposed study date.

The Region VE coordinator then works with the state VE Manager to determine the team leader and team members.

The design team prepares a study package of project information for each of the team members. A list of potential items is shown in Figure 315-3.

The Region provides a facility and the equipment (see Figure 315-3) for the study.

(e) **Team Leader**

The quality of the VE study is dependent on the skills of the VE team leader. This individual guides the team's efforts and is responsible for its actions during the study. The best VE team leader is knowledgeable and proficient in transportation design and construction and in the VE study process for transportation projects.

For best results, the team leader should be certified by the Society of American Value Engineers (SAVE) as a Certified Value Specialist (CVS) or as a Value Methodology Practitioner (VMP).

The state VE Manager coordinates with the Region VE coordinator to select the team leader. Team leadership can be supplied from within the Region (or from other Regions), Headquarters, consultants, or other qualified leaders outside the department. A statewide pool of qualified team leaders is maintained by the state VE Manager.

(f) **Team Members**

The VE team is usually composed of five to ten persons with diverse expertise relevant to the specific study. The team members may be selected from the Regions, Headquarters, other state and federal agencies, local agencies, or the private sector.

Team members are selected on the basis of the kinds of expertise needed to address the major functional areas and critical high-cost issues of the study. All team members must be committed to the time required for the study. For best results, the team members should have VE training before participating in a VE study.

(g) **VE Study Requirements**

The time required to conduct a VE study varies with the complexity and size of the project, but typically ranges from three to five days.

The VE study Final Report includes a narrative description of project information; the background, history, list of constraints, drivers, and VE team focus areas; a discussion of the team speculation and evaluation processes; and the team's final recommendations. All of the team's evaluation documentation (including sketches, calculations, analyses, and rationale for recommendations) is included in the Final Report. Include a copy of the Final Report in the Project File. The number of copies of the Final Report is specified by the project manager.

(2) Implementation Phase

The VE team's recommendations are included in the Final Report. The project manager reviews and evaluates the recommendations and prepares a VE Decision Document. This document has a specific response for each of the VE team's recommendations and a summary statement containing the managers' decisions and schedule for implementation regarding further project development.

The VE Decision Document also includes the estimated additional costs or cost savings of the recommendations, as well as the estimated costs to implement the recommendations. A copy of this document is sent to the state VE Manager so the results can be included in the annual VE report to FHWA.

The VE Decision Document is submitted to the State Design Engineer and a copy becomes a vital element in the Project File. Project development then continues based on the decisions developed from the preliminary engineering and VE study recommendations (barring participation agreements funded by other agencies, utilities, developers, and so forth).

315.05 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

1.	**Selection Phase 315.04(1)**	Select the right projects, timing, team, and project processes and elements.
2.	**Investigation Phase**	Investigate the background information, technical input reports, field data, function analysis, and team focus and objectives.
3.	**Speculation Phase**	Be creative and brainstorm alternative proposals and solutions.
4.	**Evaluation Phase**	Analyze design alternatives, technical processes, life cycle costs, documentation of logic, and rationale.
5.	**Development Phase**	Develop technical and economic supporting data to prove the feasibility of the desirable concepts. Develop team recommendations. Recommend long-term as well as interim solutions.
6.	**Presentation Phase**	Present the recommendations of the VE team in an oral presentation and in a written report.
7.	**Implementation Phase 315.04(2)**	Evaluate the recommendations. Prepare an implementation plan (VE Decision Document), including the response of the managers and a schedule for accomplishing the decisions based on the recommendations.
8.	**Audit Phase**	Maintain a records system to track the results and accomplishments of the VE program on a statewide basis. Compile appropriate statistical analyses, as requested.

Note:
Phases 2–6 are performed during the study; see *Value Standard and Body of Knowledge* for procedures during these steps.

Eight-Phase Job Plan for VE Studies
Figure 315-1

Project Title:					
SR No.	**MP**	**To**	**MP**	**Length**	**Subprogram**
PIN			**WIN**		
Assigned Project Engineer					
Proposed Advertising Date					
Estimated Right of Way Costs			**Estimated Construction Costs**		
Design Speed			**Projected ADT**		
Route Conditions/Geometry: **Adjacent Segments** **Overall Route**					
Major Project Elements					
Environmental Issues					
Construction Issues					
Suggested Value Team Composition: ☐ Architecture ☐ Landscape Architecture ☐ Bridge ☐ Maintenance ☐ Construction ☐ Planning/Programming ☐ Design ☐ Real Estate Services ☐ Environmental ☐ Traffic ☐ Hydraulics ☐ Other ____________					
Region Contact Person			**Dates requested for VE study**		

Request for Value Engineering Study
Figure 315-2

Project-Related Input* (Study Package)	Study-Related Facilities and Equipment
Design File	Room With Large Table
Quantities	Phone
Estimates	Photo/Video Log Access/SRView
R/W Plans	Van for Field Trip**
Geotechnical Reports	Easel(s)
Plan Sheets	Large Tablet Paper (2x2 Squares)
Environmental Documents	Colored Marking Pens
X-Sections and Profiles	Masking and Clear Adhesive Tape
Land Use Maps	Workbook(s)
Contour Maps	Digital Camera
Quadrant Maps	*Design Manual*
Accident Data	"*Green Book*"
Traffic Data	*Standard Plans*
Up-to-Date Large-Scale Aerial Photographs	*Standard Specifications*
Vicinity Map	M.P. Log
Hydraulics Report	Bridge List
Aerial Photos	WSDOT Phone Book
Existing As-Built Plans	Scales and Straight Edge
	Red Book – Field Tables
	Unit Bid Prices
	Calculators
	Scissors

* Not all information listed may be available to the team, depending on the stage of the project.

** If a field trip is not possible, provide video of the project.

VE Study Team Tools

Figure 315-3

325.01 General

The *Design Manual* provides guidance for three levels of design for highway projects: the basic, modified, and full design levels. The design matrices in this chapter are used to identify the design level(s) for a project and the associated processes for allowing design variances. The matrices address the majority of Preservation and Improvement projects and focus on those design elements that are of greatest concern in project development.

The design matrices are five tables that are identified by route type. Two of the matrices apply to Interstate highways; the other three apply to non-Interstate highways and address Preservation and Improvement projects.

A design matrix is used to determine the design level for the design elements of a project. Apply the appropriate design levels and document the design decisions as required by this chapter and Chapter 330.

325.02 Selecting a Design Matrix

Selection of a design matrix (see Figure 325-1) is based on highway system (Interstate, NHS excluding Interstate, and non-NHS) and location (main line and interchange).

Highway System	Location	
	Main Line	Interchange Area
Interstate	Matrix 1	Matrix 2
NHS*	Matrix 3	Matrix 4
Non-NHS	Matrix 5	Matrix 4
* Except Interstate.		

Design Matrix Selection Guide
Figure 325-1

The **Interstate System** (Matrices 1 and 2) is a network of routes selected by the state and the FHWA under terms of the federal-aid acts. These routes are the principal arterials that are the most important to the economic welfare and defense of the United States. They connect, as directly as practicable:

- Principal metropolitan areas and cities.
- Industrial centers.
- International border crossings.

The Interstate System includes important routes into, through, and around urban areas; serves the national defense; and (where possible) connects with routes of continental importance. It also serves international and interstate travel and military movements.

The Interstate System is represented on the list of NHS highways (see Figure 325-2) with the letter "I" before the route number.

The **National Highway System (NHS)** (Matrices 3 and 4) is an interconnected system of principal arterial routes and highways (including toll facilities) that serves the following:

- Major population centers
- International border crossings
- Industrial centers
- Ports
- Airports
- Public transportation facilities
- Other intermodal transportation facilities
- Other major travel destinations

The NHS includes the Interstate System and the Strategic Highway Corridor Network (STRAHNET) and its highway connectors to major military installations (Interstate and non-Interstate).

The NHS meets national defense requirements and serves international, interstate, and interregional travel (see Figure 325-2).

The **Non-NHS** highways (Matrices 4 and 5) are state routes that form a highway network that supplements the NHS system by providing for freight mobility and regional and interregional travel. Non-NHS highways are not shown on Figure 325-2. They are shown on WSDOT's (free) Official State Highway Map of Washington.

325.03 Using a Design Matrix

The design matrices are shown in Figures 325-3 through 325-7. Follow *Design Manual* guidance for all projects except as noted in the design matrices (and elsewhere as applicable). The definitions presented in this chapter are meant to provide clarification of terminology used in the *Design Manual*. There is no assurance that these terms are used consistently in references outside the *Design Manual*.

(1) Project Type

For project types not listed in the design matrices (such as unstable slopes), consult the Headquarters (HQ) Design Office for guidance.

In the design matrices, row selection is based on Project Type. The Project Summary (see Chapter 330) defines and describes the project. For NHS and non-NHS routes (Matrices 3, 4, and 5), the project's program/subprogram might provide sufficient information to identify the Project Type. (See the *Programming Manual* for details about funding programs and subprograms.)

The various sources of funds for these subprograms carry eligibility requirements that the designers and project development must identify and monitor throughout project development. This is especially important to ensure accuracy when writing agreements and to avoid delaying advertisement for bids if the Project Type changes.

Some projects involve work from several subprograms. In such cases, identify the various limits of the project that apply to each subprogram. Where the project limits overlap, apply the higher design level to the overlapping portion.

Project Types (in alphabetical order) are:

At Grade. Safety improvement projects on NHS highways (45 mph or greater) to build grade-separation facilities that replace the existing intersections.

Bike Routes (Shldrs). Main line economic development improvement projects to provide a statewide network of rural bicycle touring routes with shoulders a minimum of 4 feet wide.

Bike/Ped. **Connectivity**. Mobility improvement projects to provide bicycle/pedestrian connections, along or across state highways within urban growth areas, to complete local networks.

Bridge Deck Rehab. Structures preservation projects that repair delaminated bridge decks and add protective overlays to provide a sound, smooth surface, prevent further corrosion of the reinforcing steel, and preserve operational and structural integrity.

Bridge Rail Upgrades. Safety improvement projects to update older bridge rails to improve strength and redirectional capabilities.

Bridge Repl. (Multilane). Non-NHS main line structures preservation projects that replace bridges on multilane highways to improve operational and structural capacity.

Bridge Replacement. NHS and two-lane non-NHS (main line and interchange) structures preservation projects that replace bridges to improve operational and structural capacity.

Bridge Restrictions. Main line economic development improvement projects that remove vertical or load capacity restrictions to benefit the movement of commerce.

BST. Non-NHS roadway preservation projects to do bituminus surface treatment (BST) work only, to protect the public investment.

BST Routes/Basic Safety. Non-NHS roadway preservation projects that resurface highways at regular intervals and restore existing safety features, to protect the public investment.

Corridor. Main line improvement projects to reduce and prevent vehicular, nonmotorized, and pedestrian collisions (within available resources).

Diamond Grinding. Grinding a concrete pavement, using gang-mounted diamond saw blades, to remove surface wear or joint faulting.

Dowel Bar Retrofit. Reestablishing the load transfer efficiencies of the existing concrete joints and transverse cracks by cutting slots, placing epoxy-coated dowel bars, and placing high-early strength, nonshrink concrete.

Four-Lane Trunk System. NHS economic development improvement projects to complete contiguous four-lane limited access facilities on a trunk system consisting of all Freight and Goods Transportation Routes (FGTS) with a classification of 10,000,000 tons/year.

Freight & Goods (Frost Free). Main line economic development improvement projects to reduce delay from weather-related closures on high-priority freight and goods highways.

Guardrail Upgrades. Safety improvement projects limited to the specified roadside design elements. These projects focus on W beam with 12-foot-6-inch spacing and on guardrail systems with concrete posts. The length of need is examined and minor adjustments are made. Removal is an option if guardrail is no longer needed. For Interstate main line, address length of need as specified in Chapter 710. For non-interstate routes, additional length of more than 5% of the existing length is beyond the intent of this program. In these instances, consider funding in accordance with priority programming instructions and, if the length of need is not met, document to the Design Documentation Package (DDP) that the length of need is not addressed because it is beyond the intent of this program.

HMA/PCCP. Non-NHS roadway preservation projects to resurface highways at regular intervals and restore existing safety features to protect the public investment.

HMA/PCCP/BST Overlays. NHS main line roadway preservation projects that resurface the existing surfaces at regular intervals to protect the public investment.

HMA/PCCP/BST Overlays Ramps. NHS and non-NHS ramp roadway preservation projects that resurface the existing surfaces at regular intervals and restore existing safety features to protect the public investment.

HMA Structural Overlays. Hot mix asphalt overlays that are placed to increase the load-carrying ability of the pavement structure. Structural overlay thickness is greater than 0.15 foot.

HOV Bypass. NHS and non-NHS ramp mobility improvement projects to improve mobility within congested highway corridors by providing HOV bypass lanes on freeway ramps. Congested highway corridors have high congestion index values as described in the *Highway System Plan* (footnote in text for Improvement/Mobility).

HOV. Main line mobility improvement projects completing the freeway Core HOV lane system in the Puget Sound region and providing level of service C on HOV lanes (including business access transit lanes) within congested highway corridors.

Intersection. Safety improvement projects to reduce and prevent collisions, to increase the safety of highways, and to improve pedestrian safety (within available resources).

Median Barrier. Limited safety improvement projects; mainly new median barrier, with a focus on cable barrier, to reduce median crossover accidents.

Milling with HMA Inlays. Removing a specified thickness of the existing HMA pavement, typically from the traveled lanes, and then overlaying with HMA at the same specified thickness.

New/Reconstruction projects include the following types of work:

- Capacity changes: add a through lane, convert a general purpose (GP) lane to a special purpose lane (such as an HOV lane), or convert a high occupancy vehicle (HOV) lane to GP
- Other lane changes: add or eliminate a collector-distributor or auxiliary lane (a rural truck-climbing lane that, for its entire length, meets the warrants in Chapter 1010 is not considered new/reconstruction)

- Pavement reconstruction: full depth PCCP or HMA replacement
- New interchange
- Changes in interchange type such as diamond to directional or adding a ramp
- New or replacement bridge (on or over, main line or interchange ramp)

Non-Interstate Freeway (mobility). On non-NHS and NHS interchanges and on NHS main line, these are mobility improvement projects on multilane divided highways with limited access control, within congested highway corridors.

Non-Interstate Freeway (roadway preservation). Roadway preservation projects on non-NHS and NHS interchanges and on NHS main line, to overlay or inlay with HMA/PCCP/BST on multilane divided highways with limited access control to minimize long-term costs and restore existing safety features.

Non-Interstate Freeway (safety). NHS and non-NHS (main line and interchanges) safety improvement projects on multilane divided highways with limited access control to increase the safety within available resources.

Nonstructural Overlay. An HMA pavement overlay that is placed to minimize the aging effects and minor surface irregularities of the existing HMA pavement structure. The existing HMA pavement structure is not showing extensive signs of fatigue (longitudinal or alligator cracking in the wheel paths). Nonstructural overlays are less than or equal to 0.15-foot thick and frequently less than 0.12-foot thick.

PCCP Overlays. Portland cement concrete pavement overlays of existing PCCP or HMA surfaces.

Preventive Maintenance. Includes roadway work such as pavement patching; restoration of drainage system; panel replacement; joint and shoulder repair; and bridge work such as crack sealing, joint repair, slope stabilization, seismic retrofit, scour countermeasures, and painting. Preventive maintenance projects must not degrade any existing safety or geometric aspects of the facility. Any elements that will be reconstructed as part of a preventive maintenance project are to be addressed in accordance with full design level.

Replace HMA w/ PCCP at I/S (intersections). NHS and non-NHS main line roadway preservation projects that restore existing safety features and replace existing HMA intersection pavement that has reached the point of lowest life cycle cost (11–15 years old) with PCCP that has about a 40-year life cycle.

Rest Areas (New). NHS and non-NHS main line economic development and safety improvement projects to provide rest areas every 60 miles and some RV dump stations.

Risk: Realignment. Improvement projects intended to improve alignment at specific locations where the Risk program has identified a high probability of collisions/accidents.

Risk: Roadside. Improvement projects intended to mitigate roadside conditions at specific locations where the Risk program has identified a high probability of vehicular encroachment.

Risk: Roadway Width. Improvement projects intended to adjust the roadway width at specific locations where the Risk program has identified a high probability of a vehicle leaving its lane of travel.

Risk: Sight Distance. Improvement projects intended to improve sight distance at specific locations where the Risk program has identified a high probability of collisions/accidents.

Rural. Mobility improvement projects providing uncongested level of service on rural highways within congested highway corridors. (See HOV Bypass for cross reference regarding "congested.")

Urban. NHS and two-lane non-NHS (main line and interchange) mobility improvement projects within congested urban highway corridors. (See HOV Bypass for cross reference regarding "congested.")

Urban (Multilane). Non-NHS mobility improvement projects within congested urban multilane highway corridors. (See HOV Bypass for cross reference regarding "congested.")

(2) Design Elements

The column headings on a design matrix are **Design Elements**. Not all potential design elements have been included in the matrices.

The design elements that are included are based on the following thirteen FHWA controlling design criteria: design speed, lane width, shoulder width, bridge width, structural capacity, horizontal alignment, vertical alignment, grade, stopping sight distance, cross slope, superelevation, vertical clearance, and horizontal clearance. For the column headings, some of these controlling criteria have been combined (for example, design speed is part of horizontal and vertical alignment).

If using a design element that is not on the assigned matrix, use full design level as found elsewhere in this manual.

If using a design element that is not covered in this manual, use an approved manual or guidance on the subject and document the decision and the basis for the decision.

The following elements are shown on the design matrices. If the full design level applies, see the chapters listed below. If basic design level applies, see Chapter 410. If the modified design level applies, see Chapter 430.

Horizontal Alignment. The horizontal attributes of the roadway, including horizontal curvature, superelevation, and stopping sight distance; all based on design speed. (See Chapter 620 for horizontal alignment, Chapter 642 for superelevation, Chapter 650 for stopping sight distance, and Chapters 440 or 940 for design speed.)

Vertical Alignment. The vertical attributes of the roadway including vertical curvature, profile grades, and stopping sight distance; all based on design speed. (See Chapter 630 for vertical alignment, Chapters 430, 440, 630, and 940 for grades, Chapters 430 and 650 for stopping sight distance, and Chapters 430, 440, or 940 for design speed.)

Lane Width. Defined in Chapter 440 (also see Chapters 430, 640, 641, and 940).

Shoulder Width. Defined in Chapter 440 (also see Chapters 430, 640, and 940). For shy distance requirements when barrier is present, see Chapter 710.

Lane Transitions (pavement transitions). The rate and length of transition of changes in width of lanes (see Chapter 620).

On/Off Connection. The widened portion of pavement at the end of a ramp connecting to a main lane of a freeway (see Chapter 940).

Median Width. The distance between inside edge lines (see Chapters 440 and 640).

Cross Slope: Lane. The rate of elevation change across a lane. This element includes the algebraic difference in cross slope between adjacent lanes (see Chapters 430 and 640).

Cross Slope: Shoulder. The rate of elevation change across a shoulder (see Chapters 430 and 640).

Fill/Ditch Slopes. The downward slope from edge of shoulder to bottom of ditch or catch (see Chapters 430 and 640).

Access. The means of entering or leaving a public road, street, or highway with respect to abutting private property or another public road, street, or highway (see Chapter 1420).

Clear Zone. The total roadside border area, starting at the edge of the traveled way, available for use by errant vehicles. This area may consist of a shoulder, a recoverable slope, a nonrecoverable slope, and/or a clear run-out area. The median is part of a clear zone (see Chapter 700).

Signing, Delineation, Illumination. Signs, guideposts, pavement markings, and lighting. (See Chapter 820 for signing and 1120 for bridge signs, Chapter 830 for delineation, and Chapter 840 for illumination.)

Vertical Clearance. Defined in Chapter 1120.

Basic Safety. The list of safety items is in Chapter 410.

Bicycle and Pedestrian. Defined in Chapter 1020, Bicycle Facilities, and Chapter 1025, Pedestrian Design Considerations.

Bridges: Lane Width. The width of a lane on a structure (see Chapters 430, 440, 640, 641, 940, and 1120).

Bridges: Shoulder Width. The distance between the edge of traveled way and the face of curb or barrier, whichever is less (see Chapters 430, 440, 640, 940, and 1120; also see Chapter 710 for shy distance requirements).

Bridges/Roadway: Vertical Clearance. The minimum height between the roadway, including shoulder, and an overhead obstruction (see Chapter 1120).

Bridges: Structural Capacity. The load-bearing ability of a structure (see Chapter 1120).

Intersections/Ramp Terminals: Turn Radii. Defined in Chapter 910.

Intersections/Ramp Terminals: Angle. Defined in Chapter 910.

Intersections/Ramp Terminals: Intersection Sight Distance. Definitions are in Chapters 910 and 940.

Barriers: Terminals and Transition Sections. Terminals: Crashworthy end treatments for longitudinal barriers that are designed to reduce the potential for spearing, vaulting, rolling, or excessive deceleration of impacting vehicles from either direction of travel. Impact attenuators are considered terminals. Beam guardrail terminals include anchorage. Transition Sections: Sections of barriers used to produce a gradual stiffening of a flexible or semirigid barrier as it connects to a more rigid barrier or fixed object (see Chapters 700, 710, and 720).

Barriers: Standard Run. Guardrail and other barriers as found in the *Standard Plans for Road Bridge and Municipal Construction* excluding terminals, transitions, attenuators, and bridge rails (see Chapter 710).

Barriers: Bridge Rail. Barrier on a bridge, excluding transitions (see Chapter 710).

(3) Design Level

In the non-Interstate matrices, design levels are noted in the cells by B, M, F, and sometimes with a number corresponding to a footnote on the matrix. For Improvement projects, full design level applies to all design elements, except as noted in the design matrices and in other chapters as applicable. In the Interstate matrices, only full design level applies.

The design levels of basic, modified, and full (B, M, and F) were used to develop the design matrices. Each design level is based on the investment intended for the highway system and Project Type. (For example, the investment is higher for an Interstate overlay than for an overlay on a non-NHS route.)

A **blank cell** in a design matrix row signifies that the design element will not be addressed because it is beyond the scope of the typical project. In rare instances, a design element with a blank cell may be included if that element is linked to the original need that generated the project and is identified in the Project Summary or a Project Change Request Form.

Basic design level (B) preserves pavement structures, extends pavement service life, and maintains safe operations of the highway. (See Chapter 410 for design guidance.)

Modified design level (M) preserves and improves existing roadway geometrics, safety, and operational elements. (See Chapter 430 for design guidance.) Use full design level for design elements or portions of design elements that are not covered in Chapter 430.

Full design level (F) improves roadway geometrics, safety, and operational elements. (See Chapter 440 and other applicable *Design Manual* chapters for design guidance.)

(4) Design Variances

Types of design variances are design exceptions, evaluate upgrades, and deviations. (See Chapter 330 concerning the Design Variance Inventory System (DVIS).)

A **design exception (DE)** in a matrix cell indicates that WSDOT has determined that the design element is usually outside the scope of the Project Type. Therefore, an existing condition that does not meet or exceed the design level specified in the matrix may remain in place unless a need has been identified in the *Highway System Plan* and prioritized in accordance with the programming process. (See Chapter 330 regarding documentation.)

An **evaluate upgrade (EU)** in a matrix cell indicates that WSDOT has determined that the design element is an item of work that is to be considered for inclusion in the project. For an existing element that does not meet or exceed the specified design level, an analysis is required to determine the impacts and cost-effectiveness of including the element in the project. The EU analysis must support the decision regarding whether or not to upgrade that element. (See Chapter 330 regarding documentation.)

A **deviation** is required when an existing or proposed design element differs from the specified design level for the project and neither DE nor EU processing is indicated. (See Chapter 330 regarding documentation.)

DE or EU with /F or /M in a cell means that the design element is to be analyzed with respect to the specified design level. For instance, a DE/F is analyzed with respect to full design level and might be recorded as having an existing design element that does not meet or exceed current full design level. An EU/M is analyzed to decide whether or not to upgrade any existing design element that does not meet or exceed the current modified design level.

(5) Terminology in Notes

F/M Full for freeways/Modified for nonfreeway uses the word **freeway** to mean a divided highway facility that has a minimum of two lanes in each direction, for the exclusive use of traffic and with full control of access. For matrix cells with an F/M designation, analyze freeway routes at full design level and nonfreeway routes at modified design level.

The **HAL, HAC, and PAL** mentioned in note (1) in Design Matrices 3, 4, and 5 are high accident locations (HAL), high accident corridors (HAC), and pedestrian accident locations (PAL).

The **Access Control Tracking System** mentioned in note (3) in Design Matrices 3, 4, and 5 is a database list related to highway route numbers and mileposts, available under the RELATED SITES heading at: www.wsdot.wa.gov/eesc/design/access/. (See Chapter 1420 for access control basics and 1430 and 1435 for limited and managed access, respectively.)

The **corridor or project analysis** mentioned in notes (2) and (4) on Design Matrices 3, 4, and 5 is the justification needed to support a change in design level from the indicated design level. The first step is to check for recommendations for future improvements in an approved *Route Development Plan*. If none are available, an analysis can be based on route continuity and other existing features. (See Chapter 330 regarding documentation.)

Note **(21) Analyses required** appears only on Design Elements for Risk projects on Design Matrices 3, 4, and 5. These design elements are to be evaluated using benefit/cost (B/C) to compare and rank each occurrence of the design element. The B/C evaluation supports engineering decisions regarding which proposed solutions are included in a Risk project.

Most components of a Risk project will have a B/C of 1.0 or greater. Proposed solutions with a B/C ratio less than 1.0 may be included in the project based on engineering judgment of their significant contribution to corridor continuity. Risk program size, purpose and need, or project prioritization may lead to instances where design elements with a ratio greater than 1.0 are excluded from a project. The analysis, design decisions, and program funding decisions are to be documented in the Design Documentation Package. Decisions regarding which design elements to include in a project are authorized at the WSDOT Region level.

State Route	NHS Route Description	Begin SR MP	Begin ARM	End SR MP	End ARM
US 2	I-5 to Idaho State Line	0.00B	0.00	334.51	326.64
US 2 Couplet	Brown Street Couplet	287.45	0.00	288.08	0.63
US 2 Couplet	Division Street Couplet	289.19	0.00	290.72	1.53
SR 3	US 101 to SR 104	0.00	0.00	60.02	59.81
SR 4	US 101 to I-5	0.00	0.00	62.28	62.27
I-5	Oregon State Line to Canadian Border	0.00	0.00	276.56	276.62
SR 8	US 12 to US 101	0.00	0.00	20.67	20.67
SR 9	SR 546 to Canadian Border	93.61	93.52	98.17	98.08
SR 9 Spur	Sumas Spur	98.00	0.00	98.25	0.24
SR 11	I-5 to Alaskan Ferry Terminal	19.93	19.93	21.28	21.28
US 12	US 101 to Idaho State Line	0.00	0.00	434.19	430.76
US 12 Couplet	Aberdeen Couplet	0.33	0.00	0.68	0.35
SR 14	I-5 to US 97	0.00	0.00	101.02	100.93
SR 14 Spur	Maryhill Spur	100.66	0.00	101.05	0.39
SR 16	I-5 to SR 3	0.00	0.00	29.19	27.01
SR 16 Spur	SR 16 to SR 3	28.74	0.00	29.13	0.39
SR 17	US 395 to I-90	7.43	0.00	50.89	43.40
SR 18	SR 99 to I-5	2.20B	0.00	0.00	0.53
SR 18	I-5 to I-90	0.00	0.53	27.91	28.41
SR 20	US 101 to I-5	0.00	0.00	59.54	59.49
SR 20 Spur	SR 20 to San Juan Ferry	47.89	0.00	55.67	7.78
SR 22	US 97 to I-82	0.70	0.00	4.00	3.31
SR 26	I-90 to US 195	0.00	0.00	133.53	133.61
SR 26 Spur	SR 26 to US 195	133.44	0.00	133.51	0.07
SR 28	US 2 to SR 281	0.00B	0.00	29.77	33.91
I-82	I-90 to Oregon State Line	0.00	0.00	132.60	132.57
I-90	I-5 to Idaho State Line	1.94	0.00	299.82	297.52
I-90 Reverse Lane	Reversible lane	1.99	0.00	9.44	7.45
SR 96	I-5 to McCollum Park and Ride	0.00	0.00	0.52	0.52
US 97	Oregon State Line to SR 22	0.00B	0.00	61.44	61.30
US 97	I-90 to Canadian Border	133.90	118.80	336.48	321.62
US 97 Couplet	Maryhill Couplet	2.59	0.00	2.68	0.09
US 97 Spur	US 97 to US 2 (Orondo)	213.36	0.00	213.62	0.26
SR 99	188th to SeaTac Airport	18.35	14.70	18.77	15.12
SR 99	SR 509 to SR 104	26.04	22.40	43.60	39.84
US 101	Oregon State Line to SR 401	0.00	0.00	0.46	0.46
US 101	SR 4 to I-5	28.89	28.89	367.41	365.78
US 101 Couplet	Aberdeen Couplet	87.49	0.00	91.66	4.17
US 101 Couplet	Port Angeles Couplet	249.65	0.00	251.32	1.67
SR 104	US 101 to I-5	0.20	0.00	29.67	29.14
SR 109	Pacific Beach Access	0.00	0.00	30.25	30.29
SR 125	Oregon State Line to SR 125 Spur	0.00	0.00	6.09	6.08
SR 125 Spur	SR 125 to US 12	6.09	0.00	6.76	0.67
SR 127	US 12 to SR 26	0.03	0.00	27.05	27.05
SR 128	US 12 to Idaho State Line	0.00	0.00	2.30	2.30

NHS Highways in Washington
Figure 325-2

State Route	NHS Route Description	Begin SR MP	Begin ARM	End SR MP	End ARM
SR 166	SR 16 to Bay St	0.02	0.00	3.40	3.38
SR 167	I-5 to SR 900 / S 2nd St	0.00	0.00	27.28	28.60
I-182	I-82 to US 395	0.00	0.00	15.19	15.19
US 195	Idaho State Line to I-90	0.00B	0.00	95.99	93.37
US 195 Spur	US 195 to Idaho State Line	0.06	0.00	0.60	0.54
I-205	Oregon State Line to I-5	26.59	0.00	37.16	10.57
SR 240	I-182 to Coast St / Bypass Hwy – Hanford Access	30.63	28.86	34.87	33.10
SR 270	US 195 to Idaho State Line	0.00	0.00	9.89	9.89
SR 270	Pullman Couplet	2.67	0.00	2.90	0.23
SR 281	I-90 to SR 28	0.00	0.00	10.55	10.55
SR 281 Spur	SR 281 to I-90	2.65	0.00	4.34	1.69
SR 303	SR 304 to SR 3	0.00B	0.00	9.16	9.32
SR 304	SR 3 to Bremerton Ferry	0.00	0.00	3.51	3.24
SR 305	Winslow Ferry to SR 3	0.02	0.00	13.52	13.50
SR 307	SR 305 to SR 104	0.00	0.00	5.25	5.25
SR 310	SR 3 to SR 304	0.00	0.00	1.84	1.84
US 395	Congressional High-Priority Route/I-82 to Canadian Border	13.05	19.81	270.26	275.09
SR 401	US 101 to SR 4	0.00	0.00	12.13	12.13
I-405	I-5 to I-5	0.00	0.00	30.32	30.30
SR 432	SR 4 to I-5	0.00	0.00	10.33	10.32
SR 433	Oregon State Line to SR 432	0.00	0.00	0.94	0.94
SR 500	I-5 to SR 503	0.00	0.00	5.96	5.96
SR 501	I-5 to Port of Vancouver	0.00	0.00	3.83	3.42
SR 502	I-5 to SR 503	0.00B	0.00	7.56	7.58
SR 503	SR 500 to SR 502	0.00	0.00	8.09	8.09
SR 509	12th Place S to SR 99	24.35B	26.13	29.83	33.11
SR 509	Pacific Ave. to Marine View Drive	0.22	1.44	3.20	4.42
SR 512	I-5 to SR 167	0.00	0.00	12.06	12.06
SR 513	Sandpoint Naval Air Station	0.00	0.00	3.35	3.35
SR 516	I-5 to SR 167	2.03	2.02	4.72	4.99
SR 518	I-5 to SR 509	0.00	0.00	3.81	3.42
SR 519	I-90 to Seattle Ferry Terminal	0.00	0.00	1.14	1.14
SR 520	I-5 to SR 202	0.00	0.00	12.83	12.82
SR 522	I-5 to US 2	0.00	0.00	24.68	24.68
SR 524	Cedar Way Spur to I-5	4.64	4.76	5.32	5.44
SR 524 Spur	Cedar Way Spur – Lynnwood Park and Ride to SR 524	4.64	0.00	5.14	0.50
SR 525	I-5 to SR 20	0.00	0.00	30.49	30.72
SR 526	SR 525 to I-5	0.00	0.00	4.52	4.52
SR 529	I-5 to Everett Homeport	0.00	0.00	2.72	2.72
SR 539	I-5 to Canadian Border	0.00	0.00	15.16	15.16
SR 543	I-5 to Canadian Border	0.00	0.00	1.09	1.09
SR 546	SR 539 to SR 9	0.00	0.00	8.02	8.02
I-705	I-5 to Schuster Parkway	0.00	0.00	1.50	1.50
SR 970	I-90 to US 97	0.00	0.00	10.31	10.31

NHS Highways in Washington
Figure 325-2 (continued)

⇩ Project Type																Bridges			Barriers		
Design Elements ⇨	Horiz. Align.	Vert. Align.	Lane Width	Shldr Width (13)	On/Off Conn.	Median Width	Cross Slope Lane	Cross Slope Shldr	Fill/Ditch Slopes	Clear Zone	Sign. (10)	Delini. (9)	Illumin.	Vert. Clear. (11)	Bike & Ped.	Lane Width	Shldr Width	Structural Capacity	Term. & Trans. Section (12)	Std Run	Bridge Rail (14)(19)
(1-1) Preventive Maintenance																					
Pavement Restoration																					
(1-2) Diamond Grinding										EU	EU	F		DE					F	EU	F
(1-3) Milling with HMA Inlays									EU	F	EU	F		DE					F	EU	F
(1-4) Nonstructural Overlay				DE			EU	EU	EU	F	EU	F		F					F	F	F
Pavement Rehab./Resurf.																					
(1-5) HMA Structural Overlays	EU	DE	F	F	F(17)	DE	F	EU	F	F	EU	F	F	F		F	DE		F	F	F
(1-6) PCCP Overlays	EU	DE	F	F	F(17)	DE	F	EU	F	F	EU	F	F	F		F	DE		F	F	F
(1-7) Dowel Bar Retrofit	EU	DE	F	F	F(17)	DE	DE		F	F	EU	F	F	DE			DE		F	F	F
Bridge Rehabilitation																					
(1-8) Bridge Deck Rehabilitation												F		F		F	DE	(11)	F(6)	F(22)	F
Safety																					
(1-9) Median Barrier				DE															F(20)	F(20)	
(1-10) Guardrail Upgrades				DE						F									F	F(23)	
(1-11) Bridge Rail Upgrades																			F	F(22)	F
Reconstruction (16)																					
(1-12) New/Reconstruction	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F

☐ Not Applicable
F Full design level. See Chapter 440.
DE Design Exception to full design level.
EU Evaluate Upgrade to full design level.

(6) Applies only to bridge end terminals and transition sections.
(9) Continuous shoulder rumble strips required in rural areas. See Chapter 700.
(10) See Chapter 820.
(11) See Chapter 1120.
(12) Impact attenuators are considered as terminals.
(13) See Chapters 440 and 640.
(14) Includes crossroad bridge rail. See Chapter 710.
(16) For design elements not in the matrix headings, apply full design level as found in the applicable chapters and see 325.03(2).
(17) DE for existing acceleration/deceleration lanes when length meets posted freeway speed and no significant accidents. See Chapter 940.
(19) The funding sources for bridge rail are a function of the length of the bridge. Consult programming personnel.
(20) Applies to median elements only.
(22) Upgrade barrier, if necessary, within 200 ft of the end of the bridge.
(23) See description of Guardrail Upgrades Project Type, 325.03(1) regarding length of need.

Design Matrix 1:
Interstate Routes (Main Line)
Figure 325-3

⇩ Project Type	Ramps and Collector Distributors														Ramp Terminals			Barriers			Cross Road								Barriers		
Design Elements ⇨	Horiz. Align.	Vert. Align.	Lane Width	Shldr Width	Lane Tran-sition	On/Off Conn.	Cross Slope Lane	Cross Slope Shldr	Fill/ Ditch Slopes	Limited Access	Clear Zone	Sign., Del., Illumin. (9)(10)	Vertical Clear. (11)	Bike & Ped.	Turn Radii	Angle	I/S Sight Dist.	Term. & Trans. Section (12)	Std Run	Bridge Rail (14)(19)	Lane Width	Shldr Width	Fill/ Ditch Slopes	Limited Access	Clear Zone	Sign., Del., Illumin. (10)	Vert. Clear. (11)	Ped. & Bike	Term. & Trans. Section (12)	Std Run	Bridge Rail (14)(19)
(2-1) Preventive Maintenance																															
Pavement Restoration																															
(2-2) Diamond Grinding											EU	F(15)						F	EU	F					EU	F(15)			F	EU	F
(2-3) Milling with HMA Inlays									EU		F	F(15)	F	M				F	F	F			EU		F	F(15)		M	F	F	F
(2-4) Nonstructural Overlay							EU	EU	EU		F	F(15)	F	M				F	F	F			EU		F	F(15)		M	F	F	F
Pavement Rehab./Resurf.																															
(2-5) HMA Structural Overlays	EU	DE	F	F	F	F(17)	F	EU	F	F	F	F(15)	F	M	F	F	F	F	F	F	DE	DE	DE	F	F	F(15)	F	M	F	F	F
(2-6) PCCP Overlays	EU	DE	F	F	F	F(17)	F	EU	F	F	F	F(15)	F	M	F	F	F	F	F	F	DE	DE	DE	F	F	F(15)	F	M	F	F	F
(2-7) Dowel Bar Retrofit	DE		DE	DE	F	F(17)	DE		F	F	F	F(15)	DE		F	F	F	F	F	F				F		F(15)			F	F	F
Bridge Rehabilitation																															
(2-8) Bridge Deck Rehabilitation													F	M				F(6)	F(22)	F							F	M	F(6)	F(22)	F
Safety																															
(2-9) Intersection			F	F	F				F	F	F	F		M	F	F	F	F	F	F			F	F	F	F	F	M	F	F	F
(2-10) Guardrail Upgrades				DE							F							F	F(23)										F	F(23)	
(2-11) Bridge Rail Upgrades																		F	F(22)	F									F	F(22)	F
Reconstruction (16)																															
(2-12) New/Reconstruction	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F

☐ Not Applicable
F Full design level. See Chapter 440.
M Modified design level. See Chapter 430.
DE Design Exception to full design level.
EU Evaluate Upgrade to full design level.

(6) Applies only to bridge end terminals and transition sections.
(9) Continuous shoulder rumble strips required in rural areas. See Chapter 700.
(10) See Chapter 820.
(11) See Chapter 1120.
(12) Impact attenuators are considered as terminals.
(14) Includes crossroad bridge rail. See Chapter 710.
(15) EU for signing and illumination.
(16) For design elements not in the matrix headings, apply full design level as found in the applicable chapters and see 325.03(2).
(17) DE for existing acceleration/deceleration lanes when length meets posted freeway speed and no significant accidents. See Chapter 940.
(19) The funding sources for bridge rail are a function of the length of the bridge. Consult programming personnel.
(22) Upgrade barrier, if necessary, within 200 ft of the end of the bridge.
(23) See description of Guardrail Upgrades Project Type, 325.03(1) regarding length of need.

Design Matrix 2:
Interstate Interchange Areas
Figure 325-4

⇩ Project Type																Bridges (11)				Intersections			Barriers		
Design Elements ⇨	Horiz. Align.	Vert. Align.	Lane Width	Shldr Width	Lane Tran-sition	On/Off Conn.	Median Width	Cross Slope Lane	Cross Slope Shldr	Fill/ Ditch Slopes	Access (3)	Clear Zone (18)	Sign., Del., Illumin.	Basic Safety	Bike & Ped.	Lane Width	Shldr Width	Vertical Clear-ance	Structural Capacity	Turn Radii	Angle	I/S Sight Dist.	Term. & Trans. Section (12)	Std Run	Bridge Rail (14)(19)
Preservation																									
Roadway																									
(3-1) Non-Interstate Freeway	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F		B	B		DE/F	DE/F	F					F	B	F
(3-2) HMA/PCCP/BST Overlays	DE/M	DE/M	DE/M	DE/M	DE/F	DE/F	DE/M	DE/M	DE/M	DE/M			B	B	M	DE/M	DE/M	F				B	F	B	F
(3-3) Replace HMA w/ PCCP at I/S	DE/M	DE/M	EU/M	EU/M	DE/F		DE/M	EU/M	DE/M	DE/M			B	B	M	DE/M	DE/M	F				B	F	B	F
Structures																									
(3-4) Bridge Replacement	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F(2)		F	F		F	F(2)	F(2)	F	F	F(2)	F(2)	F	F	F	F
(3-5) Bridge Deck Rehab.													B	B	M			F					F(6)	F(22)	F
Improvements (16)																									
Mobility																									
(3-6) Non-Interstate Freeway	F	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F	F	F	F	F	F	F	F
(3-7) Urban	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F (2)	F	F	F (2)	F (2)	F	F	F	F
(3-8) Rural	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F (2)	F	F	F (2)	F (2)	F	F	F	F
(3-9) HOV	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F (2)	F	F	F (2)	F (2)	F	F	F	F
(3-10) Bike/Ped. Connectivity	(5)	(5)	(5)	(5)	(5)			(5)	(5)	(5)	(5)	(5)	(5)		F	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
Safety																									
(3-11) Non-Interstate Freeway	F	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F		F	F	F	F	F	F
(3-12) Intersection (1)			F(2)	F(2)	F					F (2)	F	F	F		M					F	F	F	F	F	F
(3-13) Corridor (1)(24)	M(4)	M(4)	M(4)	M(4)	F	F(17)	M(4)	M(4)	M(4)	M(4)	F	F	F		F	M(4)	M(4)	F		M(4)	M(4)	F	F	F	F
(3-14) Median Barrier				DE/F																			F(20)	F(20)	
(3-15) Guardrail Upgrades				DE/F																			F	F(23)	
(3-16) Bridge Rail Upgrades																							F	F(22)	F
(3-17) Risk: Roadside										F	EU/F	F	F										F	F	F
(3-18) Risk: Sight Distance	F/M(21)	F/M(21)	F/M(21)	F/M(21)						F/M(21)	F(21)	F(21)	F		F	F(21)	F(21)	F(21)		F/M(21)	F/M(21)	F(21)	F	F	F
(3-19) Risk: Roadway Width			F/M(21)	F/M(21)	F(21)	F(21)	F/M(21)	F/M(21)	F/M(21)	F/M(21)	F	F	F		F	F(21)	F(21)	F(21)		F/M(21)	F/M(21)	F(21)	F	F	F
(3-20) Risk: Realignment	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F		F(2)	F(2)	F(2)	F	F	F
Economic Development																									
(3-21) Freight & Goods (Frost Free)(8)	F(2)	F(2)	F(2)	F(2)	F	F (2)	F(2)	F(2)	F(2)	F(2)	EU/F	F	B		EU/F(26)	DE/F	DE/F	F	F	EU/F	EU/F	EU/F	F	F	F
(3-22) Four-Lane Trunk System	F	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F	F	F	F	F	F	F	F
(3-23) Rest Areas (New)	F	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F		F	F	F	F	F	F
(3-24) Bridge Restrictions	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F(2)		F	F		EU/F(26)	F(2)	F(2)	F	F	F(2)	F(2)	F	F	F	F
(3-25) Bike Routes (Shldrs)			EU/M	(7)	EU/F				EU/M	EU/M			B	B	F	EU/M	EU/M	F				B	F	B	EU/F

☐ Not Applicable
F Full design level. See Chapter 440.
M Modified design level. See Chapter 430.
B Basic design level. See Chapter 410.
F/M Full for freeways/Modified for nonfreeway
DE Design Exception
EU Evaluate Upgrade

(1) Collision Reduction (HAL, HAC, PAL), or Collision Prevention (At-Grade Removal, Signalization & Channelization). Specific deficiencies that created the project must be upgraded to design level as stated in the matrix.
(2) Modified design level may apply based on a corridor or project analysis. See 325.03(5).
(3) If designated as L/A acquired in the Access Control Tracking System, limited access requirements apply. If not, managed access applies. See 325.03(5).
(4) Full design level may apply based on a corridor or project analysis. See 325.03(5).
(5) For bike/pedestrian design see Chapters 1020 and 1025.
(6) Applies only to bridge end terminals and transition sections.
(7) 4 ft minimum shoulders.
(8) If all weather structure can be achieved with spot digouts and overlay, modified design level applies to NHS highways and basic design level applies to non-NHS highways.
(11) See Chapter 1120.
(12) Impact attenuators are considered as terminals.
(14) Includes crossroad bridge rail. See Chapter 710.
(16) For design elements not in the matrix headings, apply full design level as found in the applicable chapters and see 325.03(2).
(17) DE for existing acceleration/deceleration lanes when length meets posted freeway speed and no significant accidents. See Chapter 940.
(18) On managed access highways within the limits of incorporated cities and towns, City and County Design Standards apply to areas outside the curb or outside the paved shoulder where no curb exists.
(19) The funding sources for bridge rail are a function of the length of the bridge. Consult programming personnel.
(20) Applies to median elements only.
(21) Analyses required. See 325.03(5) for details.
(22) Upgrade barrier, if necessary, within 200 ft of the end of the bridge.
(23) See description of Guardrail Upgrades Project Type, 325.03(1) regarding length of need.
(24) Apply Full design level to projects that realign or reconstruct significant portions of the alignment.
(26) Sidewalk ramps must be addressed for ADA compliance. See Chapter 1025.

Design Matrix 3:
Main Line NHS Routes (Except Interstate)
Figure 325-5

⇩ Project Type	Ramps and Collector Distributors																				Cross Road											
															Ramp Terminals			Barriers												Barriers		
Design Elements ⇨	Horiz. Align.	Vert. Align.	Lane Width	Shldr Width	Lane Tran-sition	On/Off Conn.	Cross Slope Lane	Cross Slope Shldr	Fill/ Ditch Slopes	Access (3)	Clear Zone	Sign, Del., Illumin.	Basic Safety	Bike & Ped.	Turn Radii	Angle	I/S Sight Dist.	Term. & Trans. Section (12)	Std Run	Bridge Rail (14)(19)	Lane Width	Shldr Width	Fill/ Ditch Slopes	Access (3)	Clear Zone	Sign., Del., Illumin.	Basic Safety	Vert. Clear. (11)	Ped. & Bike	Term. & Trans. Section (12)	Std . Run	Bridge Rail (14)(19)
Preservation																																
Roadway																																
(4-1) Non-Interstate Freeway	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F	DE/F		B	B	M	DE/F	DE/F	DE/F	F	B	F	DE/F	DE/F	DE/F			B	B	F	M	F	B	F
(4-2) HMA/PCCP/BST Overlays Ramps												B	B	M			B	F	B	F						B	B	F	M	F	B	F
Structures																																
(4-3) Bridge Replacement	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F	F	F	F	F	F	F(2)	F(2)	F(2)	F	F	F		F	F	F	F	F
(4-4) Bridge Deck Rehab.												B	B	M				F(6)	F(22)	F						B	B	F	M	F(6)	F(22)	F
Improvements (16)																																
Mobility																																
(4-5) Non-Interstate Freeway	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F	F
(4-6) Urban	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F	F	F	F	F(2)	F(2)	F(2)	F	F	F		F	F	F	F	F
(4-7) Rural	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F	F	F	F	F(2)	F(2)	F(2)	F	F	F		F	F	F	F	F
(4-8) HOV By Pass	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F	F	F	F	F(2)	F(2)	F(2)	F	F	F		F	F	F	F	F
(4-9) Bike/Ped. Connectivity	(5)	(5)	(5)	(5)	(5)		(5)	(5)	(5)	(5)	(5)	(5)		F	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)			(5)		(5)	F	(5)	(5)	(5)
Safety																																
(4-10) Non-Interstate Freeway	F	F	F	F	F	F	F	F	F	F	F	F		M	F	F	F	F	F	F	F	F	F	F	F	F		F	M	F	F	F
(4-11) At Grade (1)(25)	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F	F	F	F	F(2)	F(2)	F(2)	F	F	F		F	F	F	F	F
(4-12) Intersection (1)			F(2)	F(2)	F				F(2)	F	F	F		M	F	F	F	F	F	F			F(2)	F	F	F		F	M	F	F	F
(4-13) Guardrail Upgrades				DE/F														F	F(23)											F	F(23)	
(4-14) Bridge Rail Upgrades																														F	F(22)	F
(4-15) Risk: Roadside									F	EU/F	F	F											F	EU/F	F	F				F	F	F
(4-16) Risk: Sight Distance	F/M(21)	F/M(21)	F/M(21)	F/M(21)					F/M(21)	F(21)	F(21)	F		F	F/M(21)	F/M(21)	F	F	F	F			F/M(21)	F(21)	F(21)			F(21)	F			
(4-17) Risk: Roadway Width			F/M(21)	F/M(21)	F	F(21)	F/M(21)	F/M(21)	F/M(21)	F	F	F		F	F/M(21)	F/M(21)	F	F	F	F	F/M(21)	F/M(21)	F/M(21)	F	F			F(21)	F	F	F	F
(4-18) Risk: Realignment	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F/M(21)	F/M(21)	F	F	F	F	F(2)	F(2)	F(2)	F	F			F(21)	F	F	F	F
Economic Development																																
(4-19) Four-Lane Trunk System	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F	F	F	F	F	F	F	F	F	F		F		F	F	F

☐ Not Applicable
F Full design level. See Chapter 440.
M Modified design level. See Chapter 430.
B Basic design level. See Chapter 410.
F/M Full for freeways/Modified for nonfreeway
DE Design Exception
EU Evaluate Upgrade

(1) Collision Reduction (HAL, HAC, PAL), or Collision Prevention (At-Grade Removal, Signalization & Channelization). Specific deficiencies that created the project must be upgraded to design level as stated in the matrix.
(2) Modified design level may apply based on a corridor or project analysis. See 325.03(5).
(3) If designated as L/A acquired in the Access Control Tracking System, limited access requirements apply. If not, managed access applies. See 325.03(5).
(4) Full design level may apply based on a corridor or project analysis. See 325.03(5).
(5) For bike/pedestrian design see Chapters 1020 and 1025.
(6) Applies only to bridge end terminals and transition sections.
(11) See Chapter 1120.
(12) Impact attenuators are considered as terminals.
(14) Includes crossroad bridge rail. See Chapter 710.
(16) For design elements not in the matrix headings, apply full design level as found in the applicable chapters and see 325.03(2).
(19) The funding sources for bridge rail are a function of the length of the bridge. Consult programming personnel.
(21) Analyses required. See 325.03(5) for details.
(22) Upgrade barrier, if necessary, within 200 ft of the end of the bridge.
(23) See description of Guardrail Upgrades Project Type, 325.03(1) regarding length of need.
(25) For main line, use the Project Type row for Safety, Non-Interstate Freeway on Matrix 3 for NHS and on Matrix 5 for non-NHS.

Design Matrix 4: Interchange Areas, NHS (Except Interstate) and Non-NHS
Figure 325-6

⇩ Project Type														Bridges (11)				Intersections			Barriers		
Design Elements ⇨	Horiz. Align.	Vert. Align.	Lane Width	Shldr Width	Lane Tran-sition	Median Width	Cross Slope Lane	Cross Slope Shldr	Fill/ Ditch Slopes	Access (3)	Clear Zone (18)	Sign, Del., Illumin.	Basic Safety	Bike & Ped.	Lane Width	Shldr Width	Vertical Clear.	Structural Capacity	Turn Radii	Angle	I/S Sight Dist.	Term. & Trans. Section (12)	Std Run	Bridge Rail (19)
Preservation																								
Roadway																								
(5-1) HMA/PCCP												B	B	M			F				B	F	B	F
(5-2) BST																								
(5-3) BST Routes/Basic Safety												B	B								B	F	B	F
(5-4) Replace HMA with PCCP at I/S			EU/M	EU/M		DE/M	EU/M					B	B	M			F					F	B	F
Structures																								
(5-5) Bridge Replacement	M	F	M	M	F		M	M	M		F	F		F	F(2)	F(2)	F	F	M	M	F	F	F	F
(5-6) Bridge Repl. (Multilane)	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)		F	F		F	F(2)	F(2)	F	F	F(2)	F(2)	F	F	F	F
(5-7) Bridge Deck Rehab												B	B	M								F(6)	F(22)	F
Improvements (16)																								
Mobility																								
(5-8) Urban (Multilane)	F(2)	F(2)	F(2)	F(2)	F	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F	F	EU/F	EU/F	F	F	F	F
(5-9) Urban	M	M	M	M	F		M	M	M	F	F	F		F	M	M	F	F	EU/M	EU/M	F	F	F	F
(5-10) Rural	M	M	M	M	F	M	M	M	M	F	F	F		F	M	M	F	F	EU/M	EU/M	F	F	F	F
(5-11) HOV	M	M	M	M	F	M	M	M	M	F	F	F		F	M	M	F	F	EU/M	EU/M	F	F	F	F
(5-12) Bike/Ped. Connectivity	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)		F	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
Safety																								
(5-13) Non-Interstate Freeway	F(2)	F(2)	F(2)	F(2)	F(2)	F(2)	F(2)	F(2)	F(2)	F	F	F		F	F(2)	F(2)	F		F(2)	F(2)	F	F	F	F
(5-14) Intersection (1)			M(4)	M(4)	F				M(4)	F	F	F		M					M(4)	M(4)	F	F	F	F
(5-15) Corridor (1)	M(4)	M(4)	M(4)	M(4)	F	M(4)	M(4)	M (4)	M(4)	F	F	F		M	M(4)	M(4)	F		M(4)	M(4)	F	F	F	F
(5-16) Median Barrier				DE/F																		F(20)	F(20)	
(5-17) Guardrail Upgrades				DE/F																		F	F(23)	
(5-18) Bridge Rail Upgrades																						F	F(22)	F
(5-19) Risk: Roadside									M(4)	EU/F	F	F										F	F	F
(5-20) Risk: Sight Distance	F/M(21)	F/M(21)	F/M(21)	F/M(21)					F/M(21)	F(21)	F(21)	F		F	F(21)	F(21)	F(21)		F/M(21)	F/M(21)	F(21)	F	F	F
(5-21) Risk: Roadway Width			F/M(21)	F/M(21)	F	F/M(21)	F/M(21)	F/M(21)	F/M(21)	F	F	F		F	F(21)	F(21)	F(21)		F/M(21)	F/M(21)	F(21)	F	F	F
(5-22) Risk: Realignment	F/M	F/M	F/M	F/M	F	F/M	F(2)	F(2)	F/M	F	F	F		F	F(21)	F(21)	F(21)		F/M(21)	F/M(21)	F(21)	F	F	F
Economic Development																								
(5-23) Freight & Goods (Frost Free) (8)	EU/M	EU/M	EU/M	EU/M	EU/F	EU/M	M	M	EU/M		F	B	B	EU/F(26)	DE/M	DE/M	F		EU/M	EU/M	EU/F	F	B	F
(5-24) Rest Areas (New)	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F			F	F	F	F	F	F
(5-25) Bridge Restrictions	M	F	M	M	F	M	M	M	M		F	F		EU/F(26)	M	M	F	F	M	M	F	F	F	F
(5-26) Bike Routes (Shldrs)			EU/M	(7)	EU/F			EU/M	EU/M			B	B	F	EU/M	EU/M					B	F	B	EU/F

☐ Not Applicable
F Full design level. See Chapter 440.
M Modified design level. See Chapter 430.
F/M Full for freeways/Modified for nonfreeway
B Basic design level. See Chapter 410.
DE Design Exception
EU Evaluate Upgrade

(1) Collision Reduction (HAL, HAC, PAL), or Collision Prevention (At Grade Removal, Signalization & Channelization). Specific deficiencies that created the project must be upgraded to design level as stated in the matrix.
(2) Modified design level may apply based on a corridor or project analysis. See 325.03(5).
(3) If designated as L/A acquired in the Access Control Tracking System, limited access requirements apply. If not, managed access applies. See 325.03(5).
(4) Full design level may apply based on a corridor or project analysis. See 325.03(5).
(5) For bike/pedestrian design see Chapters 1020 and 1025.
(6) Applies only to bridge end terminals and transition sections.
(7) 4 ft minimum shoulders.
(8) If all weather structure can be achieved with spot digouts and overlay, modified design level applies to NHS highways and basic design level applies to non-NHS highways.
(11) See Chapter 1120.
(12) Impact attenuators are considered as terminals.
(16) For design elements not in the matrix headings, apply full design level as found in the applicable chapters and see 325.03(2).
(18) On managed access highways within the limits of incorporated cities and towns, City and County Design Standards apply to areas outside the curb or outside the paved shoulder where no curb exists.
(19) The funding sources for bridge rail are a function of the length of the bridge. Consult programming personnel.
(20) Applies to median elements only.
(21) Analyses required. See 325.03(5) for details.
(22) Upgrade barrier, if necessary, within 200 ft of the end of the bridge.
(23) See description of Guardrail Upgrades Project Type, 325.03(1) regarding length of need.
(26) Sidewalk ramps must be addressed for ADA compliance. See Chapter 1025.

Design Matrix 5:
Main Line Non-NHS Routes
Figure 325-7

Chapter 330 Design Documentation, Approval, and Process Review

330.01 General

The Project File (PF) contains the documentation for planning, scoping, programming, design, approvals, contract assembly, utility relocation, needed right of way, advertisement, award, construction, and maintenance review comments for a project. A Project File is completed for all projects and is retained by the Region office responsible for the project. Responsibility for the project may pass from one office to another during the life of a project, and the Project File follows the project as it moves from office to office. Portions of the Project File that are not designated as components of the Design Documentation Package (DDP) may be purged when retention of the construction records is no longer necessary.

The Design Documentation Package is a part of the Project File. It documents and justifies design decisions and the design process that was followed. The Design Documentation Package is retained in a permanent, retrievable file for a period of 75 years, in accordance with WSDOT records retention policy.

For operational changes and developer projects, design documentation is also required and is retained by the Region office responsible for the project, in accordance with WSDOT records retention policy. All participants in the design process must provide the appropriate documentation for their decisions.

330.02 References

(1) Federal/State Laws and Codes

23 CFR 635.111, Tied bids

23 CFR 635.411, Material or product selection

RCW 47.28.030, Contracts – State forces – Monetary limits – Small businesses, minority, and women contractors – Rules

RCW 47.28.035, Cost of project, defined

"Washington Federal-Aid Stewardship Agreement," as implemented in the design matrices (Chapter 325)

(2) Design Guidance

Advertisement and Award Manual, M 27-02, WSDOT

Directional Documents Index, WSDOT: wwwi.wsdot.wa.gov/docs/

Executive Order E 1010.00, "Certification of Documents by Licensed Professionals," WSDOT

Hydraulics Manual, M 23-03, WSDOT

Master Plan for Limited Access Highways, WSDOT

Plans Preparation Manual, M 22-31, WSDOT

Roadside Classification Plan, M 25-31, WSDOT

Route Development Plan, WSDOT

Washington State Highway System Plan, WSDOT

(3) Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

330.03 Definitions

Design Approval Documented approval of the design criteria, which becomes part of the Design Documentation Package. This approval is an endorsement of the design criteria by the designated representative of the approving organization, as shown in Figures 330-2a and 2b.

design exception (DE) Preauthorization to omit correction of an existing design element for various types of projects, as designated in the design matrices (see Chapter 325). A DE designation indicates that the design element is normally outside the scope of the project type (see Figure 330-1).

design variance A recorded decision to differ from the design level specified in the *Design Manual*, such as an Evaluate Upgrade (EU) not upgraded, a DE, or a deviation. EUs leading to an upgrade are documented but are not considered to be variances. A project or corridor analysis may also constitute a design variance if that analysis leads to a decision to use a design level or design classification that differs from what the *Design Manual* specifies for the project type.

Design Variance Inventory (DVI) A list of design elements that will not be improved in accordance with the *Design Manual* criteria designated for the project.

Design Variance Inventory System (DVIS) A database application developed to generate the DVI form. The DVIS also provides query functions, giving designers an opportunity to search for previously granted variances. The DVIS database is intended for internal WSDOT use only, and WSDOT staff access it from: www.wsdot.wa.gov/design/projectdev

deviation A documented decision granting approval at project-specific locations to differ from the design level specified in the *Design Manual* (see Figures 325-3 through 7 and Figure 330-1).

environmental documents:

- ***NEPA*** National Environmental Policy Act
- ***SEPA*** [Washington] State Environmental Policy Act
- ***CE*** NEPA: Categorical Exclusion
- ***CE*** SEPA: Categorical Exception
- ***EA*** Environmental Assessment
- ***ECS*** Environmental Classification Summary
- ***EIS*** Environmental Impact Statement
- ***ERS*** Environmental Review Summary
- ***FONSI*** Finding Of No Significant Impact
- ***ROD*** Record of Decision

evaluate upgrade (EU) A decision-making process to determine whether or not to correct an existing design element as designated in the design matrices. Documentation is required (see Figure 330-1)

FHWA Federal Highway Administration.

HQ The Washington State Department of Transportation Headquarters organization.

Project Change Request Form A form used to document and approve revisions to project scope, schedule, or budget, from a previously approved Project Definition (see Project Summary).

Project Development Approval Final approval of all project development documents by the designated representative of the approving organization prior to the advertisement of a capital transportation project (see Figures 330-2a and 2b).

Project File (PF) A file containing all documentation and data for all activities related to a project (see 330.01 and 330.04).

- ***Design Documentation Package (DDP)*** The portion of the Project File, including Project Development Approval, that will be retained long term in accordance with WSDOT document retention policies. Depending on the scope of the project, it contains the Project Summary and some or all of the other documents discussed in this chapter. Common components are listed in Figure 330-5. Technical reports and calculations are part of the Project File, but are not designated as components of the DDP. Include estimates and justifications for decisions made in the DDP (see 330.04(2)). The DDP explains how and why the design was chosen, and documents approvals (see 330.01).

Project Summary A set of electronic documents consisting of the Design Decisions Summary (DDS), the Environmental Review Summary (ERS), and the Project Definition (PD). The Project Summary is part of the design documentation required to obtain Design Approval and is ultimately part of the design documentation required for Project Development Approval (see 330.06).

- ***Design Decisions Summary*** An electronic document that records major design decisions regarding roadway geometrics, roadway and roadside features, and other issues that influence the project scope and budget.
- ***Environmental Review Summary*** An electronic document that records the environmental requirements and considerations for a specific project.
- ***Project Definition*** An electronic document that records the purpose and need of the project, along with program level and design constraints.

scoping phase The first phase of project development for a specific project. It follows identification of the need for a project and precedes detailed project design. It is the process of identifying the work to be done and developing a cost estimate for completing the design and construction. The Project Summary, engineering and construction estimates, and several technical reports (geotechnical, surfacing, bridge condition, etc.) are developed during this phase.

330.04 Design Documentation

(1) Purpose

Design documentation records the evaluations and decisions by the various disciplines that result in design recommendations. Design assumptions and decisions made prior to and during the scoping phase are included. Changes that occur throughout project development are documented. Required justifications and approvals are also included.

The DDP identifies the purpose of and need for the project and documents how the project addresses the purpose and need. The "Design Documentation Checklist" has been developed as a tool (optional) to assist in generating the contents of the DDP and the PF: www.wsdot.wa.gov/design/projectdev/

(2) Design Documents

The DDP portion of the PF preserves the decision documents generated during the design process. In each package, a summary (list) of the documents is recommended.

The design documents commonly included in the PF and DDP for all but the simplest projects are listed in Figure 330-5.

Documentation is not required for components not related to the project.

The DVI is *required* for all projects on the National Highway System (NHS) having design variances; it is recommended for all projects having design variances. The DVI lists all EUs not upgraded to the applicable design level, DEs, and deviations as indicated by the design matrices. Record variances resulting from a project or corridor analysis in the DVI. Use the DVIS database application to record and manage design variances: www.wsdot.wa.gov/design/projectdev

The ERS and the PD are required for most projects. Exceptions will be identified by the Project Control and Reporting Office.

The DDS is not required for the following project types unless they involve reconstructing the lanes, shoulders, or fill slopes. Since these and some other project types are not included in the design matrices, evaluate them with respect to modified design level (M) for non-NHS routes and full design level (F) for NHS routes. Include in the evaluation only those design elements specifically impacted by the project. Although the following list illustrates some of the project types that do not require a DDS, the list is not intended to be a complete accounting of all such projects. Consult with the HQ System Analysis and Program Development Office for projects not included in the list.

- Bridge painting
- Crushing and stockpiling
- Pit site reclamation
- Lane marker replacement

- Guidepost replacement
- Signal rephasing
- Signal upgrade
- Seismic retrofit
- Bridge joint repair
- Navigation light replacement
- Signing upgrade
- Illumination upgrade
- Rumble strips
- Electrical upgrades
- Major drainage
- Bridge scour
- Fish passage
- Other projects as approved by the HQ Design Office

(3) Certification of Documents by Licensed Professionals

All original technical documents must bear the certification of the responsible licensee (see Executive Order E 1010.00).

(4) Design Exception (DE), Evaluate Upgrade (EU), and Deviation Documentation

In special cases, projects may need to address design elements, which are shown as blank cells in a design matrix (see Figure 330-1). These special cases must be coordinated with the appropriate Assistant State Design Engineer (ASDE) and the HQ Project Control and Reporting Office. When this is necessary, document the reasons for inclusion of that work in your project.

When the design matrices specify a DE for a design element, the DE documentation must specify the matrix and row, the design element, and the limits of the exception. When a DVI is required for the project, the DE locations must be recorded in the inventory.

The EU process determines if an item of work will or will not be done, through analysis of factors such as benefit/cost, route continuity, accident reduction potential, environmental impact, and economic development. Document all EU decisions to the DDP using the list in Figure 330-6 as a guide for the content. The cost of the improvement must always be considered when making EU decisions. EU examples on the Internet can serve as models for development of EU documentation. The appropriate approval authority for EUs is designated in Figures 330-2a and 2b.

Deviation requests are stand-alone documents requiring enough information and project description for an approving authority to make an informed decision of approval or denial. Documentation of a deviation must contain justification and must be approved at the appropriate administrative level, as shown in Figures 330-2a and 2b. Submit the request as early as possible because known deviations are to be approved prior to Project Development Approval or Intersection/Interchange Plan approval.

When applying for deviation approval, it is necessary to provide two explanations. The first identifies the design element and explains why the design level specified in the design matrices was not or cannot be used. The second provides the justification for the design that is proposed. Justification for a deviation must be supported by at least two of the following:

- Accident history and accident analysis
- Benefit/cost analysis
- Engineering judgment
- Environmental issues
- Route continuity

Engineering judgment includes a reference to another publication, with an explanation of why that reference is applicable to the situation encountered on the project.

If the element meets current AASHTO guidance adopted by FHWA, such as *A Policy on Geometric Design of Highways and Streets*, but not the *Design Manual* criteria, it is a deviation from the *Design Manual* that does not require approval by FHWA or the HQ Design Office. However, it only requires documentation and justification in the DDP to support the use of the AASHTO guidance. The following documentation is required:

- Identify the design element
- Explain why the design level specified in the design matrices was not used
- Explain which AASHTO guidance was used (including the title of the AASHTO guidance, the publication date, and the chapter and page number of the guidance)

Deviation approval is at the appropriate administrative level, as shown in Figures 330-2a and 2b.

Reference a corridor or project analysis as supporting justification for design deviations dealing with route continuity issues (see Chapter 325).

Once a deviation is approved, it applies to that project only. When a new project is programmed at the same location, the subject design element must be reevaluated and either (1) the subject design element is rebuilt to conform to the applicable design level, or (2) a new deviation is developed, approved, and preserved in the DDP for the new project. Check the DVIS for help in identifying previously granted deviations.

A change in a design level resulting from an approved *Route Development Plan* or a corridor or project analysis, as specified in design matrix notes, is documented similar to a deviation. Design elements that do not comply with the design level specified in an approved corridor or project analysis are documented as deviations.

To prepare a deviation request, use the list in Figure 330-7 as a general guide for the sequence of the content. The list is not all-inclusive of potential content and it might include suggested topics that do not apply to a particular project. For Design deviation examples, see: www.wsdot.wa.gov/design/projectdev

Matrix Cell Contents	Project Corrects Design Elements That Do Not Conform to Specified Design Level	Document to File[1]	Record in DVIS[2]
Blank cell in design matrix		No[3]	No
Cell Entry			
Full (F), Modified (M), or Basic (B) (with no DE or EU qualifiers)	Yes	No	No
	No[4]	Yes[5]	Yes
Design Exception (DE)	Yes[3]	DDP	No
	No	DDP	Yes
Evaluate Upgrade (EU)[5]	Yes	DDP	No
	No	DDP	Yes

DDP = Document to Design Documentation Package

Notes:

[1] See 330.04(3).

[2] See 330.04(2).

[3] Document to the DDP if the element is included in the project as identified in the Project Summary or Project Change Request Form.

[4] Nonconformance with specified design level (see Chapter 325) requires an approved deviation.

[5] Requires supporting justification (see 330.04(4)).

Design Matrix Documentation Requirements
Figure 330-1

330.05 Project Development

In general, the Region initiates the development of a specific project by preparing the Project Summary. Some project types may be initiated by other WSDOT groups such as the HQ Bridge and Structures Office or the HQ Traffic Office, rather than the Region. The project coordination with other disciplines (such as Real Estate Services, Roadside and Site Development, Utilities, and Environmental) is started in the project scoping phase and continues throughout the project's development. The Region coordinates with state and federal resource agencies and local governments to provide and obtain information to assist in developing the project.

The project is developed in accordance with all applicable Directives, Instructional Letters, Supplements, and manuals; the *Master Plan for Limited Access Highways*; the *Washington State Highway System Plan*; the *Route Development Plan*; the Washington Federal-Aid Stewardship Agreement, as implemented in the design matrices (see Chapter 325); and the Project Summary.

The Region develops and maintains documentation for each project. The Project File includes documentation of project work including planning; scoping; public involvement; environmental action; design decisions; right of way acquisition; Plans, Specifications, and Estimates (PS&E) development; project advertisement; and construction. Refer to the *Plans Preparation Manual* for PS&E documentation.

All projects involving FHWA action require NEPA clearance. Environmental action is determined through the ECS form. The environmental approval levels are shown in Figure 330-3.

Upon receipt of the ECS approval for projects requiring an EA or EIS under NEPA, the Region proceeds with environmental documentation, including public involvement, appropriate for the magnitude and type of the project (see Chapter 210).

Design Approval and approval of Right of Way plans are required prior to acquiring property. If federal funds are used to purchase the property, then NEPA clearance is also required.

The ASDEs work with the Regions on project development and conduct process reviews on projects as described in 330.10.

330.06 Scoping Phase

Development of the project scope is the initial phase of project development. This effort is prompted by the *Washington State Highway System Plan*. The project scoping phase consists of determining a project description, schedule, and cost estimate. The intent is to make design decisions early in the project development process that focus the scope of the project. During the project scoping phase, the Project Summary documents are produced.

(1) Project Summary

The Project Summary provides information on the results of the scoping phase; links the project to the *Washington State Highway System Plan* and the *Capital Improvement and Preservation Program* (CIPP); and documents the design decisions, the environmental classification, and agency coordination. The Project Summary is developed and approved before the project is funded for design and construction, and consists of ERS, DDS, and PD documents, which are electronic forms. The Project Summary database contains specific online instructions for completing the documents.

(a) **Environmental Review Summary (ERS)**. Lists the environmental permits and approvals that will be required, environmental classifications, and environmental considerations. This form lists requirements by environmental and permitting agencies. If there is a change in the PD or DDS, the information in the ERS must be reviewed and revised to match the rest of the Project Summary. The ERS is prepared during the scoping phase and is approved by the Region. During final design and permitting, revisions may need to be made to the ERS and be reapproved by the Region.

(b) **Design Decisions Summary (DDS)**. Provides the design matrix used to develop the project, and the roadway geometrics, design deviations, EUs, other roadway features, roadside restoration, and any design decisions made during the scoping of a project. The information contained in this form is compiled from various databases of departmental information, field data collection, and evaluations made in development of the PD and the ERS. Design decisions may be revised throughout the project development process based on continuing evaluations.

    The DDS is approved by the appropriate ASDE for new construction and reconstruction projects on the Interstate System before submittal to FHWA (see 330.07). The Region design authority approves the DDS for all other types of projects. To approve the Design Decisions Summary, the Region must be confident that there will be no significant change in the PD or estimated cost. However, if there is a change to the PD or a significant change in the cost estimate, the DDS is to be revised or supplemented and reapproved. Significant cost changes require a Project Change Request Form to be submitted and approved by the appropriate designee.

(c) **Project Definition (PD)**. Identifies the various disciplines and design elements that will be encountered in project development. The PD states the purpose and need for the project, the program categories, and the recommendations for project phasing. This information determines the level of documentation and evaluation that is needed for Project Development Approval. The PD is completed early in the scoping phase to provide a basis for full development of the ERS, DDS, schedule, and estimate. If circumstances necessitate a change to an approved PD, process a Project Change Request Form for approval by the appropriate designee, revise the original PD form, and obtain approval of the revisions.

330.07 FHWA Approval

For all NHS projects, the level of FHWA oversight varies according to the type of project, the agency doing the work, and the funding source as shown in Figures 330-2a and 2b. Oversight and funding do not affect the level of design documentation required for a project.

FHWA approval is required for any new or revised access point (including interchanges, temporary access breaks, and locked gate access points) on the Interstate System, regardless of funding (see Chapter 1425).

Documents for projects requiring FHWA review, Design Approval, and Project Development Approval are submitted through the HQ Design Office. Include applicable project documents as specified in Figure 330-5.

330.08 Design Approval

When the Project Summary documents are complete, and the Region is confident that the proposed design adequately addresses the purpose and need for the project, a Design Approval may be entered into the Design Documentation Package. Approval levels for design and PS&E documents are presented in Figures 330-2a through 330-4.

The following items must be provided for Design Approval:

- A one- or two-page reader-friendly memo that describes the project
- Project Summary documents
- Corridor or project analysis
- Design Criteria worksheets: www.wsdot.wa.gov/design/projectdev
- Design Variances Inventory (for known variances)
- Channelization plans, Intersection plans, or Interchange plans (if applicable)
- Alignment plans and profiles (if project significantly modifies either the existing vertical or horizontal alignment)
- Current cost estimate with a confidence level

Design Approval remains valid for three years. Evaluate policy changes or revised design criteria that are adopted by the department during this time to determine if these changes would have a significant impact on the scope or schedule of the project. If it is determined that these changes will not be incorporated into the project, document this decision with a memo from the Region Project Development Engineer that is included in the DDP. For an overview of design policy changes, consult the Detailed Chronology of Design Policy Changes Affecting Shelved Projects:
www.wsdot.wa.gov/design/policy/designpolicy

(1) Alternative Project Delivery Methods

Design Approval applies to projects delivered using alternative means, including design-build projects. Design documentation begins in the project scoping phase and continues through the life of the design-build project. This documentation is thus started by WSDOT and is completed by the design-builder. Since Design Approval is related to project scoping, this milestone may very well be accomplished prior to issuing a Design-Build Request for Proposal (see Figure 110-1). However, the design-builder shall refer to the RFP for direction on approval milestones.

330.09 Project Development Approval

When all project development documents are complete and approved, Project Development Approval is granted by the approval authority designated in Figures 330-2a and 2b. The Project Development Approval becomes part of the DDP. (See 330.04 and Figure 330-5 for design documents that may lead to Project Development Approval.) Figures 330-2a through 330-4 provide approval levels for project design and PS&E documents.

The following items must be approved prior to Project Development Approval:

- Required environmental documents
- Design Approval documents (and any supplements)
- Design Variance Inventory (as required)
- Cost estimate
- Stamped cover sheet (project description)

Project Development Approval remains valid for three years. Evaluate policy changes or revised design criteria that are adopted by the department during this time to determine if these changes would have a significant impact on the scope or schedule of the project. If it is determined that these changes will not be incorporated into the project, document this decision with a memo from the Region Project Development Engineer that is included in the DDP. For an overview of design policy changes, consult the Detailed Chronology of Design Policy Changes Affecting Shelved Projects at: www.wsdot.wa.gov/design/policy/designpolicy

(1) Alternative Project Delivery Methods

For projects delivered using alternative methods, such as design-build, the design-builder shall refer to the project RFP for specification on final and intermediate deliverables and final records for the project. Project Development Approval is *required* prior to project completion.

It is a prudent practice to start the compilation of design documentation early in a project and to acquire Project Development Approval before the completion of the project. At the start of a project, it is critical WSDOT project administration staff recognize the importance of all required documentation and how it will be used in the design-build project delivery process.

330.10 Process Review

The process review is done to provide reasonable assurance that projects are prepared in compliance with established policies and procedures and that adequate records exist to show compliance with state and federal requirements. Process reviews are conducted by WSDOT, FHWA, or a combination of both.

The design and PS&E process review is performed in each Region at least once each year by the HQ Project Development Branch. The documents used in the review process are (1) the Design Documentation Checklist, (2) the PS&E Review Checklist, and (3) the PS&E Review Summary. These are generic forms used for all project reviews. Copies of these working documents are available for reference when assembling project documentation. The HQ Design Office, Project Development Branch, maintains current copies at: www.wsdot.wa.gov/design/projectdev

Each project selected for review is examined completely and systematically beginning with the scoping phase (including planning documents) and continuing through contract plans and, when available, construction records and change orders. Projects are normally selected after contract award. For projects having major traffic design elements, the HQ Maintenance and Operations Programs' Traffic Operations personnel are involved in the review. The WSDOT process reviews may be held in conjunction with FHWA process reviews.

The HQ Project Development Branch schedules the process review and coordinates it with the Region and FHWA.

A process review follows this general agenda:

1. Review team meets with Region personnel to discuss the object of the review.
2. Review team reviews the design and PS&E documents, and the construction documents and change orders (if available) using the checklists.
3. Review team meets with Region personnel to ask questions and clarify issues of concern.
4. Review team meets with Region personnel to discuss findings.
5. Review team submits a draft report to the Region for comments and input.
6. If the review of a project shows a serious discrepancy, the Region design authority is asked to report the steps that will be taken to correct the deficiency.
7. The process review summary forms are completed.
8. The summary forms and checklists are evaluated by the State Design Engineer.
9. The findings and recommendations of the State Design Engineer are forwarded to the Region design authority for action and/or information within 30 days of the review.

Project Design	FHWA Oversight Level	Deviation and Corridor/Project Approval[a][b]	EU Approval[b]	Design Approval and Project Development Approval
Interstate				
New/Reconstruction[c] • Federal funds • No federal funds	 (d) (e)	FHWA	Region	FHWA*
Intelligent Transportation Systems (ITS) over $1 million	(f)	HQ Design	Region	HQ Design
All Other[g] • Federal funds • State funds • Local agency funds	 (f) (f) (e)	HQ Design	Region	Region
National Highway System (NHS)				
Managed access highway outside incorporated cities and towns or inside unincorporated cities and towns, or limited access highway	(f)	HQ Design	Region	Region
Managed access highway within incorporated cities and towns[h] • Inside curb or EPS[i] • Outside curb or EPS	 (f) (f)	 HQ Design HQ H&LP	 Region N/A	 Region City/Town

FHWA = Federal Highway Administration

HQ = WSDOT Headquarters

H&LP = WSDOT Highways & Local Programs Office

EPS = Edge of paved shoulder where curbs do not exist

Notes:

(a) These approval levels also apply to deviation processing for local agency work on a state highway.

(b) See 330.04(4).

(c) For definition, see Chapter 325.

(d) Requires FHWA review and approval (full oversight) of design and PS&E submitted by HQ Design Office.

(e) To determine the appropriate oversight level, FHWA reviews the Project Summary (or other programming document) submitted by HQ Design Office, or by WSDOT Highways & Local Programs through the HQ Design Office.

(f) FHWA oversight is accomplished by process review (see 330.10).

(g) Reduction of through lane or shoulder widths (regardless of funding) requires FHWA review and approval of the proposal.

(h) Applies to the area within the incorporated limits of cities and towns.

(i) Includes raised medians.

* FHWA will accept design criteria prior to NEPA approval, but will not approve the design until NEPA is complete.

Design Approval Level

Figure 330-2a

Project Design	FHWA Oversight Level	Deviation and Corridor/ Project Approval[a][b]	EU Approval[b]	Design Approval and Project Development Approval
Non-National Highway System (Non-NHS)				
Improvement project on managed access highway outside incorporated cities and towns or within unincorporated cities and towns, or on limited access highway (Matrix lines 5-8 through 5-26)	N/A	HQ Design	Region	Region
Improvement project on managed access highway within incorporated cities and towns[h] • Inside curb or EPS[i] • Outside curb or EPS (Matrix lines 5-8 through 5-26)	 N/A N/A	 HQ Design HQ H&LP	 Region N/A	 Region City/Town
Preservation project on managed access highway outside incorporated cities and towns or within unincorporated cities and towns, or on limited access highway[j] (Matrix lines 5-1 through 5-7)	N/A	Region[k]	Region	Region
Preservation project on managed access highway within incorporated cities and towns[h][j] • Inside curb or EPS[i] • Outside curb or EPS (Matrix lines 5-1 through 5-7)	 N/A N/A	 Region HQ H&LP	 Region N/A	 Region City/Town

FHWA = Federal Highway Administration

HQ = WSDOT Headquarters

H&LP = WSDOT Highways & Local Programs Office

EPS = Edge of paved shoulder where curbs do not exist

Notes:

(a) These approval levels also apply to deviation processing for local agency work on a state highway.

(b) See 330.04(4).

(h) Applies to the area within the incorporated limits of cities and towns.

(i) Includes raised medians.

(j) For Bridge Replacement projects in the preservation program, follow the approval level specified for improvement projects.

(k) For guidance on access deviations, see Chapters 1430 and 1435.

Design Approval Level

Figure 330-2b

Item	Approval Authority		
	Region	HQ	FHWA
Program Development			
Work Order Authorization		X	X[1]
Public Hearings			
Corridor Hearing Summary		X[2]	
Design Summary		X[3]	
Access Hearing Plan		X[4]	
Access Findings and Order		X[5]	
Environmental by Classification			
Summary (ECS) NEPA			X
Class I NEPA (EIS)		[7]	X
Class I SEPA (EIS)		X	
Class II NEPA – Programmatic Categorical Exclusion (CE)*	X		
Class II NEPA – Documented Categorical Exclusion (CE)	[6]		X
Class II SEPA – Categorical Exemption (CE)	X		
Class III NEPA – Environmental Assessment (EA)		[7]	X
SEPA Checklist	X		
Design			
Design Deviations	[8]	[8]	[8]
Experimental Features		X	X[9]
Environmental Review Summary	X		
Final Design Decisions Summary	X	X[3]	
Final Project Definition		X[10]	
Interchange Justification Report		[7]	X
Non-Interstate Interchange Justification Report		X	
Interstate Interchange Plans (includes Intersection Plans)		[7]	X[9][11]
Non-Interstate Interchange Plans	X[11]		
Intersection Plans	X[11]		
Right of Way Plans	[12]	X	
Monumentation Map	X		
Materials Source Report		X[13]	
Pavement Determination Report		X[13]	
Roundabout Geometric Design	X[11]	X[11]	
Design Approval	[8]	[8]	[8]
Project Development Approval	[8]	[8]	[8]

Approvals
Figure 330-3

Item	Approval Authority		
	Region	HQ	FHWA
Design (continued)			
Resurfacing Report		X[13]	
Signal Permits	X[14]		
Geotechnical Report		X[13]	
Tied Bids	X[15]		X[9][15]
Bridge Design Plans (Bridge Layout)	X	X	
Hydraulic Report	X[16][17]	X[16][17]	
Preliminary Signalization Plans		X[6]	
Rest Area Plans		X	
Roadside Restoration Plans	X[18]	X[19]	
Structures Requiring TS&L's		X	X
Planting Plans	X[18]	X[19]	
Grading Plans	X[18]	X[19]	
Continuous Illumination – Main Line		X[20]	
Project Change Request Form	X[21]	X[21]	
Work Zone Transportation Management Plan/Traffic Control Plan	X[22]		
Public Art Plan – Interstate (see Chapter 1360)	X[18][23]	X[19][23]	X[9][19][23]
Public Art Plan – Non-Interstate (see Chapter 1360)	X[18][23]	X[19][23]	

X Normal procedure * If on the preapproved list

Notes:

[1] Federal-aid projects only.

[2] Approved by Environmental and Engineering Programs Director.

[3] Approved by State Design Engineer.

[4] Approved by Right of Way Plans Engineer.

[5] Refer to Chapter 210 for approval requirements.

[6] Final review & concurrence required at the Region prior to submittal to approving authority.

[7] Final review & concurrence required at HQ prior to submittal to approving authority.

[8] Refer to Figures 330-2a & 2b for Design Approval and Project Development Approval levels.

[9] Applies to new/reconstruction projects on Interstate routes.

[10] Approved by HQ Project Control & Reporting.

[11] Include channelization details.

[12] Certified by the responsible professional licensee.

[13] Submit to HQ Materials Laboratory for review and approval.

[14] Approved by Region Administrator or designee.

[15] See 23 CFR 635.111.

[16] For additional guidance, see the *Hydraulics Manual*, M 23-03.

[17] Region to submit Hydraulic Report. Refer to *Hydraulics Manual*.

[18] Applies only to Regions with a Landscape Architect.

[19] Applies only to Regions without a Landscape Architect.

[20] Approved by State Traffic Engineer.

[21] Consult HQ Project Control & Reporting for clarification on approval authority.

[22] Region Traffic Engineer.

[23] The State Bridge and Structures Architect reviews and approves the Public Art Plan (see Chapter 1360 for further details on approvals).

Approvals

Figure 330-3 (continued)

Item	New/Reconstruction (Interstate only)	NHS and Non-NHS
DBE/training goals* **	(a)	(a)
Right of way certification for federal-aid projects	FHWA(b)	FHWA(b)
Right of way certification for state-funded projects	Region(b)	Region(b)
Railroad agreements	(c)	(c)
Work performed for public or private entities*	[1][2]	Region[1][2]
State force work*	FHWA[3](d)	Region[3](d)
Use of state-furnished stockpiled materials*	FHWA[4]	FHWA[4]
Stockpiling materials for future projects*	FHWA[4]	FHWA[4]
Work order authorization	[5](d)	[5](d)
Ultimate reclamation plan approval through DNR	Region	Region
Proprietary item use*	FHWA[4]	[4](c)
Mandatory material sources and/or waste sites*	FHWA[4]	Region[4]
Nonstandard bid item use*	Region	Region
Incentive provisions	FHWA	(e)
Nonstandard time for completion liquidated damages*	FHWA(e)	(e)
Interim liquidated damages*	(f)	(f)

Notes:

[1] This work requires a written agreement.
[2] Region approval subject to $250,000 limitation.
[3] Use of state forces is subject to $60,000 limitation and $100,000 in an emergency situation, as stipulated in RCWs 47.28.030 and 47.28.035.
[4] Applies only to federal-aid projects; however, document for all projects.
[5] Prior FHWA funding approval required for federal-aid projects.

Region or Headquarters approval authority:

(a) Office of Equal Opportunity
(b) Real Estate Services Office
(c) Design Office
(d) Project Control & Reporting Office
(e) Construction Office
(f) Transportation Data Office

References:

**Plans Preparation Manual*
***Advertisement and Award Manual*

PS&E Process Approvals
Figure 330-4

Document[1]	Required for FHWA Oversight
Project Definition	X
Design Decisions Summary	X
Environmental Review Summary	X
Design Variance Inventory (and supporting information for DEs, EUs not upgraded, and deviations)[2]	X
Cost Estimate	X
SEPA & NEPA documentation	X
Design Clear Zone Inventory (see Chapter 700)	X
Interchange plans, profiles, roadway sections	X
Interchange Justification Report (if requesting new or revised access points)	X
Corridor or project analysis (see Chapter 325)	X
Traffic projections and analysis	
Accident analysis	
Right of way plans	
Work zone traffic control strategy	
Record of Survey or Monumentation Map	
Documentation of decisions to differ from WSDOT design guidance	
Documentation of decisions for project components for which there is no WSDOT design guidance	
Paths and Trails Calculations[3]	

Notes:

[1] For a complete list, see the Design Documentation Checklist.

[2] Required for NHS highways; recommended for all highways.

[3] See the *Plans Preparation Manual*.

Common Components of Design Documentation Package

Figure 330-5

1. **Design Element Upgraded to the Level Indicated in the Matrix**
   (a) Design element information
   - Design element
   - Location
   - Matrix number and row

   (b) Cost estimate[1]
   (c) B/C ratio[2]
   (d) Summary of the justification for the upgrade[3]

2. **Design Element Not Upgraded to the Level Indicated in the Matrix**
   (a) Design element information
   - Design element
   - Location
   - Matrix number and row

   (b) Existing conditions
   - Description
   - Accident Summary
   - Advantages and disadvantages of leaving the existing condition unchanged

   (c) Design using the *Design Manual* criteria
   - Description
   - Cost estimate[1]
   - B/C ratio[2]
   - Advantages and disadvantages of upgrading to the level indicated in the matrix

   (d) Selected design, if different from existing but less than the level indicated in the matrix
   - Description
   - Cost estimate[1]
   - B/C ratio[2]
   - Advantages and disadvantages of the selected design

   (e) Summary of the justification for the selected design[3]

Notes:

[1] An estimate of the approximate total additional cost for the proposed design. Estimate may be based on experience and engineering judgment.

[2] Include only when B/C is part of the justification. An approximate value based on engineering judgment may be used.

[3] A brief (one or two sentence) explanation of why the proposed design was selected.

Evaluate Upgrade (EU) Documentation Contents List
Figure 330-6

1. **Overview**
   (a) The safety or improvement need that the project is to meet
   (b) Description of the project as a whole
   (c) Highway classification and applicable design matrix number and row
   (d) Funding sources
   (e) Evidence of deviations approved for previous projects (same location)

2. **Design Alternatives in Question**
   (a) Existing conditions and design data
   - Location in question
   - Rural, urban, or developing
   - *Route development plan*
   - Environmental issues
   - Right of way issues
   - Number of lanes and existing geometrics
   - Present and 20-year projected ADT
   - Design speed, posted speed, and operating speed
   - Percentage of trucks
   - Terrain Designation
   - Managed access or limited access

   (b) Accident Summary and Analysis
   (c) Design using the *Design Manual* criteria
   - Description
   - Cost estimate
   - B/C ratio
   - Advantages and disadvantages
   - Reasons for considering other designs

   (d) Other alternatives (may include "No-build" alternative)
   - Description
   - Cost estimate
   - B/C ratio
   - Advantages and disadvantages
   - Reasons for rejection

   (e) Selected design requiring justification or documentation to file
   - Description
   - Cost estimate
   - B/C ratio
   - Advantages and disadvantages

3. **Concurrences, Approvals, and Professional Seals**

Deviation Request Contents List
Figure 330-7

Chapter 340 Minor Operational Enhancement Projects

340.01 General

This chapter complements Chapter 325 by providing guidance for development of minor operational enhancement projects. Do not use this chapter to develop Preservation or Improvement projects. Refer to Chapter 325 for guidance in development of Preservation and Improvement projects and also for projects initiated by local agencies or developers. The minor operational enhancement matrices contained in this chapter identify the design level(s) for a project, the associated approval level, and the documentation requirements for the most common minor operational enhancement projects. The matrices focus on the various elements of greatest concern during project development.

Minor enhancement projects are categorized as low-cost enhancements to improve the operational safety and efficiency of the highway system. These enhancements are most often installed by state forces through work orders, but may be accomplished through a stand-alone state contract funded entirely through the Q Program; a Q Program-funded bid item within a larger Improvement project; a change order to an existing state contract; or agreements with local agencies. An important characteristic of these projects is the ability to quickly develop and implement them without a cumbersome approval process. Balanced with this is a need to apply consistency in design policies and guidelines in the development and approval processes. Therefore, the intent of this chapter is to clarify the design guidelines and documentation requirements for minor operational enhancement projects without unduly impeding the process.

The objective of the Q Program is to maximize highway transportation system safety and efficiency through a statewide program focused on the WSDOT business function for "Traffic Operations." It is the smallest of the four major highway programs that comprise the *Highway System Plan* (Improvement, Maintenance, Preservation, and Traffic Operations). Elements within the Q Program include:

- Q1 – Traffic Operations Program Management
- Q2 – Traffic Operations Program Operations
- Q3 – Special Advanced Technology Projects

This chapter is intended to guide the development of projects in the Low-Cost Enhancements subcategory within the Q2 program. Large capital improvement projects developed for the Q3 subprogram are beyond the scope and intent of this chapter. Normally, these projects are developed using *Design Manual* guidelines for Preservation and Improvement projects. Consult the HQ Traffic Office for guidance when designing Q3 subprogram projects.

The minor operational enhancement matrices consist of three tables and are identified by route type. One of the matrices applies to Interstate and NHS freeways, one applies to NHS Nonfreeway routes, and the third matrix applies to non-NHS routes.

340.02 References

(1) Federal/State Laws and Codes

RCW 47.28.030, Contracts – State forces – Monetary limits – Small businesses, minority, and women contractors – Rules

(2) Supporting Information

Chart of Accounts, M 13-02, WSDOT

340.03 Definitions

National Highway System (NHS) For the definition and a list of specific routes on the NHS, see Chapter 325.

freeway Applies to multilane, divided highways with full access control.

minor operational enhancement projects These projects usually originate from the Q2 component of the Q Program and are quick responses to implement low-cost improvements. They are typically narrow in scope, and focus on improvements to traffic operations and modifications to traffic control devices. Guidance on the type of work included in the Q subprograms is in the *Chart of Accounts*.

(1) Project Types

Regulatory projects include actions undertaken to manage or regulate traffic conflict, movement, and use of the roadway. Potential projects in this category include revisions to speed limits, parking restrictions, turn restrictions, truck restrictions, signal operations, unsignalized intersection control, intersection lane use control, ramp meters, no passing zones, crosswalks, special traffic control schemes, and lane use restrictions.

Driver Guidance projects are actions to improve driver guidance, clarify options, or reduce hazards in the roadway setting. Potential projects include informational signs, warning signs, lighting and supplemental illumination, supplemental delineation, glare screen, signals, roadside guidance, and intelligent transportation systems (ITS).

Pavement Widening projects involve expansion of the roadway surface for vehicular use and may include earthwork, drainage, and paving elements. Consult with the Region bicycle/pedestrian coordinator to ensure that the concerns of bicyclists and pedestrians are given adequate consideration. These projects are considered alterations of the roadway and must address Americans with Disabilities Act (ADA) accessibility for pedestrians. (See Chapter 1025 for guidance on pedestrian facilities.) Potential projects are:

- **Turn lane**. The addition of a new channelized turn bay at an intersection.
- **Pullout**. Pavement widening to provide auxiliary highway uses, including transit stops, Washington State Patrol (WSP) enforcement pullouts, snow chain-up areas, and maintenance vehicle turnouts.

- **Expansion**. Widen at intersection corners, lengthen existing channelized turn bays, widen shoulders, and flatten approach tapers. This type of work is not anticipated for main line sections on interstate freeways.
- **Median Crossover**. Restricted-use median crossover on separated highways for emergency or maintenance use. (See Chapter 960 for design of median crossovers.)

Rechannelize Existing Pavement projects alter the use of the roadway without additional widening. These projects may add, delete, or modify channelization features and may include reduction of existing shoulder or lane widths. Consult with the Region bicycle/pedestrian coordinator to ensure that the concerns of bicyclists and pedestrians are given adequate consideration. Projects that change the traffic configuration by reducing shoulders to add turn lanes are considered an alteration of the existing roadway and have the same requirements as Preservation projects for ADA accessibility. (See Chapter 1025 for guidance on pedestrian facilities.) Potential projects are:

- **Pavement Markings**. Develop added storage, additional lanes, or altered lane alignment. This work may modify tapers, radii, or painted islands, or channelize bicycle lanes, preferential-use lanes, or shoulders.
- **Raised Channelization**. New or altered raised curbing to channelization islands to enhance guidance, curtail violation or misuse, or introduce access control.
- **Left-Turn Channelization (two-lane highways)**. Restriping two-lane highways with a minimum pavement width of 39 feet to provide left-turn channelization at existing intersections. Restripe to provide a minimum of 11-foot lanes and 3-foot shoulders. Ensure that the pavement is structurally adequate for the anticipated traffic loads. Within this configuration at “T” intersections, a reduced length refuge lane may be provided for traffic entering the main line from the intersecting roadway. (See Figure 340-6 for minimum dimensional characteristics of the refuge lane.)

Nonmotorized Facilities projects add adjacent roadside features for bicycle or pedestrian use. Involve the Region bicycle/pedestrian coordinator in the project development process. Potential projects are:

- **Sidewalk**. Installation of sidewalks, which might involve preserving existing shoulder or converting some portion of existing shoulder for use as a new sidewalk.
- **Walkway**. Adds to the existing roadway’s overall width to provide a wider walkable shoulder.
- **Separated Trails**. Separated bike lane or pedestrian paths on independent alignment or parallel to the highway.
- **Spot Improvement**. Installation of ADA sidewalk curb cuts, new pedestrian landings, sidewalk bulbouts at intersections, or new or revised trailhead features.

Roadside projects are modifications to roadside features for safety purposes. Potential projects are:

- **Cross Section**. Altering roadway cross sections to address clear zone hazard or sight distance concerns such as slope flattening, recontouring a ditch, closing a ditch with culvert, or removing a hazard.

- **Protection**. Installation of hazard protection for clear zone mitigation, including guardrail, barrier, and impact attenuator.
- **New Object**. Placement within clear zone of new hardware or fixed object unable to meet breakaway criteria.

(2) Design Elements

The following elements are shown on the minor operational enhancement matrices. If full design level applies, see the chapters listed below. If modified design level applies, see Chapter 430.

Sight Distance. Any combination of horizontal and vertical stopping sight distance, decision sight distance, passing sight distance, and intersection sight distance. (See Chapters 650 and 910 for definitions and guidance.)

Lane Width. Definition is in Chapter 325.

Lane Transition. Definition is in Chapter 325.

Shoulder Width. Definition is in Chapter 325.

Fill/Ditch Slope. Definition is in Chapter 325.

Clear Zone. Definition is in Chapter 325.

Ramp Sight Distance. Any combination of horizontal and vertical stopping sight distance, decision sight distance, and intersection sight distance. (See Chapters 650 and 910 for definitions and guidance.)

Ramp Lane Width. The lane width for ramp alignments. (See Lane Width definition in Chapter 325.)

Ramp Lane Transition. The lane transition applied to a ramp alignment. (See definition for Lane Transitions in Chapter 325; also see Chapter 940.)

Ramp Shoulder Width. The shoulder width for a ramp alignment. (See Shoulder Width definition in Chapter 325.)

Ramp Fill/Ditch Slopes. The fill/ditch slope along a ramp alignment. (See Fill/Ditch Slope definition in Chapter 325.)

Ramp Clear Zone. The clear zone along a ramp alignment. (See Clear Zone definition in Chapter 325.)

Ramp Terminals or Intersection Turn Radii. Definition is in Chapter 910.

Ramp Terminals or Intersection Angle. Definition is in Chapter 910.

Ramp Terminals or Intersection Sight Distance. Definition is in Chapter 910.

Pedestrian and Bike. The facilities along a route for accommodation of pedestrians and/or bicycles. (See Chapter 1020 for bicycles and Chapter 1025 for pedestrians.)

Crossroads at Ramps Lane Width. The lane width on a crossing alignment intersected by a ramp. (See Lane Width definition in Chapter 325.)

Crossroads at Ramps: Shoulder Width. The shoulder width on a crossing alignment intersected by a ramp. (See Shoulder Width definition in Chapters 325 and 440.)

Crossroads at Ramps: Pedestrian and Bike. The facilities on a crossing alignment intersected by a ramp for accommodation of pedestrians and/or bicycles. (See Pedestrian and Bike definition.)

Crossroads at Ramps: Fill/Ditch Slopes. The fill/ditch slope along a crossroad intersected by a ramp. (See Fill/Ditch Slope definition in Chapter 325.)

Crossroads at Ramps: Clear Zone. The clear zone along a crossroad intersected by a ramp. (See Clear Zone definition in Chapter 325.)

Barriers: Terminals and Transition Sections. Definition is in Chapter 325.

Barriers: Standard Run. Definition is in Chapter 325.

340.04 Minor Operational Enhancement Matrix Procedures

During Project Definition and design, the following steps are used to select and apply the appropriate *minor operational enhancement matrix*. Each step is further explained in this chapter.

- Select a *minor operational enhancement matrix* by identifying the route: Interstate/NHS Freeway, NHS nonfreeway, or non-NHS.
- Within the minor operational enhancement matrix, select the *row* by the type of work.
- Use the minor operational enhancement matrix to determine the *documentation and approval levels for the various design elements* in the project. Apply the appropriate design levels and document the design decisions as required by this chapter and Chapter 330.

340.05 Selecting a Minor Operational Enhancement Matrix

Selection of a minor operational enhancement matrix is based on highway system: Interstate/NHS Freeway, NHS nonfreeway, non-NHS (see Figure 340-1). Figure 325-2 provides a list of the NHS and the Interstate routes in Washington. The minor operational enhancement matrices are shown in Figures 340-2 through 340-4. Follow *Design Manual* guidance for all projects except as noted in the minor operational enhancement matrices.

Route	Project	
	Freeway	Nonfreeway
Interstate	Matrix 1	
NHS	Matrix 1	Matrix 2
Non-NHS	Matrix 1	Matrix 3

Minor Operational Enhancement Matrix Selection Guide
Figure 340-1

340.06 Project Type

Row selection in the design matrices is based on project type or type of work (see 340.03(1)). For projects not listed in the matrices, consult the Headquarters (HQ) Traffic Office and the HQ Design Office.

Some projects might include work from several project types. In such cases, identify the design and approval level for each project element. In all cases, select the higher design level and approval level where overlaps are found.

340.07 Using a Minor Operational Enhancement Matrix

The column headings on a minor operational enhancement matrix are design elements. They are based on the following thirteen Federal Highway Administration (FHWA) controlling design criteria: design speed, lane width, shoulder width, bridge width, structural capacity, horizontal alignment, vertical alignment, grade, stopping sight distance, cross slope, superelevation, vertical clearance, and horizontal clearance. For the column headings, some of the controlling criteria are combined (for example, design speed is part of horizontal and vertical alignment).

Unlike the design matrices described in Chapter 325, designers using a minor operational enhancement matrix are not required to inventory deficiencies for elements not improved by the minor enhancement project. Similarly, they are not required to justify existing deficiencies not addressed by minor enhancement projects. In the case where improvements to existing features surpass the existing condition but do not meet the design guidelines, Basic Documentation plus Supplemental Coordination (BD+) is required (see 340.09(1)).

A **blank cell** on a minor operational enhancement matrix signifies that the design element is beyond the scope of the project and need not be addressed.

For work on ramps on interstate or NHS freeway routes, there is a requirement to provide assurance of no adverse effect to main line flow. Forward to FHWA a copy of the documentation providing assurance, or process a deviation through FHWA if there is an adverse effect.

(1) Design Level

The minor operational enhancement matrices specify the appropriate design level for the various project elements. The design levels specified are “full” and “modified.”

Full design level (F) improves roadway geometrics, safety, and operational elements. (See Chapter 440 and other applicable chapters for design guidance.) Use the current traffic volume with Chapter 440 to evaluate design class for Q Program projects.

Modified design level (M) preserves and improves existing roadway geometrics, safety, and operational elements (see Chapter 430).

Design levels specified in a matrix cell are supplemented with notations for design variances.

(2) Design Variances

Design variances are information packages that justify the introduction of features that are not in accordance with design guidelines. Variances specified in minor operational enhancement project cells include Design Justification: Level 2, Level 3, or Level 4. (See 340.09 for details on documentation requirements.)

340.08 Project Approval

Project approval for minor operational enhancement projects authorizes expenditures for the project. The State and/or Region Traffic Engineer have the responsibility and authority to authorize all expenditures for Q2 Low-Cost Enhancements. Delegation of design and/or expenditure approval authority for Q Program-funded projects must be identified in writing from the appropriate Traffic Engineer to the person receiving the delegated authority. Such written delegation must identify the specific conditions for which approval authority has been delegated. Design Approval authority for Plans, Specifications, and Estimates (PS&E) contracts cannot be delegated.

Mechanisms for project expenditure approval vary with the types of projects and the costs involved.

- **Minor-cost projects** are projects normally implemented by state forces directed through maintenance task orders within the monetary limits established in RCW 47.28.030. Expenditure authority is granted by initialing the work order.
- **Midrange projects** include all contract change orders, local agency agreements, or Q Program bid items included in an Improvement or Preservation project, regardless of cost. Maintenance task orders exceeding the monetary limits established in RCW 47.28.030 are included in this category. Expenditure authority is granted by initialing the task order, change order, or agreement memo.
- **PS&E contracts** are stand-alone contracts funded through the Q Program for minor operational enhancement projects. A Design Summary/Approval memorandum must be prepared and signed by the Region Traffic Engineer to approve a project in this category. Figure 340-5 provides a template for the approval memo.

Project development decisions and approvals for “Regulatory” and for “Driver Guidance” projects reside within Region or HQ Traffic offices. Projects impacting roadway geometric features in the “Pavement Widening,” “Rechannelizing Existing Pavement,” “Nonmotorized Facilities” or “Roadside” categories are developed jointly by Region Traffic and Project Development offices. Depending on the route type, the approval authority may involve the Assistant State Design Engineer and the FHWA.

340.09 Documentation

The minor operational enhancement matrices include a column that specifies the documentation levels for each project type listed. The documentation levels are categorized as Basic Documentation (BD) and Basic Documentation plus Supplemental Coordination (BD+).

In all cases, the documentation must outline the rationale for the project and include backup information sufficient to support the design decisions. Document the roadway configuration prior to implementing a minor operational enhancement project. Retain the documentation in a permanent retrievable file at a central location in each Region.

(1) Projects

Basic Documentation (BD) level applies to regulatory or driver guidance projects. Documentation consists of an unstructured compilation of materials sufficient to validate the designer's decisions. Materials may include meeting notes, printed e-mails, records of phone conversations, copies of memos, correspondence, and backup data such as level of service modeling, accident data, and design drawings.

A single narrative outlining the decision-making process from start to finish is not required, provided that the materials retained in the file can be traced to a decision consistent with the project design. This level of documentation includes a requirement for inputting the project information into the TRaffic ACtion Tracking System (TRACTS) database at the conclusion of the project.

Basic Documentation plus Supplemental Coordination (BD+) level applies to all projects except regulatory or driver guidance projects.

A more comprehensive evaluation of options and constraints is required for this documentation level. Documentation includes basic documentation with additional information describing coordination efforts with other WSDOT groups having a stake in the project. Document the coordination efforts with the following disciplines: Environmental, Hydraulics, Local Agencies and WSDOT Local Programs, Maintenance, Materials, Program Management, Real Estate Services, Urban Corridors, Utilities, and the general public. This level of documentation also includes a requirement for inputting the project information into the TRACTS database at the conclusion of the project.

(2) Design Deviations

Design Justification (DJ) is a written narrative summarizing the rationale for introduction of a feature that varies from the applicable *Design Manual* guidelines. Include in the narrative sufficient information to describe the problem, the constraints, and the trade-offs at a level of detail that provides a defendable professional judgment. DJs are not intended to have the same level of formality as Level 2, 3, and 4 deviations. DJs may use written memos, e-mails, or documented discussions with the approving traffic authority. The Region Traffic Engineer has responsibility for approving Design Justifications, and the DJ documentation must include the name and date of the approving authority. At the time the work order is approved, the Region Project Development Engineer and the Assistant State Design Engineer are to be sent informational copies of the Design Justification to provide them an opportunity to communicate their concerns. Comment on the informational copy is not mandatory and progress toward project implementation does not wait on a response.

Level 2 documentation serves to justify a deviation to the specified design guidance. Within the document, summarize the project, the design guidelines, the proposed elements that vary from design guidelines, alternatives analyzed, constraints and impacts of each alternative, and the recommended alternative. Level 2 documentation requires the joint approval of the Region Traffic Engineer and the Region Project Development Engineer. At the time the work order is approved, the Assistant State Design Engineer is to be sent an informational copy of the Level 2 documentation to provide an opportunity to communicate concerns. Comment on the informational copy is not mandatory, and progress toward project implementation does not wait on a response.

Level 3 documentation requirements include the Level 2 requirements; however, the approval process is through the Region Traffic Engineer and Region Project Development Engineer, with final approval from the Assistant State Design Engineer.

Level 4 documentation requirements include the Level 3 requirements; however, the approval process is through the Region Traffic Engineer, the Region Project Development Engineer, and the Assistant State Design Engineer, with final approval from the Federal Highway Administration on interstate routes.

Level 2, 3, and 4 design deviation requests are intended to be stand-alone documentation describing the project, design criteria, proposed element(s), why the desired design level was not or cannot be used, alternatives evaluated, and a request for approval. Include funding source(s), type of route, project limits, design classification, posted speed, current ADT, and percent truck traffic in the project description. Justification for the design deviation can include project costs, but must be supported by at least two of the following:

- Accident history or potential
- Engineering judgment
- Environmental issues
- Route continuity (consistency with adjoining route sections)
- The project is an interim solution (covering a 4- to 6-year time horizon)

⇩ Project Type	Main Line						Ramps (1)						Ramp Terminalsor Intersections			Crossroads at Ramps					Barriers All		Doc. Level
Design Elements ⇨	Sight Dist.	Lane Width	Lane Tran-sition	Shldr Width	Fill/ Ditch Slopes	Clear Zone	Sight Dist.	Lane Width	Lane Tran-sition	Shldr Width	Fill/ Ditch Slopes	Clear Zone	Turn Radii	Angle	Sight Dist.	Lane Width	Shldr Width	Ped & Bike	Fill/ Ditch Slopes	Clear Zone	Term. & Trans. Section	(2)Std Run	
Regulatory - (Traffic Office Authority)																							**BD**
Driver Guidance - (Traffic Office Authority)																							**BD**
Pavement Widening																							
(1-1Q) Turn Lane								**F/DJ**	**F/DJ**	**F/DJ**			**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(1-2Q) Pullout							**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**	**M/DJ**		**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(1-3Q) Expansion	**F/3**	**F/4**	**F/3**	**F/4**	**F/3**	**F/3**		**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**	**M/DJ**		**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(1-4Q) Median Crossover	**F/3**	**F/4**	**F/3**	**F/4**	**F/3**	**F/3**															**F/3**	**F/3**	**BD+**
Rechannelize Existing Pavement																							
(1-5Q) Pavement Markings	**F/3**	**F/4**	**F/3**	**F/4**		**F/3**	**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**		**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**		**F/DJ**	**F/3**	**F/3**	**BD+**
(1-6Q) Raised Channelization							**F/DJ**	**F/DJ**	**F/DJ**	**F/DJ**		**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**		**F/DJ**	**F/3**	**F/3**	**BD+**
(1-7Q) Left-Turn Channelization 2-Lane Hwys (3)																**DJ**	**DJ**	**M**					
Nonmotorized Facilities																							
(1-8Q) Sidewalk/Walkway													**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(1-9Q) Separated Trails																		**F/DJ**			**F/3**	**F/3**	**BD+**
(1-10Q) Spot Improvement													**M/DJ**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**		**F/DJ**			**BD+**
Roadside																							
(1-11Q) Cross Section	**F/3**				**F/3**	**F/3**	**F/DJ**				**F/DJ**	**F/DJ**			**F/DJ**				**M/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(1-12Q) Protection	**F/3**			**F/4**	**F/3**	**F/3**	**F/DJ**			**F/DJ**	**F/DJ**	**F/DJ**			**F/DJ**		**M/DJ**		**M/DJ**	**F/DJ**	**F/3**	**F/3**	**BD+**
(1-13Q) New Object	**F/3**					**F/3**	**F/DJ**					**F/DJ**			**F/DJ**					**F/DJ**	**F/3**	**F/3**	**BD+**

□ Not Applicable
F Full design level
M Modified design level. See Chapter 430.
DJ Design Justification required and Project Approval by region Traffic, with notification to Headquarters Design.
2 Deviation approval through the region's Traffic and Project Development Engineers, with notification to Headquarters Design.
3 Deviation approval through level 2 and the Assistant State Design Engineer.
4 Deviation approval through level 3, and FHWA on Interstate routes.
BD Basic Documentation required.
BD+ Basic Documentation plus supplemental coordination required.

If a project impacts any design element, the impacted elements are addressed. Elements not impacted, are not ddressed.

For items not meeting the design level provided in the matrix, justification or deviation is required and is processed through the designated approval level, DJ, 2, 3, or 4

For at-grade intersections on NHS routes, apply Matrix 2.

(1) Documentation must provide assurance of no adverse effect to main line flow. Otherwise process a deviation through level 4

(2) If existing shoulder width is decreased below minimum values, when placing new guardrail or concrete barrier, a deviation request justifying the proposal is required.

(3) Where existing pavement width is 39 feet or greater.

Minor Operational Enhancement Matrix 1: Interstate and NHS Freeway Routes

Figure 340-2

⇩ Project Type	Main Line						Intersections				Barriers All		Doc. Level
Design Elements ⇨	Sight Dist.	Lane Width	Lane Tran-sition	Shldr Width	Fill/ Ditch Slopes	Clear Zone	Turn Radii	Angle	Sight Dist.	Ped & Bike	Term. & Trans. Section	(2)Std Run	
Regulatory - (Traffic Office Authority)													BD
Driver Guidance - (Traffic Office Authority)													BD
Pavement Widening													
(2-1Q) Turn Lane	M/2	M/3	F/2	M/3	M/2	F/2	M/DJ	M/DJ	F/DJ	F/DJ	F/3	F/3	BD+
(2-2Q) Pullout	M/2	M/3	F/2	M/3	M/2	F/2	M/DJ	M/DJ	F/DJ	F/DJ	F/3	F/3	BD+
(2-3Q) Expansion	M/2	M/3	F/2	M/3	M/2	F/2	M/DJ	M/DJ	F/DJ	F/DJ	F/3	F/3	BD+
Rechannelize Existing Pavement													
(2-4Q) Pavement Markings	M/2	M/3	F/2	M/3		F/2	M/DJ	M/DJ	F/DJ	F/DJ	F/3	F/3	BD+
(2-5Q) Raised Channelization	M/2	M/3	F/2	M/3		F/2	M/DJ	M/DJ	F/DJ	F/DJ	F/3	F/3	BD+
(2-6Q) Left-Turn Channelization 2-Lane Hwys (3)		DJ		DJ						M			
Nonmotorized Facilities													
(2-7Q) Sidewalk/Walkway	M/2	M/3	F/2	M/3	M/2	F/2	M/DJ	M/DJ	F/DJ	F/DJ	F/3	F/3	BD+
(2-8Q) Separated Trails	M/2				M/2	F/2				F/DJ	F/3	F/3	BD+
(2-9Q) Spot Improvement	M/2	M/3	F/2	M/3	M/2	F/2	M/DJ	M/DJ	F/DJ	F/DJ	F/3	F/3	BD+
Roadside													
(2-10Q) Cross Section	M/2				M/2	F/2			F/DJ		F/3	F/3	BD+
(2-11Q) Protection	M/2				M/2	F/2			F/DJ		F/3	F/3	BD+
(2-12Q) New Object	M/2				M/2	F/2			F/DJ		F/3	F/3	BD+

□ Not Applicable
F Full design level
M Modified design level. See Chapter 430.
DJ Design Justification required and Project Approval by region Traffic, with notification to Headquarters Design.
2 Deviation approval through the region's Traffic and Project Development Engineers, with notification to Headquarters Design.
3 Deviation approval through level 2 and the Assistant State Design Engineer.
BD Basic Documentation required.
BD+ Basic Documentation plus supplemental coordination required.

If a project impacts any design element, the impacted elements are addressed. Elements not impacted, are not addressed.

For items not meeting the design level provided in the matrix, justification or deviation is required and is processed through the designated approval level, DJ, 2 or 3.

For interchange features, apply Matrix 1.

(2) If existing shoulder width is decreased below minimum values, when placing new guardrail or concrete barrier, a deviation request justifying the proposal is required.

(3) Where existing pavement width is 39 feet or greater.

Minor Operational Enhancement Matrix 2: NHS Nonfreeway Routes

Figure 340-3

⇩ Project Type	Main Line						Intersections				Barriers All		Doc. Level
Design Elements ⇨	Sight Dist.	Lane Width	Lane Tran-sition	Shldr Width	Fill/ Ditch Slopes	Clear Zone	Turn Radii	Angle	Sight Dist.	Ped & Bike	Term. & Trans. Section	(2)Std Run	
Regulatory - (Traffic Office Authority)													**BD**
Driver Guidance - (Traffic Office Authority)													**BD**
Pavement Widening													
(3-1Q) Turn Lane	**M/DJ**	**M/2**	**F/DJ**	**M/2**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
(3-2Q) Pullout	**M/DJ**	**M/2**	**F/DJ**	**M/2**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
(3-3Q) Expansion	**M/DJ**	**M/2**	**F/DJ**	**M/2**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
Rechannelize Existing Pavement													
(3-4Q) Pavement Markings	**M/DJ**	**M/2**	**F/DJ**	**M/2**		**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
(3-5Q) Raised Channelization	**M/DJ**	**M/2**	**F/DJ**	**M/2**		**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
(3-6Q) Left-Turn Channelization 2-Lane Hwys (3)		**DJ**		**DJ**						**M**			
Nonmotorized Facilities													
(3-7Q) Sidewalk/Walkway	**M/DJ**	**M/2**	**F/DJ**	**M/2**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
(3-8Q) Separated Trails	**M/DJ**				**M/DJ**	**F/DJ**				**F/DJ**	**F/2**	**F/2**	**BD+**
(3-9Q) Spot Improvement	**M/DJ**	**M/2**	**F/DJ**	**M/2**	**M/DJ**	**F/DJ**	**M/DJ**	**M/DJ**	**F/DJ**	**F/DJ**	**F/2**	**F/2**	**BD+**
Roadside													
(3-10Q) Cross Section	**M/DJ**				**M/DJ**	**F/DJ**			**F/DJ**		**F/2**	**F/2**	**BD+**
(3-11Q) Protection	**M/DJ**				**M/DJ**	**F/DJ**			**F/DJ**		**F/2**	**F/2**	**BD+**
(3-12Q) New Object	**M/DJ**				**M/DJ**	**F/DJ**			**F/DJ**		**F/2**	**F/2**	**BD+**

□ Not Applicable
F Full design level
M Modified design level. See Chapter 430.
DJ Design Justification required and Project Approval by region Traffic, with notification to Headquarters Design.
2 Deviation approval through the region's Traffic and Project Development Engineers, with notification to Headquarters Design.
3 Deviation approval through level 2 and the Assistant State Design Engineer.
BD Basic Documentation required.
BD+ Basic Documentation plus supplemental coordination required.

If a project impacts any design element, the impacted elements areaddressed. Elements not impacted, are not addressed.

For items not meeting the design level provided in the matrix, justification or deviationis required and is processed through the designated approval level, DJ, 2 or 3.

For interchange features, apply Matrix 1.

(2) If existing shoulder width is decreased below minimum values, when placing new guardrail or concrete barrier, a deviation request justifying the proposal is required.

(3) Where existing pavement width is 39 feet or greater.

Minor Operational Enhancement Matrix 3: Non-NHS Routes
Figure 340-4

Date Placeholder

TO: (Specify) Region Traffic Engineer[1]

THRU:

FROM:

SUBJECT:

Design Approved By:

____
(Specify) Region Traffic Engineer[1]

____
Date

General Information
SR is a (*NHS or Non-NHS*) route, and classified as a (*Urban or Rural*) (*Interstate, Principal Arterial, Minor Arterial, Collector or Urban Managed Access Roadway*) in __________________ County. The posted speed limit is __________________ mph. The ADT is, __________________ with __________________ percent trucks. The project is within a (*full, partial, or modified limited access control, or Class 1 - 5 managed access controlled*) area.

Project Initiation
How did the project get started? Accident history, constituent call, e-mail, or letter?

Existing Geometrics
What is out there today? Lane, shoulder, sidewalk widths? Turn pockets, etc.?

Project Description
How did you come to the design decision being proposed? What does it resolve for the situation at hand? What options have you looked at? Why were other options not selected?

Proposed Geometrics
What will be out there when you are through? Lane, shoulder, sidewalk widths? Turn pockets, etc.?

[1] For example "Eastern Region Traffic Engineer"

Q Project Design Summary/Approval Template
Figure 340-5

Resurfacing
If pavement is involved what does the resurfacing report say to use?

Pavement Marking/Traffic Control Devices

What happens with the pavement markings? Signing? Illumination? Signals? Etc.?

Environmental Approval
Did you check with the Environmental Services Office? Are there any issues or permits that need to be addressed? Hydraulics?

Deviations
Are there any deviations? Describe briefly what features are deviated and the date of approval.

Permits
Are there any permits or easements needed? Construction permits? Noise variances? Utility relocations? Detours? Signal? Others?

Project Cost and Schedule
How much do you anticipate spending? When is the project scheduled for advertisement? When do you anticipate the project will be completed?

Sole Source Justification
Some traffic items are sole source and require justification. Have you completed the process?

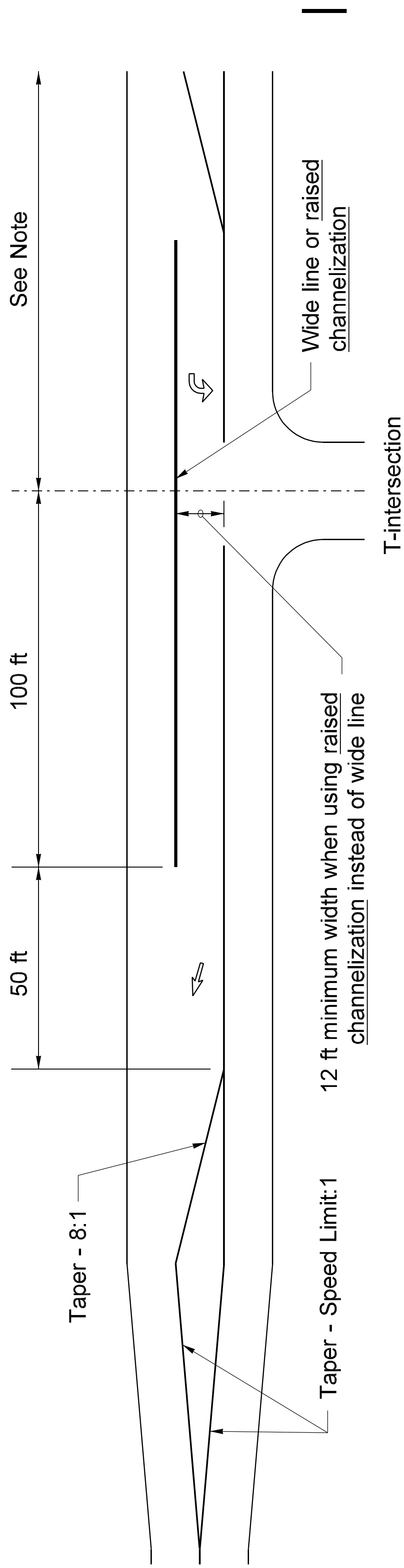
Work Zone Traffic Control
What happens to traffic, pedestrians, and bicyclists during construction? Is a lane taken or reduced in width? Night work? Shoulder work? Duration? Does Washington State Patrol (WSP) need to be involved?

Local Agency Coordination
Do we need to coordinate with, or notify the city or county? WSP?
We are requesting approval for the Subject project. This project was designed in accordance with Q Program guidelines for Minor Operational Enhancements, Matrix ____________ *note matrix title and project type line.*

Typist's Initials Placeholder

Attachments: Channelization Plan? Permits? Deviations?
cc: Headquarters Design 47329

Q Project Design Summary/Approval Template
Figure 340-5 (continued)



Note:
For left-turn channelization, see Chapter 910.

Refuge Lane for T-Intersections on Two-Lane Highways
Figure 340-6

410.01 General

Basic design level (B) preserves pavement structures, extends pavement service life, and maintains safe operations of the highway. Basic design level includes restoring the roadway for safe operations and may include safety enhancement. Flexibility is provided so that other conditions can be enhanced while remaining within the scope of pavement preservation work.

The required safety items of work listed below may be programmed under a separate project from the paving project as long as there is some benefit to the delay, the safety features remain functional, and the work is completed within two years after the completion of the paving project. If some of the required items are separated from the paving project, maintain a separate documentation file that addresses the separation of work during the two-year time period.

For bituminous surface treatment projects on non-NHS routes, the separation of required safety items is not limited to the two-year time period. The safety work can be accomplished separately using a corridor-by-corridor approach.

410.02 Required Basic Safety Items of Work

For basic design level, the following items of work are required:

- Install and replace delineation in accordance with Chapter 830
- Install and replace rumble strips in accordance with the design matrices (see Chapter 325) and Chapter 700
- Adjust existing features such as monuments, catch basins, and access covers that are affected by resurfacing
- Adjust guardrail height in accordance with Chapter 710
- Replace deficient signing as needed (this does not include replacement of sign bridges or cantilever supports)
- Relocate, protect, or provide breakaway features for sign supports, luminaires, and WSDOT electrical service poles inside the Design Clear Zone
- Restore sight distance at public road intersections and the inside of curves through low-cost measures (when available) such as removal or relocation of signs and other obstructions and cutting of vegetative matter
- Upgrade nonstandard bridge rail in accordance with the matrices and Chapter 710
- Upgrade barrier terminals and bridge end protection, including transitions, in accordance with Chapter 710
- Restore the cross slope to 1.5% when the existing cross slope is flatter than 1.5% and, in the engineer's judgment, the steeper slope is needed to solve highway runoff problems in areas of intense rainfall
- Remove the rigid top rail and brace rails from Type 1 and Type 6 chain link fence and retrofit with a tension wire design (see Chapter 1460)

410.03 Minor Safety and Minor Preservation Work

Consider the following items, where appropriate, within the limits of a pavement preservation project:

- Spot safety enhancements, which are modifications to isolated roadway or roadside features that, in the engineer's judgment, reduce potential accident frequency or severity.
- When recommended by the Region Traffic Engineer, additional or improved channelization to address intersection-related accident concerns, where sufficient pavement width and structural adequacy exist or can be obtained. With justification, and considering the impacts to all roadway users, channelization improvements may be implemented, with lane and shoulder widths no less than the design criteria specified in the "Rechannelize Existing Pavement projects" section in Chapter 340. Consider illumination of these improvements. Document decisions when full illumination is not provided, including an analysis of the frequency and severity of nighttime accidents.
- Roadside safety hardware (such as guardrail, signposts, and impact attenuators).
- Addressing Location 1 Utility Objects in accordance with the *Utilities Accommodation Policy*.

Consider the following items when restoration, replacement, or completion is necessary to ensure that an existing system can function as intended:

- Right of way fencing
- Drainage
- Illumination
- Electrical
- Pedestrian and bicycle use

Examples of the above include, but are not limited to, the following:

- Installing short sections of fence needed to control access
- Replacing grates that are a hazard to bicycles
- Upgrading electrical system components that require excessive maintenance
- Beveling culverts

Chapter 430 Modified Design Level

430.01 General

Modified design level (M) preserves and improves existing roadway geometrics, safety, and operational elements. This chapter provides the design criteria that are unique to the modified design level.

The modified design level design criteria have been developed to apply to all applicable functional classes. As a result, for the lower volumes and urban highways, modified design level design criteria might exceed full level design criteria. In these cases, full level design criteria may be used.

Projects developed to correct a deficiency must address all design elements contributing to that deficiency, even when those elements meet modified design level design criteria.

Design elements that do not have modified design level guidance include:

- Lane transitions – Chapter 620
- On- and off-connections – Chapter 940
- Access control – Chapter 1420
- Clear zone – Chapter 700
- Signing, delineation, and illumination – Chapters 820, 830, and 840
- Basic safety – Chapter 410
- Structural capacity – Chapter 1120
- Vertical clearance – Chapter 1120
- Intersection sight distance – Chapter 910
- Traffic barriers – Chapter 710

430.02 Design Speed

When applying modified design level to a project, select a design speed for use in the design process that reflects the character of the terrain and the type of highway. The desirable design speed for modified design level is given in Figure 430-1. The minimum design speed is not less than the posted speed or the *proposed* posted speed. Document the speed used, including any supporting studies and data. (See Chapter 440 for additional information on design speed.)

Route Type	Posted Speed	Desirable Design Speed
Freeways	All	10 mph over the posted speed
Nonfreeways	45 mph or less	Not less than the posted speed
	Over 45 mph	5 mph over posted speed

Desirable Design Speed
Figure 430-1

When the posted speed exceeds the design speed for existing geometric features that are to remain in place (curve radius, superelevation, sight distance, or other elements that the design speed controls), one of two choices must be made:

- When appropriate, work with the Region Traffic Office to lower the posted speed to be consistent with the existing design speeds for the geometric features on the facility.
- Complete a corridor analysis in order to leave the posted speed unchanged and identify all design elements that do not meet the criteria for the existing posted speed. Identify each appropriate location for cautionary signing (including road approach sight distance) and work with the Region Traffic Office to install the cautionary signing as provided for in the MUTCD (either by contract or Region sign personnel). Consult with and obtain guidance from Region project development leadership prior to progressing with the corridor analysis and the design.

430.03 Alignment

(1) Horizontal Alignment

Consideration of horizontal alignment for modified design level is normally limited to curves. Curve design is controlled by the design speed (see 430.02), superelevation (see 430.03(4)), and stopping sight distance (see 430.03(3)).

Identify major modifications to horizontal alignment in the Project Summary. Total removal of pavement and reconstruction of the subgrade are examples of major modifications.

(2) Vertical Alignment

Vertical alignment consists of a series of profile grades connected by vertical curves.

(a) **Vertical Curves**. Stopping sight distance controls crest vertical curves. Figure 430-8 gives the minimum curve length for crest vertical curves to remain in place for modified design level stopping sight distance. (See 430.03(3) for additional information on modified design level stopping sight distance.)

When modified design level is being applied, existing sag vertical curves are not normally addressed.

When either a crest or a sag vertical curve is to be reconstructed, use full design level design criteria (see Chapters 630 and 650).

(b) **Profile Grades**. When applying modified design level, profile grades generally are not flattened. However, corrective action may be justified for combinations of steep grades and restricted horizontal or vertical curvature. Identify major modifications to vertical alignment in the Project Summary. Total removal of pavement and reconstruction of the subgrade are examples of major modifications. When changing the profile grade, see Chapter 440 for the maximum grade for the functional class of the route.

(3) Stopping Sight Distance

Stopping sight distance is a controlling factor for both vertical and horizontal alignment. A 2-foot object height is used for modified design level stopping sight distance evaluation. Figure 430-2 gives the minimum stopping sight distances allowed to remain in place.

Design Speed (mph)	Design Stopping Sight Distance (ft)
40 or less	155
45	200
50	250
55	305
60	360
65	425
70	495
75	570
80	645

Stopping Sight Distance: Modified Design Level
Figure 430-2

(a) **Stopping Sight Distance for Horizontal Curves**. For modified design level, use the existing lateral clearance to the sight obstruction and the curve radius to compare the existing condition to Figure 430-9a. When reconstructing a horizontal curve, apply full design level criteria for sight distance (see Chapter 650).

For Figure 430-9a, an obstruction is any object with a height of greater than 2.75 feet above the roadway surface on the inside of a curve. Examples of possible obstructions are median barrier, guardrail, bridges, walls, cut slopes, wooded areas, and buildings. Objects between 2.75 feet and 2.00 feet above the roadway surface within the M distance might be a sight obstruction (see Figure 430-9b for guidance) depending on the distance from the roadway.

(b) **Stopping Sight Distance for Vertical Curves**. For existing crest vertical curves, use the algebraic difference in grades and the length of curve to compare the existing condition to the stopping sight distance requirements from Figure 430-2. Use the equations in Figure 430-3 or use Figure 430-8 to evaluate the existing curve.

When a crest vertical curve is lengthened, the minimum sight distance is increased; however, the length of the roadway that has the minimum sight distance is also increased. This results in a questionable benefit when the new sight distance is less than for full design level. Therefore, when the existing roadway is reconstructed to improve stopping sight distance, apply full design level criteria (see Chapter 650).

When s < L:
$$L = \frac{As^2}{2158}$$
When s > L:
$$L = 2s - \frac{2158}{A}$$
Where: L = Length of vertical curve (ft) s = Sight distance from Figure 430-2 (ft) A = Absolute value of the algebraic difference in grades (%)

Minimum Crest Vertical Curve Length: Modified Design Level
Figure 430-3

(4) Superelevation

Evaluate existing superelevation using the equation in Figure 430-4 with the friction factors from Figure 430-5 or with a ball banking analysis. When the existing superelevation equals or exceeds the value from the equation or when the maximum speed determined by a ball banking analysis equals or exceeds the design speed, the modified design level design criteria are met.

When modifying the superelevation of an existing curve where the existing pavement is to remain in place, the equation in Figure 430-4 may be used to determine the required superelevation.

For curves on realigned roadways or where the roadway is to be rebuilt, provide full design-level superelevation (see Chapter 642).

The "minimum radius for normal 2% crown" values from Figure 430-5 are the radii that, with the design speed and side friction factor, result in a 2% adverse crown (e=-2%) (see the equation in Figure 430-4). The modified design-level design criteria are met when a roadway has not more than 2% crown in both directions and a radius equal to or greater than the minimum radius for normal 2% crown.

$$e = \left(\frac{6.69V^2}{R}\right) - f$$
Where: R = Existing curve radius (ft) V = Design speed from 430.02 (mph) e = Superelevation rate (%) f = Side friction factor from Figure 430-5

Minimum Superelevation: Modified Design Level
Figure 430-4

Design Speed (mph)	Side Friction Factor (*f*)	Minimum Radius for Normal 2% Crown (ft)
15	32	51
20	27	107
25	23	199
30	20	335
35	18	512
40	16	764
45	15	1041
50	14	1392
55	13	1838
60	12	2405
65	11	3137
70	10	4092
75	9	5369
80	8	7126

Side Friction Factor
Figure 430-5

430.04 Roadway Widths

Review route continuity and roadway widths. Select widths on the tangents to be consistent throughout a given section of the route. Make any changes where the route characteristics change. The design of a project must not decrease the existing roadway width.

(1) Lane and Shoulder Width

Lane and shoulder widths are shown in Figures 430-10 and 11. Consider joint use with other modes of transportation in shoulder design.

Minimum ramp lane and shoulder widths are shown in Figure 430-14. Use full design level lane and shoulder widths (see Chapter 940) for new and rebuilt ramps.

(2) Turning Roadway Widths

It might be necessary to widen the roadway on curves to accommodate large vehicles. The proposed roadway width for a curve shall not be less than that of the adjacent tangent sections.

Widening of the total roadway width of a curve by less than 2 feet is not required for existing two-lane roadways that are to remain in place.

(a) **The two-lane two-way roadway** width of a curve may not be less than that shown in Figure 430-12a or, if the internal angle (delta) is less than 90°, Figure 430-12b. The minimum total roadway width from Figure 430-12a or 12b may include the shoulder. When the shoulder is included, full-depth pavement is required.

(b) **One-way roadway and ramp** widths on a curve are shown in Figure 430-6 for existing roadways that are to remain in place. Use full design level width (see Chapters 641 and 940) for new and rebuilt ramps.

(3) Median Width

Minimum median widths are given in Figure 430-10.

Curve Radius (ft)	One-Lane[1]	Two-Lane[2]
Tangent to 1001	20	24
500	21	25
400	21	25
300	22	25
200	22	26
150	23	26
100	25	28
75	27	29
50	30	31

Notes:

[1] Includes the shoulder width.

[2] Add shoulder widths from Figure 430-10 for highways and 10 ft for ramps.

One-Way Roadway and Ramp Turning Roadway Widths: Modified Design Level
Figure 430-6

430.05 Cross Slopes

On all tangent sections, the normal cross slopes of the traveled way are 2%.

If a longitudinal contiguous section of pavement is to be removed or is on a reconstructed alignment, or if a top course is to be placed over existing pavement, design the restored pavement cross slope to full design level criteria (see Chapter 640).

The algebraic difference in cross slopes is an operational factor during a passing maneuver on a two-lane two-way roadway. Its influence increases when increased traffic volumes decrease the number and size of available passing opportunities.

A somewhat steeper cross slope may be necessary to facilitate pavement drainage in areas of intense rainfall, even though this might be less desirable from the operational point of view. In such areas, the design cross slopes may be increased to 2.5% with an algebraic difference of 5%.

For existing pavements, cross slopes within a range of 1% to 3% may remain if there are no operational or drainage problems and, on a two-lane two-way roadway, the following conditions are met:

- The algebraic difference is not greater than 4% where the ADT is greater than 2000.
- The algebraic difference is not greater than 5% where the ADT is 2000 or less.
- The algebraic difference is not greater than 6% and the road is striped or signed for no passing.

For a two-lane two-way roadway, provide an algebraic difference to meet the appropriate conditions stated above, except when facilitating drainage in areas of intense rainfall. When applying modified design level to a road with bituminous surface treatment (BST), cross slope correction is not required on the basis of algebraic differences alone.

To maintain or restore curb height, consider lowering the existing pavement level and correcting cross slope by grinding before an asphalt overlay. The cross slope of the shoulder may be steepened to maximize curb height and minimize other related impacts. The shoulder may be up to 6% with a rollover between the traveled way and the shoulder of no more than 8% (see Chapter 640).

430.06 Side Slopes

(1) Fill/Ditch Slopes

Foreslopes (fill slopes and ditch inslopes) and cut slopes are designed as shown in the Fill and Ditch Slope Selection Table in Figure 430-13 for modified design level main line roadway sections. After the foreslope has been determined, use the guidance in Chapter 700 to determine the need for a traffic barrier.

When a crossroad or road approach has steep foreslopes, there is the possibility that an errant vehicle could become airborne. Therefore, flatten crossroad and road approach foreslopes to 6H:1V where feasible and at least to 4H:1V. Provide smooth transitions between the main line foreslopes and the crossroad or road approach foreslopes. Where possible, move the crossroad or road approach drainage away from the main line. This can locate the pipe outside the Design Clear Zone and reduce the length of pipe required.

(2) Cut Slopes

Existing stable backslopes (cut slopes) are to remain undisturbed unless disturbed by other work. When changes are required to a cut slope, design them as shown in the Cut Slope Selection Table in Figure 430-13.

430.07 Bike and Pedestrian

Sidewalk ramps must be addressed for Americans with Disabilities Act of 1990 (ADA) compliance on projects that include hot mix asphalt (HMA) or Portland cement concrete pavement (PCCP) overlays or inlays. Evaluate existing sidewalk ramps for compliance. Construct ADA-compliant sidewalk ramps as required.

On Interstate Pavement Rehab./Resurface projects (see Chapter 325) that include HMA or PCCP overlays, or inlays on ramps or crossroads, sidewalk ramps must be addressed for ADA compliance. Other bicycle or pedestrian elements are design exceptions on HMA or PCCP overlays or inlays on Interstate ramps or crossroads.

Projects that widen the roadway or change the traffic configuration by reducing the shoulders to add turn lanes are considered alterations of the roadway. Such alterations include a requirement to address ADA compliance for sidewalk ramps. (See Chapter 1025 for guidance on pedestrian facilities.)

430.08 Bridges

Design all new and replacement bridges to full design level (see Chapter 440) unless a corridor or project analysis justifies the use of modified design level lane and shoulder widths. Evaluate bridges to remain in place using Figures 430-10 and 11. Whenever possible, continue the roadway lane widths across the bridge and adjust the shoulder widths.

Consider joint use with other modes of transportation in lane and shoulder design (see Chapters 1020, 1025, 1050, and 1060).

430.09 Intersections

Except as given below, design intersections to meet the requirements in Chapter 910.

(1) Turn Radii

The intersection turn radii (or right-turn corners) are controlled by the design vehicle. Figure 430-7 is a guide for determining the design vehicle for modified design level. Perform a field review to determine intersection type, types of vehicles that use the intersection, and adequacy of the existing geometrics. When the crossroad is a city street or county road, consider the requirements of the city or county when selecting a design vehicle.

Design right-turn corners to meet the requirements of Chapter 910 using the design vehicle selected from Figure 430-7 or from the field review.

(2) Angle

The allowable angle between any two respective legs is between 60° and 120°. When realignment is required to meet this angle requirement, consider realigning to an angle between 75° and 105°.

Intersection Type	Design Vehicle
Junction of Major Truck Routes	WB-67
Junction of State Routes	WB-40
Ramp Terminals	WB-40
Other Rural	SU[1]
Urban Industrial	SU[1]
Urban Commercial	P[1]
Residential	P[1]

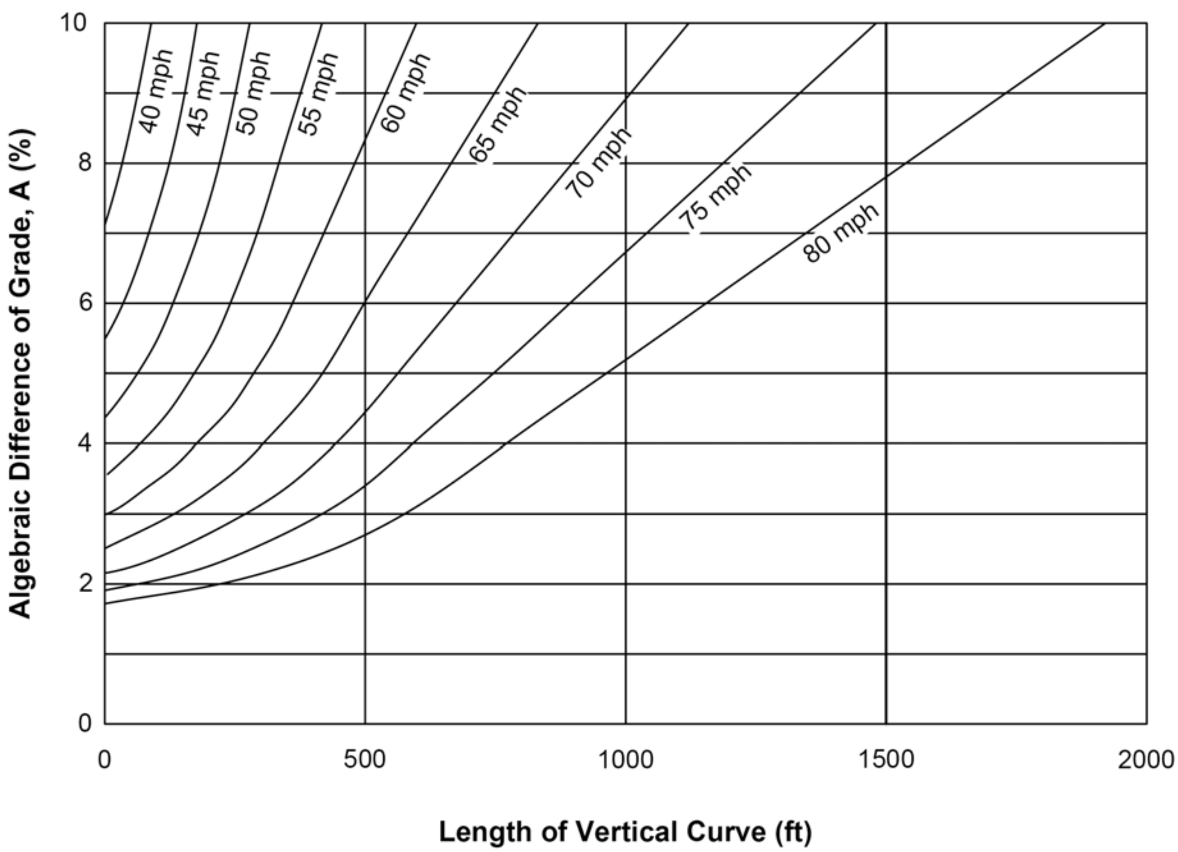
Note:

[1] When the intersection is on a transit or school bus route, use the BUS design vehicle. (See Chapter 1060 for additional guidance on transit facilities and for the BUS turning path templates.)

Design Vehicles: Modified Design Level
Figure 430-7

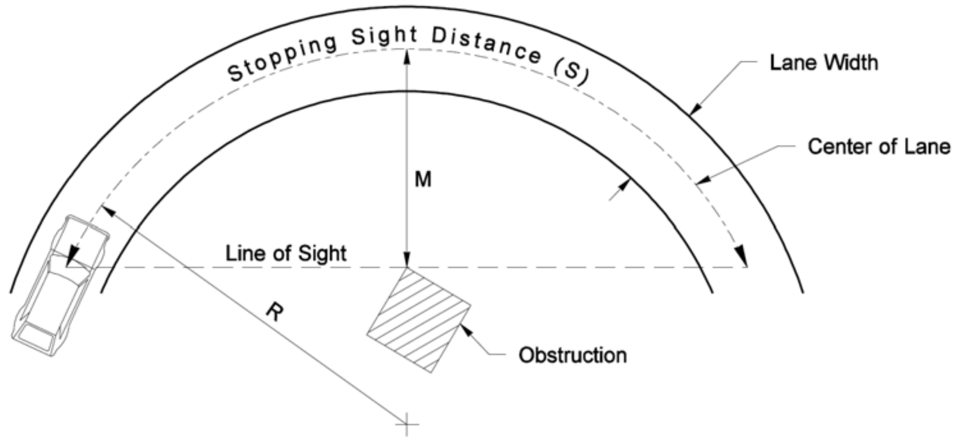
430.10 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

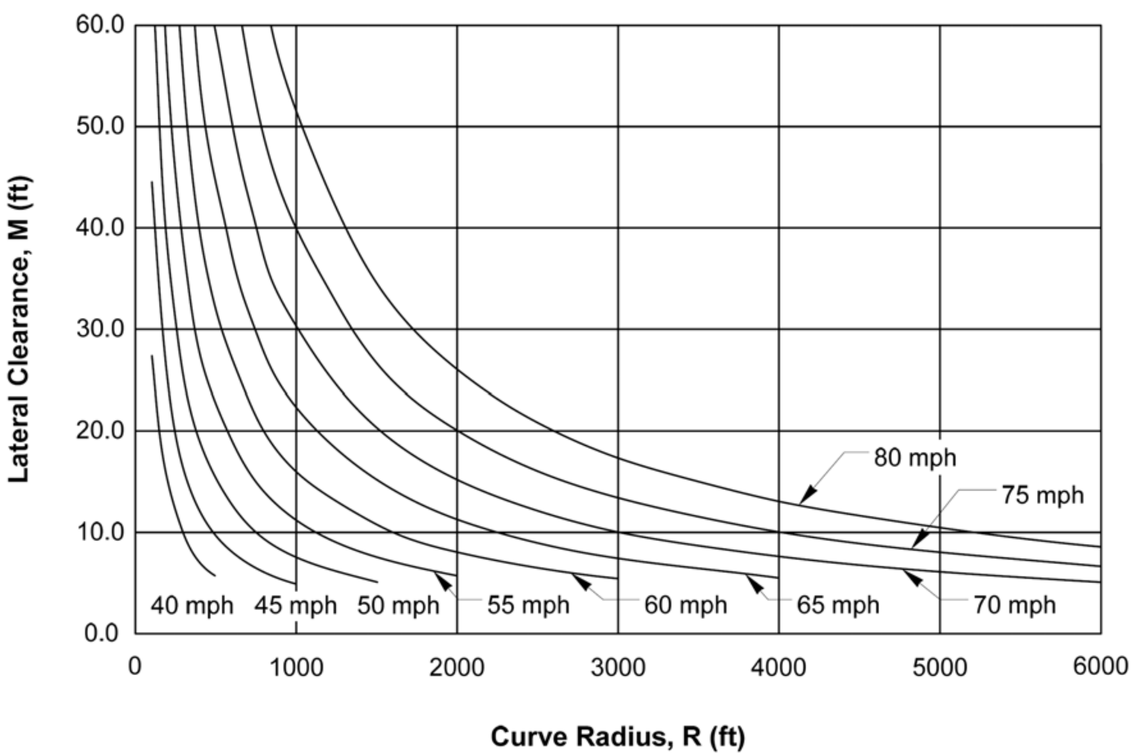


Note:
When the intersection of the algebraic difference of grade with the length of vertical curve is below the selected design speed line, modified design level design criteria are met.

Evaluation for Stopping Sight Distance for Crest Vertical Curves: Modified Design Level
Figure 430-8



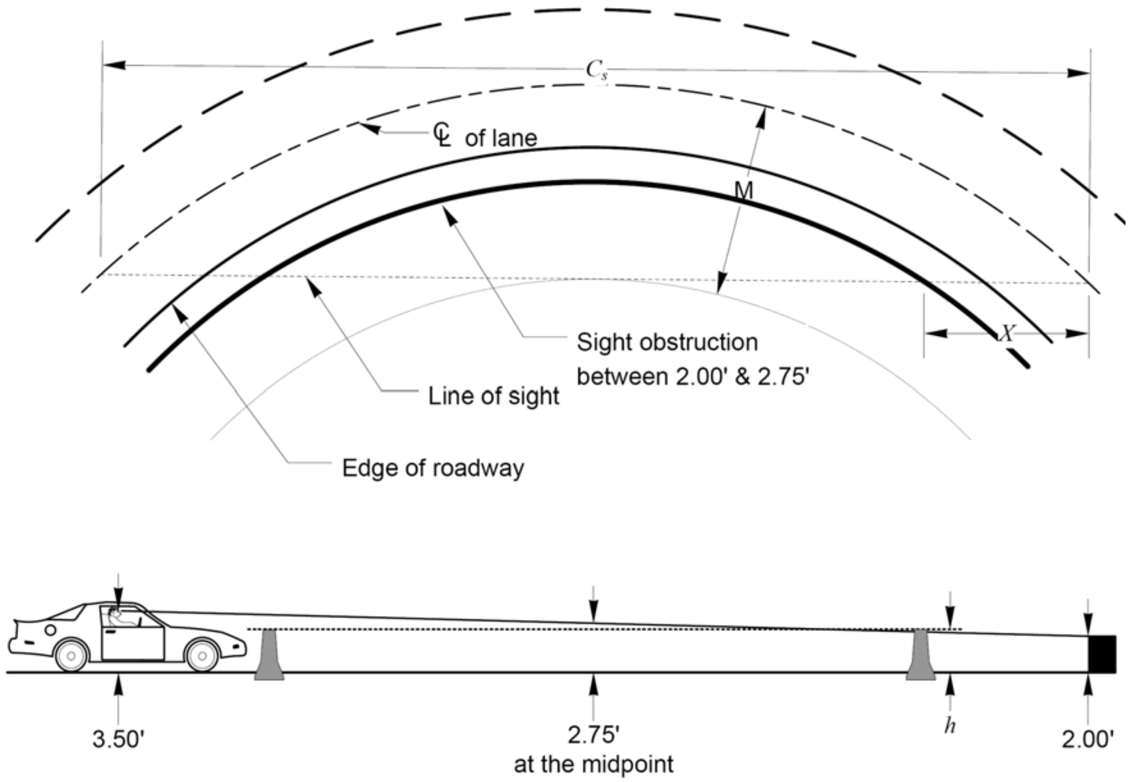
M is the distance in ft from the centerline of the inside lane to the obstruction. The obstruction is a cut slope or other object 2.75 ft or more above the inside lane. Objects between 2.75 ft and 2.00 ft above the roadway surface within the M distance might be a sight obstruction, depending on the distance from the roadway (see Figure 430-9b).



Note:

When the intersection of the lateral clearance (M) with the curve radius (R) falls above the curve for the selected design speed, modified design criteria are met.

Evaluation for Stopping Sight Distance for Horizontal Curves:
Modified Design Level
Figure 430-9a



When $h \le \left(2 + \frac{1.5X}{C_s}\right)$ modified design criteria are met.

Where:

M = Lateral clearance for sight distance (ft) (see Figure 430-9a)

Cs = Stopping sight distance chord (ft)

X = Distance from sight obstruction to the end of sight distance chord (ft)

h = Height of sight obstruction above the inside lane

Evaluation for Stopping Sight Distance Obstruction for Horizontal Curves: Modified Design Level

Figure 430-9b

	Multilane Divided				Multilane Undivided			
	Trucks Under 10%		Trucks 10% and Over		Trucks Under 10%		Trucks 10% and Over	
Design Class	**MDL-1**	**MDL-2**	**MDL-3**	**MDL-4**	**MDL-5**	**MDL-6**	**MDL-7**	**MDL-8**
Current ADT[1]	Under 4000	Over 4000	Under 4000	Over 4000	Under 4000	Over 4000	Under 4000	Over 4000
Design Speed	See Figure 430-1							
Traffic Lanes Number Width	4 or more 11 ft	4 or more 11 ft	4 or more 11 ft`	4 or more 12 ft	4 or more 11 ft	4 or more 11 ft	4 or more 11 ft	4 or more 12 ft
Parking Lanes Urban	None	None	None	None	8 ft	8 ft[2]	8 ft	8 ft[2]
Median Width[15] Rural Urban	Existing Existing	Existing Existing	Existing Existing	Existing Existing	2 ft 2 ft	4 ft 2 ft	4 ft 2 ft	4 ft 2 ft
Shoulder Width Right[3] Left[4]	4 ft 2 ft	6 ft 2 ft	4 ft 2 ft	6 ft 2 ft	4 ft	6 ft[5]	4 ft	6 ft[5]
Minimum Width for Bridges to Remain in Place[6][7][8]	24 ft[9]	26 ft[9]	24 ft[9]	26 ft[10]	48 ft[9]	50 ft[9][11]	50 ft[9][11]	54 ft[10][11]
Minimum Width for Rehabilitation of Bridges to Remain in Place[6][8][12]	28 ft[9]	30 ft[9]	28 ft[9]	32 ft[10]	54 ft[9]	60 ft[9][11][13]	56 ft[9][11]	64 ft[10][11][13]
Minimum Width for Replacement Bridges	Full Design Level Applies[14]							
Access Control	For Limited Access Highways, see Chapters 1430 and 1435 and the Master Plan, or WAC 468-52 and the Region’s Highway Management Classification Report.							

Notes:

[1] If current ADT is approaching a borderline condition, consider designing for the higher classification.

[2] Parking restricted when ADT is over 15,000.

[3] When curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 4 ft. In urban areas, see Chapter 440. On a route identified as a local, state, or regional significant bicycle route, the minimum shoulder width is 4 ft (see Chapter 1020).

[4] When a curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 1 ft on the left.

[5] May be reduced by 2 ft under urban conditions.

[6] Width is the clear distance between curbs or rails, whichever is less.

[7] Use these widths when a bridge within the project limits requires deck treatment or thrie beam retrofit only.

[8] For median widths 25 ft or less, see Chapter 1120.

[9] Add 11 ft for each additional lane.

[10] Add 12 ft for each additional lane.

[11] Includes a 4-ft median, which may be reduced by 2 ft under urban conditions.

[12] Use these widths when a bridge within the project limits requires any work beyond the treatment of the deck such as bridge rail replacement, deck replacement, or widening.

[13] Includes 6-ft shoulders; may be reduced by 2 ft on each side under urban conditions.

[14] Modified design level lane and shoulder widths may be used, when justified, with a corridor or project analysis.

[15] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced by up to 4 inches.

Multilane Highways and Bridges: Modified Design Level
Figure 430-10

	Two-Lane Highways					
	Trucks Under 10%			Trucks 10% and Over		
Design Class	**MDL-9**	**MDL-10**	**MDL-11**	**MDL-12**	**MDL-13**	**MDL-14**
Current ADT[1]	Under 1000	1000-4000	Over 4000	Under 1000	1000-4000	Over 4000
Design Speed	**See Figure 430-1**					
Traffic Lane Width[2]	11 ft	11 ft	11 ft	11 ft	11 ft	12 ft
Parking Lanes Urban	8 ft	8 ft	8 ft[3]	8 ft	8 ft	8 ft[3]
Shoulder Width[4]	2 ft	3 ft[5]	4 ft	2 ft	3 ft[5]	4 ft
Minimum Width for Bridges to Remain in Place[6][7]	22 ft[8]	24 ft	28 ft	22 ft[8]	24 ft	28 ft
Minimum Width for Rehabilitation of Bridges to Remain in Place[7][9]	28 ft[10]	32 ft	32 ft	28 ft[10]	32 ft	32 ft
Minimum Width for Replacement Bridges	Full Design Level Applies[11]					
Access Control	For Limited Access Highways, see Chapters 1430 and 1435 and the Master Plan, or WAC 468-52 and the Region's Highway Management Classification Report.					

Notes:

[1] If current ADT is approaching a borderline condition, consider designing for the higher classification.

[2] For turning roadways, see Figures 430-12a and 12b.

[3] Parking restriction recommended when ADT exceeds 7500.

[4] When a curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 4 ft. In urban areas, see Chapter 440. On a route identified as a local, state, or regional significant bicycle route, the minimum shoulder width is 4 ft (see Chapter 1020).

[5] For design speeds of 50 mph or less on roads of 2000 ADT or less, width may be reduced by 1 ft, with justification.

[6] Use these widths when a bridge within the project limits requires deck treatment or thrie beam retrofit only.

[7] Width is the clear distance between curbs or rails, whichever is less.

[8] 20 ft when ADT is 250 or less.

[9] Use these widths when a bridge within the project limits requires any work beyond the treatment of the deck such as bridge rail replacement, deck replacement, or widening.

[10] 26 ft when ADT is 250 or less.

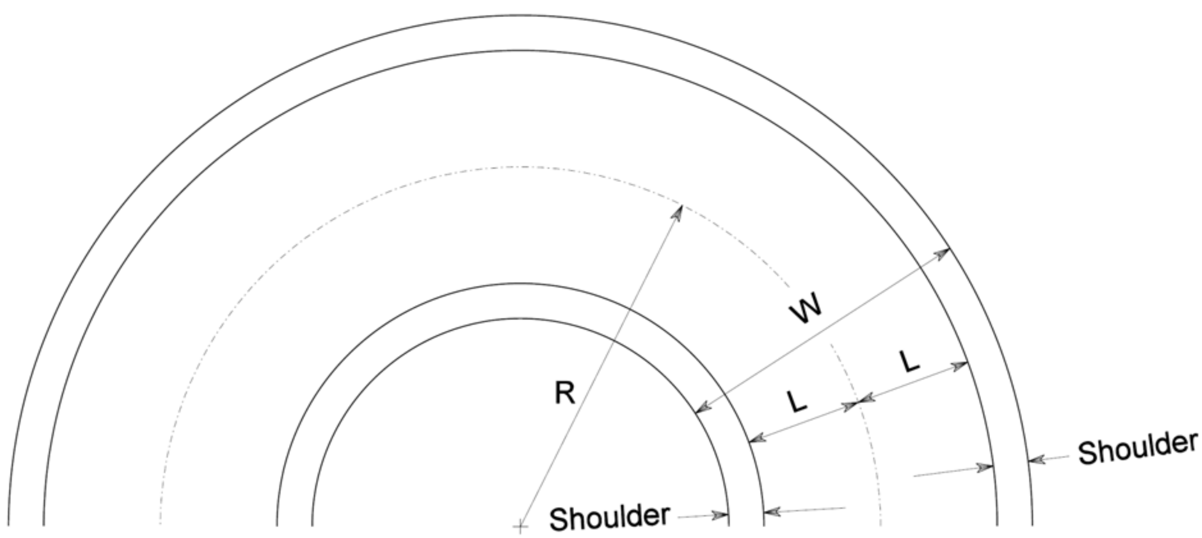
[11] Modified design level lane and shoulder widths may be used, when justified, with a corridor or project analysis.

Two-Lane Highways and Bridges: Modified Design Level
Figure 430-11

Radius of Center Line R (ft)	Minimum Total Roadway Width W (ft)	Minimum Lane Width L (ft)
Tangent	26	11
900	26	11
800	27	12
700	27	12
600	28	12
500	28	12
400	29	12
350	30	12
300	31	12
250	33	13
200	35	13
150	39	13

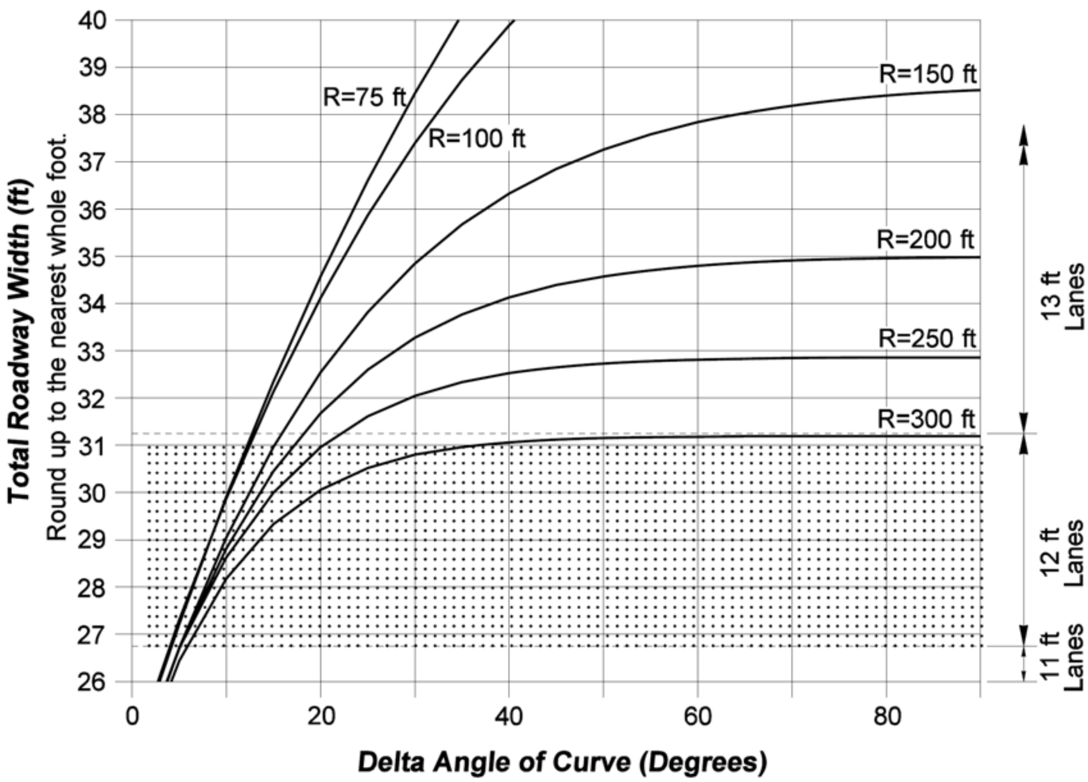
Note:

Also see minimums from Figure 430-11. If the minimum total roadway width is greater than the sum of the shoulders and lane widths, apply the extra width to the inside of the curve.



Minimum Total Roadway Widths for Two-Lane Two-Way Highway Curves: Modified Design Level

Figure 430-12a



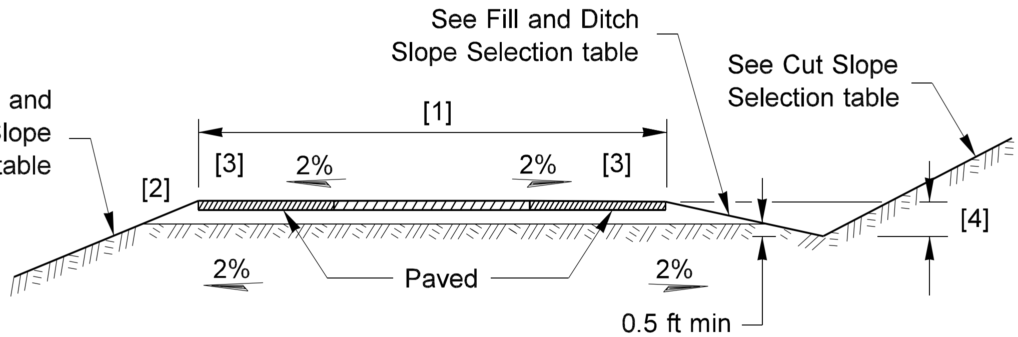
Notes:

May be used when the internal angle (delta) is less than 90°.

If result is less than the total roadway width from Figure 430-11, use the greater.

Minimum Total Roadway Widths for Two-Lane Two-Way Highway Curves: Modified Design Level

Figure 430-12b



Height of Cut (ft)	Slope not Steeper Than[5]
0 - 5	4H:1V
5 - 20	3H:1V
over 20	2H:1V

Cut Slope Selection Table

Height of Fill/Depth of Ditch (ft)	Slope not Steeper Than
0 - 20	4H:1V
20 - 30	3H:1V
over 30	2H:1V[6][7]

Fill and Ditch Slope Selection Table

Notes:

[1] For minimum roadway widths, see Figures 430-10 and 11. For turning roadway widths, see Figures 430-12a and 12b.

[2] Widen and round embankments steeper than 4H:1V.

[3] For shoulder slope requirements, see Chapter 640.

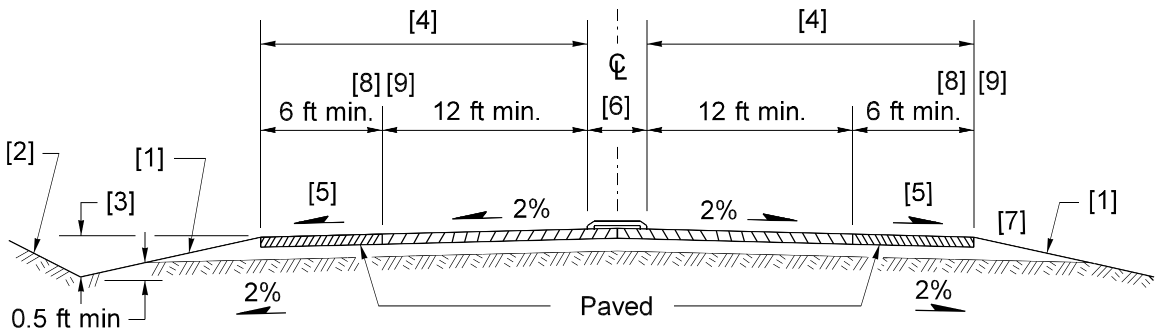
[4] Minimum ditch depth is 2 ft for design speeds over 40 mph and 1.5 ft for design speeds 40 mph or less.

[5] Or as recommended by the soils or geotechnical report. (See Chapter 700 for clear zone/barrier requirements.)

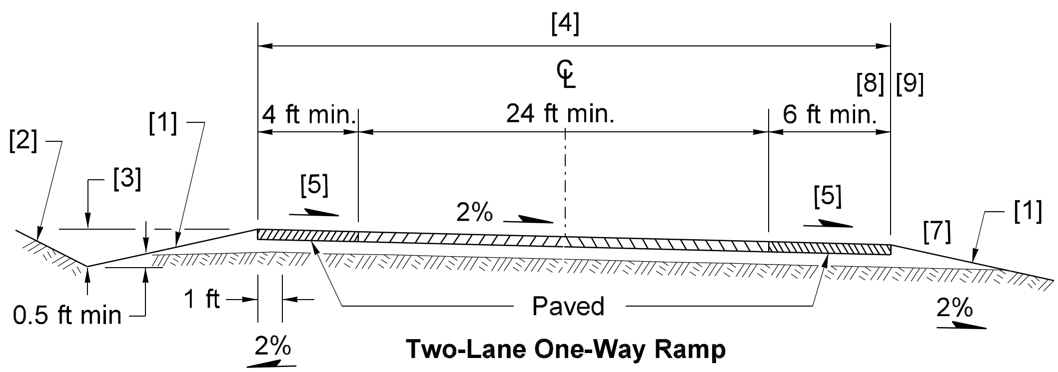
[6] Where feasible, provide flatter slopes for the greater fill heights and ditch depths.

[7] Fill slopes up to 1½H:1V may be used where favorable soil conditions exist. (See Chapter 640 for additional details and Chapter 700 for clear zone and barrier requirements.)

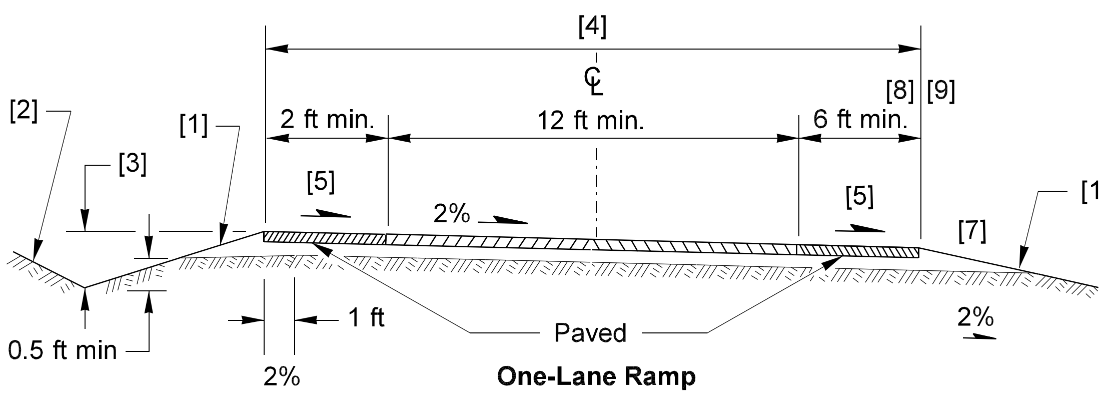
Main Line Roadway Sections: Modified Design Level
Figure 430-13



Two-Lane Two-Way Ramp



Two-Lane One-Way Ramp



One-Lane Ramp

Notes:

[1] See Fill and Ditch Slope Selection Table in Figure 430-13.
[2] See Cut Slope Selection Table in Figure 430-13.
[3] Minimum ditch depth is 2 ft for design speeds over 40 mph and 1.5 ft for design speeds at and under 40 mph.
[4] For minimum ramp width, see 430.04(2)(b) and Figure 430-6.
[5] For shoulder slope requirements, see Chapter 640.
[6] The median width of a two-lane two-way ramp shall not be less than that required for traffic control devices and their required shy distances.
[7] Widen and round embankments steeper than 4H:1V.
[8] Existing 6 ft may remain. When the roadway is to be widened, 8 ft is preferred.
[9] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced by up to 4 inches.

Ramp Roadway Sections: Modified Design Level
Figure 430-14

Chapter 440 Full Design Level

440.01 General

Full design level is the highest level of design and is used on new and reconstructed highways. These projects are designed to provide optimum mobility, safety, and efficiency of traffic movement. The overall objective is to move the greatest number of vehicles, at the highest allowable speed, and at optimum safety. Major design controls are: functional classification; terrain classification; urban or rural surroundings; traffic volume; traffic character and composition; design speed; and access control.

440.02 References

(1) Federal/State Laws and Codes

RCW 46.61.575, Additional parking regulations

RCW 47.05.021, Functional classification of highways

Chapter 47.24 RCW, City streets as part of state highways

WAC 468-18-040, Design standards for rearranged county roads, frontage roads, access roads, intersections, ramps and crossings

(2) Design Guidance

Local Agency Guidelines (LAG), M 36-63, WSDOT

Plans Preparation Manual, M 22-31, WSDOT

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

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

(3) Supporting Information

A Policy on Design Standards – Interstate System, AASHTO, 2005

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

440.03 Definitions

collector system Routes that primarily serve the more important intercounty, intracounty, and intraurban travel corridors; collect traffic from the system of local access roads and convey it to the arterial system; and on which, regardless of traffic volume, the predominant travel distances are shorter than on arterial routes (RCW 47.05.021).

design speed The speed used to determine the various geometric design features of the roadway.

divided multilane A roadway with two or more through lanes in each direction and a median that physically or legally prohibits left turns, except at designated locations.

expressway A divided highway that has a minimum of two lanes in each direction for the exclusive use of traffic and that may or may not have grade separations at intersections.

freeway A divided highway that has a minimum of two lanes in each direction for the exclusive use of traffic and with full control of access.

frontage road A road that is a local road or street located parallel to a highway for service to abutting property and adjacent areas and for control of access.

functional classification The grouping of streets and highways according to the character of the service they are intended to provide.

high pavement type Portland cement concrete pavement or hot mix asphalt (HMA) pavement on a treated base.

highway A general term denoting a street, road, or public way for the purpose of vehicular travel, including the entire area within the right of way.

incorporated city or town A city or town operating under Title 35 or 35A RCW.

intermediate pavement type Hot mix asphalt pavement on an untreated base.

Interstate System A network of routes designated by the state and the Federal Highway Administration (FHWA) under terms of the federal-aid acts as being the most important to the development of a national system. The Interstate System is part of the principal arterial system.

lane A strip of roadway used for a single line of vehicles.

lane width The lateral design width for a single lane, striped as shown in the *Standard Plans* and the *Standard Specifications*. The width of an existing lane is measured from the edge of traveled way to the center of the lane line or between the centers of adjacent lane lines.

limited access highway All highways where the rights of direct access to or from abutting lands have been acquired from the abutting landowners.

low pavement type Bituminous surface treatment (BST).

managed access highway All highways where the rights of direct access to or from abutting lands have not been acquired from the abutting landowners.

median The portion of a highway separating the traveled ways for traffic in opposite directions.

minor arterial system A rural network of arterial routes linking cities and other activity centers that generate long distance travel and, with appropriate extensions into and through urban areas, form an integrated network providing interstate and interregional service (RCW 47.05.021).

National Highway System (NHS) An interconnected system of principal arterial routes that serves interstate and interregional travel; meets national defense requirements; and serves major population centers, international border crossings, ports, airports, public transportation facilities, other intermodal transportation facilities, and other major travel destinations. The Interstate System is a part of the NHS.

operating speed The speed at which drivers are observed operating their vehicles during free-flow conditions. The 85th percentile of the distribution of observed speeds is most frequently used.

outer separation The area between the outside edge of traveled way for through traffic and the nearest edge of traveled way of a frontage road or collector-distributor (C-D) road.

posted speed The maximum legal speed as posted on a section of highway using regulatory signs.

principal arterial system A connected network of rural arterial routes with appropriate extensions into and through urban areas, including all routes designated as part of the Interstate System, that serves corridor movements with travel characteristics indicative of substantial statewide and interstate travel (RCW 47.05.021).

roadway The portion of a highway, including shoulders, for vehicular use.

rural design area An area that meets none of the conditions to be an urban design area.

shoulder The portion of the roadway contiguous with the traveled way, primarily for accommodation of stopped vehicles, emergency use, lateral support of the traveled way, and use by pedestrians and bicycles.

shoulder width The lateral width of the shoulder, measured from the edge of traveled way to the edge of roadway or the face of curb.

suburban area A term for the area at the boundary of an urban design area. Suburban settings may combine higher speeds common in rural design areas with activities that are more common to urban settings.

traveled way The portion of the roadway intended for the movement of vehicles, exclusive of shoulders and lanes for parking, turning, and storage for turning.

two-way left-turn lane (TWLTL) A lane, located between opposing lanes of traffic, to be used by vehicles making left turns from either direction, from or onto the roadway.

undivided multilane A roadway with two or more through lanes in each direction on which left turns are not controlled.

urban area An area designated by WSDOT in cooperation with the Transportation Improvement Board and Region transportation planning organizations, subject to the approval of the FHWA.

urban design area An area where urban design criteria are appropriate, that is defined by one or more of the following:

- An urban area.
- An area within the limits of an incorporated city or town.
- An area characterized by intensive use of the land for the location of structures, that receives such urban services as sewer, water, and other public utilities, as well as services normally associated with an incorporated city or town. This may include an urban growth area defined under the Growth Management Act (see Chapter 36.70A RCW, Growth management – planning by selected counties and cities), but outside the city limits.
- An area with not more than 25% undeveloped land.

urbanized area An urban area with a population of 50,000 or more.

usable shoulder The width of the shoulder that can be used by a vehicle for stopping.

440.04 Functional Classification

The state highway system is divided and classified according to the character and volume of traffic carried by the routes and distinguished by specific geometric design criteria (RCW 47.05.021). The functional classifications (from highest to lowest) used on highways are: Interstate, principal arterial, minor arterial, and collector. The higher functional classes give more priority to through traffic and less to local access. NHS routes are usually designed to a higher level of design than non-NHS routes.

For functional classification maps and criteria see:
http://www.wsdot.wa.gov/mapsdata/tdo/functionalclass.htm

440.05 Terrain Classification

To provide a general basis of reference between terrain and geometric design, three classifications of terrain have been established:

- **Level**. Level to moderately rolling, this terrain offers few or no obstacles to the construction of a highway having continuously unrestricted horizontal and vertical alignment.
- **Rolling**. Hills and foothills, with slopes that rise and fall gently; however, occasional steep slopes might offer some restriction to horizontal and vertical alignment.
- **Mountainous**. Rugged foothills; high, steep drainage divides; and mountain ranges.

Terrain classification pertains to the general character of the specific route corridor. Roads in valleys or passes of mountainous areas might have all the characteristics of roads traversing level or rolling terrain and are usually classified as level or rolling, rather than mountainous.

440.06 Geometric Design Data

(1) State Highway System

For projects on all highways in rural design areas and on limited access highways in urban design areas, the geometric design data is controlled by the functional class and traffic volume (see Figures 440-5 through 440-8). The urban managed access highway design class, based on traffic volume and design speed (see Figure 440-9), may be used on managed access highways in urban design areas, regardless of the functional class.

(2) State Highways as City Streets

When a state highway within an incorporated city or town is a portion of a city street, the design features must be developed in cooperation with the local agency. For facilities on the NHS, use *Design Manual* criteria as the minimum for the functional class of the route. For facilities not on the NHS, the *Local Agency Guidelines* may be used as the minimum design criteria; however, the use of *Design Manual* criteria is encouraged where feasible. On managed access highways within the limits of incorporated cities and towns, the cities or towns have full responsibility for design elements, including access, outside of curb, or outside the paved shoulder where no curb exists, using the *Local Agency Guidelines.*

(3) City Streets and County Roads

Plan and design facilities that cities or counties will be requested to accept as city streets or county roads according to the applicable design criteria shown in:

- WAC 468-18-040.
- *Local Agency Guidelines*.
- The standards of the local agency that will be requested to accept the facility.

440.07 Design Speed

Vertical and horizontal alignment, sight distance, and superelevation will vary with design speed. Such features as traveled way width, shoulder width, and lateral clearances are usually not affected. For the relationships between design speed, geometric plan elements, geometric profile elements, superelevation, and sight distance, see Chapters 620, 630, 642, and 650.

The choice of a design speed is primarily influenced by functional classification, posted speed, operating speed, terrain classification, traffic volumes, accident history, access control, and economic factors. A geometric design that adequately allows for future improvements is also a major criterion. Categorizing a highway by a terrain classification often results in arbitrary reductions of the design speed, when, in fact, the terrain would allow a higher design speed without materially affecting the cost of construction. Savings in vehicle operation and other costs alone might be sufficient to offset the increased cost of right of way and construction.

It is important to consider the geometric conditions of adjacent sections. Maintain a uniform design speed for a significant segment of highway.

The desirable design speed is not less than that given in Figure 440-1. Do not select a design speed less than the posted speed.

For new/reconstruction projects on all rural highways and limited access highways in urban design areas, the design speed for each design class is given in Figures 440-5 through 440-8.

When terrain or existing development limits the ability to achieve the design speed for the design class, use a corridor analysis to determine the appropriate design speed.

Route Type	Posted Speed	Desirable Design Speed
Freeways	All	10 mph over the posted speed
Nonfreeways	45 mph or less	Not less than the posted speed
	Over 45 mph	5 mph over the posted speed

Desirable Design Speed
Figure 440-1

On urban managed access highways, the design speed is less critical to the operation of the facility. Closely spaced intersections and other operational constraints usually limit vehicular speeds more than the design speed.

For managed access facilities in urban design areas, select a design speed based on Figure 440-1. In cases where the Figure 440-1 design speed does not fit the conditions, use a corridor analysis to select a design speed. Select a design speed not less than the posted speed that is logical with respect to topography, operating speed (or anticipated operating speed for new alignment), adjacent land use, design traffic volume, accident history, access control, and the functional classification. Consider both year of construction and design year. Maintain continuity throughout the corridor, with changes (such as a change in roadside development) at logical points.

440.08 Traffic Lanes

Lane width and condition have a great influence on safety and comfort. The minimum lane width is based on the highway design class, terrain type, and whether it is in a rural or urban design area. Lanes 12 feet wide provide desirable clearance between large vehicles where traffic volumes are high and a sizable number of large vehicles is expected. The added cost for 12-foot lanes is offset, to some extent, by the reduction in shoulder maintenance costs due to the lessening of wheel load concentrations at the edge of the lane.

Highway capacity is also affected by the width of the lanes. With narrow lanes, drivers must operate their vehicles closer (laterally) to each other than they normally desire. To compensate, drivers increase the headway, which results in reduced capacity.

Figures 440-5 through 440-8 give the minimum lane widths for the various design classes for use on all rural highways and limited access highways in urban design areas. Figure 440-9 gives the minimum lane widths for urban managed access highways.

The roadway on a curve may need to be widened to make the operating conditions comparable to those on tangents. For guidance on width requirements on turning roadways, see Chapter 641.

440.09 Shoulders

Shoulder width is controlled by the functional classification of the roadway, the traffic volume, and the shoulder function.

The more important shoulder functions and the associated minimum widths are given in Figure 440-2. In addition to the functions in Figure 440-2, shoulders also:

- Provide space to escape potential accidents or reduce their severity.
- Provide a sense of openness, contributing to driver ease and freedom from strain.
- Reduce seepage adjacent to the traveled way by discharging stormwater farther away.

Contact the Region Maintenance Office to determine the shoulder width for maintenance operations. When shoulder widths wider than called for in Figures 440-5 through 440-9 are requested, compare the added cost of the wider shoulders to the added benefits to maintenance operations, as well as other benefits that may be derived. When the Maintenance Office requests a shoulder width different than the design class, justify the width selected.

Shoulder Function	Minimum Shoulder Width
Stopping out of the traffic lanes	8 ft
Minimum lateral clearance	2 ft[1]
Pedestrian or bicycle use	4 ft[2]
Large-vehicle off-tracking on curves	See Chapters 641 & 910
Maintenance operations	Varies[3]
Law enforcement	8 ft[4]
Bus stops	See Chapter 1060
Slow-vehicle turnouts and shoulder driving	See Chapter 1010
Ferry holding	8 ft[5]
For use as a lane during reconstruction of the through lanes	8 ft[5]
Structural support	2 ft
Improve sight distance in cut sections	See Chapter 650
Improve capacity	See Chapter 610

Notes:

[1] See Chapters 700 and 710.

[2] Minimum usable shoulder width for bicycles. For additional information, see Chapter 1020 for bicycles and Chapter 1025 for pedestrians.

[3] 10-ft usable width to park a maintenance truck out of the through lane; 12-ft clearance (14 ft preferred) for equipment with outriggers to work out of traffic.

[4] For additional information, see Chapters 1040 and 1050.

[5] Minimum usable shoulder width (10 ft preferred).

Minimum Shoulder Width

Figure 440-2

Minimum shoulder widths for use on all rural highways and limited access highways in urban design areas are based on functional classification and traffic volume (see Figures 440-5 through 440-8). Figure 440-9 gives the minimum shoulder widths for urban managed access highways without curb.

When curb with a height less than 24 inches is present on urban managed access highways, provide the minimum shoulder widths shown in Figure 440-3. For information on curbs, see 440.11.

When traffic barrier with a height of 2 feet or greater is used adjacent to the roadway, the minimum shoulder width from the edge of traveled way to the face of the traffic barrier is 4 feet. Additional width for traffic barrier shy distance (see Chapter 710) is normally not required on urban managed access highways.

Where there are no sidewalks, the minimum shoulder width is 4 feet. Shoulder widths less than 4 feet will require that wheelchairs using the roadway encroach on the through lane. For additional information and requirements regarding pedestrians and accessible routes, see Chapter 1025.

Lane Width	Posted Speed			
	>45 mph	≤45 mph	>45 mph	≤45 mph
	On Left		On Right[3]	
12 ft or wider	4 ft	[1][2]	4 ft	2 ft
11 ft	4 ft	[1][2]	4 ft	3 ft[4]

Notes:

[1] When mountable curb is used on routes with a posted speed of 35 mph or less, shoulder width is desirable; however, with justification, curb may be placed at the edge of traveled way.

[2] 1 ft for curbs with a height of 8 inches or less. 2 ft for curbs or barriers with a height between 8 and 24 inches.

[3] When the route has been identified as a local, state, or regional significant bike route, the minimum shoulder width is 4 ft or as indicated in Chapter 1020 for signed bike lanes.

[4] When bikes are not a consideration, width may be reduced to 2 ft with justification.

[5] Measured from the edge of traveled way to the face of curb.

Shoulder Width for Curbed Sections[5] in Urban Areas
Figure 440-3

The usable shoulder width is less than the constructed shoulder width when vertical features (such as traffic barrier or walls) are at the edge of the shoulder. This is because drivers tend to shy away from the vertical feature. For traffic barrier shy distance widening, see Chapter 710.

Shoulders on the left between 4 feet and 8 feet wide are undesirable. A shoulder in this width range might appear to a driver to be wide enough to stop out of the through traffic, when it is not. To prevent the problems that can arise from this situation, when the shoulder width and any added clearance result in a width in this range, consider increasing the width to 8 feet.

Provide a minimum clearance to roadside objects so that the shoulders do not require narrowing. At existing bridge piers and abutments, a shoulder less than full width to a minimum of 2 feet is a design exception. For Design Clear Zone and safety treatment requirements, see Chapter 700.

For routes identified as local, state, or regional significant bicycle routes, provide a minimum 4-foot shoulder. Maintain system continuity for the bicycle route, regardless of jurisdiction and functional class. For additional information on bicycle facilities, see Chapter 1020.

Shoulder widths greater than 10 feet may encourage use as a travel lane. Therefore, use shoulders wider than this only where required to meet one of the listed functions (see Figure 440-2).

When walls are placed adjacent to shoulders, see Chapter 1130 for barrier requirements.

440.10 Medians

Medians are either restrictive or nonrestrictive. Restrictive medians limit left turns, physically or legally, to defined locations. Nonrestrictive medians allow left turns at any point along the route. Consider restrictive medians on multilane limited access highways and multilane managed access highways when the design hourly volume (DHV) is over 2000.

The primary functions of a median are to:

- Separate opposing traffic.
- Provide for recovery of out-of-control vehicles.
- Reduce head-on accidents.
- Provide an area for emergency parking.
- Allow space for left-turn lanes.
- Minimize headlight glare.
- Allow for future widening.
- Control access.

Medians may be depressed, raised, or flush with the through lanes. For maximum efficiency, make medians highly visible both night and day.

The width of a median is measured from edge of traveled way to edge of traveled way and includes the shoulders. The desirable median width is given in Figure 440-4. The minimum width is the width required for shoulders and barrier (including required shy distance) or ditch.

When selecting a median width, consider future needs such as wider left shoulders when widening from four to six lanes. A median width of 22 feet is desirable on a four-lane highway when additional lanes are anticipated. The minimum width required to provide additional lanes in the median, without widening to the outside, is 46 feet. On freeways or expressways requiring less than eight lanes within the 20-year design period, provide sufficient median or lateral clearance and right of way to permit the addition of a lane in each direction, if required by traffic increase after the 20-year period.

A two-way left-turn lane (TWLTL) may be used as a nonrestrictive median for an undivided managed access highway (see Figure 440-9). The desirable width of a TWLTL is 13 feet, with a minimum width of 11 feet. For more information on traffic volume limits for TWLTLs on managed access highways, see Chapter 1435. For additional information on TWLTL design, see Chapter 910.

A common form of restrictive median on urban managed access highways is the raised median. The width of a raised median can be minimized by using a dual-faced cement concrete traffic curb, a precast traffic curb, or an extruded curb. For more information on traffic volume limits for restrictive medians on managed access highways, see Chapter 1435.

Median Usage	Desirable Width (ft)[1]
Separate opposing traffic on freeways and expressways	
Rural	60[2]
Urban – 4-lane	18
Urban – 6 or more lanes	22
Allow for future widening	46[4]
Left-turn lanes[3]	13[2]
Control access on divided multilane urban managed access highways	
Design speed 45 mph or less with raised medians	3[5][6]
Design speed greater than 45 mph or barrier separated	10[6]

Notes:

[1] The minimum width is the width required for shoulders and barrier (including required shy distance) or ditch. For barrier requirements, see Chapter 710.

[2] Additional width required at rural expressway intersections for storage of vehicles crossing expressway or entering expressway with a left turn.

[3] For additional information, see Chapter 910.

[4] Narrower width will require widening to the outside for future lanes.

[5] Using a Dual-Faced Cement Concrete Traffic Curb 1 ft face of curb to face of curb.

[6] 12 ft preferred to allow for left-turn lanes.

Median Width
Figure 440-4

At locations where the median will be used to allow vehicles to make a U-turn, consider increasing the width to meet the needs of the vehicles making the U-turn. For information on U-turn locations, see Chapter 910.

Widen medians at intersections on rural divided multilane highways. Provide sufficient width to store vehicles crossing the expressway or entering the expressway with a left turn.

For undivided multilane highways, desirable median width is 4 feet in rural design areas and 2 feet in urban design areas. When signing is required in the median of six-lane undivided multilane highways, the minimum width is 6 feet. If barrier is to be installed at a future date, median widths for the ultimate divided highway are desirable.

When the median is to be landscaped or where rigid objects are to be placed in the median, see Chapter 700 for traffic barrier and clear zone requirements. When the median will include a left-turn lane, see Chapter 910 for left-turn lane design.

440.11 Curbs

(1) General

Curbs are designated as either *vertical* or *sloped*. Vertical curbs have a face batter not flatter than 1H:3V. Sloped curbs have a sloping face that is more readily traversed.

Curbs can also be classified as *mountable*. Mountable curbs are sloped curb with a height of 6 inches or less, preferably 4 inches or less. When the face slope is steeper than 1H:1V, the height of a mountable curb is limited to 4 inches or less.

Where curbing is to be provided, ensure that surface water that collects at the curb will drain and not pond or flow across the roadway.

For all existing curb, evaluate the continued need for the curb. Remove all curbing that is no longer needed.

When an overlay will reduce the height of a vertical curb, evaluate grinding to maintain curb height (or replacing the curb) versus the need to maintain the height of the curb.

Curbs can hamper snow-removal operations. The area Maintenance Superintendent's review and approval is required for the use of curbing in areas of heavy snowfall.

For curbs at traffic islands, see Chapter 910.

(2) Curb Usage

Curbing is used for the following purposes:

- Control drainage
- Delineate the roadway edge
- Delineate pedestrian walkways
- Delineate islands
- Reduce right of way
- Assist in access control
- Inhibit midblock left turns

Avoid using curbs if the same objective can be attained with pavement markings.

In general, curbs are not used on facilities with a posted speed greater than 45 mph. The exceptions are for urban design areas where sidewalks are provided or where traffic movements are to be restricted. Justify the use of curb when the posted speed is greater than 45 mph.

Do not use vertical curbs along freeways or other facilities with a posted speed greater than 45 mph. When curb is needed, use mountable curb with the height limited to 4 inches and located no closer to the traveled way than the outer edge of the shoulder. Provide sloping end treatments where the curb is introduced and terminated.

(a) Vertical curbs with a height of 6 inches or more are required:

- To inhibit or at least discourage vehicles from leaving the roadway.
- For walkway and pedestrian refuge separations.
- For raised islands on which a traffic signal or traffic signal hardware is located.

When an overlay is planned, do not reduce the height of the curb to less than 4 inches.

(b) Consider vertical curbs with a height of 6 inches or more:
- To inhibit midblock left turns.
- For divisional and channelizing islands.
- For landscaped islands.

(c) Provide mountable curbs where a curb is needed but higher vertical curb is not justified.

440.12 Parking

In urban design areas and rural communities, land use might require parking along the highway. In general, on-street parking decreases capacity, increases accidents, and impedes traffic flow; therefore, it is desirable to prohibit parking.

Although design data for parking lanes are included in Figures 440-6 through 440-9, consider them only in cooperation with the municipality involved. The lane widths given are the minimum for parking; provide wider widths when feasible.

Angle parking is not permitted on any state route without WSDOT approval (RCW 46.61.575). This approval is delegated to the State Traffic Engineer. Angle parking approval is to be requested through the Headquarters (HQ) Design Office. Provide an engineering study, approved by the Region Traffic Engineer, with the request documenting that the parking will not unduly reduce safety and that the roadway is of sufficient width that the parking will not interfere with the normal movement of traffic.

440.13 Pavement Type

The pavement types given in Figures 440-5 through 440-8 are those recommended for each design class. (See Chapter 520 for information on pavement type selection.) When a roadway is to be widened and the existing pavement will remain, the new pavement type may be the same as the existing without a pavement type determination.

440.14 Structure Width

Provide a clear width between curbs on a structure not less than the approach roadway width (lanes plus shoulders). The structure widths given in Figures 440-5 through 440-9 are the minimum structure widths for each design class.

Additional width for barriers is not normally added to the roadway width on structures. When a structure is in a run of roadside barrier with the added width, consider adding the width on shorter structures to prevent narrowing the roadway.

440.15 Right of Way Width

Right of way width must be sufficient to accommodate all roadway elements and required appurtenances necessary for the current design and known future improvements. To allow for construction and maintenance activities, provide 10 feet desirable, 5 feet minimum, wider than the slope stake for fill and slope treatment for cut. For slope treatment information, see Chapter 640 and the *Standard Plans*.

The right of way widths given in Figures 440-5 through 440-8 are desirable minimums for new alignment requiring purchase of new right of way. For additional information and consideration on right of way acquisition, see Chapter 1410.

440.16 Grades

Grades can have a pronounced effect on the operating characteristics of the vehicles negotiating them. Generally, passenger cars can readily negotiate grades as steep as 5% without appreciable loss of speed from that maintained on level highways. Trucks, however, travel at the average speed of passenger cars on the level roadway but display up to a 5% increase in speed on downgrades and a 7% or greater decrease in speed on upgrades (depending on length and steepness of grade as well as weight-to-horsepower ratio).

The maximum grades for the various functional classes and terrain conditions are shown in Figures 440-5 through 440-8. For the effects of these grades on the design of a roadway, see Chapters 630, 650, 910, 940, and 1010.

440.17 Fencing

Remove rigid top rails and brace rails from existing fencing and retrofit with a tension wire design. For information on fencing, see Chapter 1460.

440.18 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

Divided Multilane		
Design Class	I-1	
Design Year	[1]	
Access Control[2]	Full	
Separate Cross Traffic		
Highways	All	
Railroads	All	
Design Speed (mph)[3]		
Rural	80[4]	
Urbanized	70[5]	
Traffic Lanes		
Number	4 or more divided	
Width (ft)	12	
Median Width (ft)[6]	Minimum width is as required for shoulders and barrier (including required shy distance) or ditch (see 440.10).	
Shoulder Width (ft)[7]	4 lanes	6 or more lanes
Right of Traffic	10[8]	10[8]
Left of Traffic	4	10[8][9]
Pavement Type[10]	High	
Right of Way[11]		
Rural – Width (ft)	63 from edge of traveled way	
Urban – Width (ft)	As required[12]	
Structures Width (ft)[13]	Full roadway width each direction[14]	

Type of Terrain	Design Speed (mph)						
	50	55	60	65	70	75	80
	Grades (%)[15]						
Level	4	4	3	3	3	3	3
Rolling	5	5	4	4	4	4	4
Mountainous	6	6	6	6	5	5	5

Interstate Notes:

[1] The design year is 20 years after the year the construction is scheduled to begin.

[2] For access control requirements, see Chapter 1430.

[3] For new/reconstruction projects. For design speed on existing roadways, see 440.07.

[4] 80 mph is the desirable design speed; with a corridor analysis, the design speed may be reduced to 60 mph in mountainous terrain and 70 mph in rolling terrain. Do not select a design speed that is less than the posted speed.

[5] 70 mph is the desirable design speed; with a corridor analysis, the design speed may be reduced to 50 mph. Do not select a design speed that is less than the posted speed.

[6] Independent alignment and grade are desirable in all rural areas and where terrain and development permit in urban areas.

[7] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced up to 4 inches.

[8] 12-ft shoulders are desirable when the truck DDHV is 250 or greater.

[9] For existing 6-lane roadways, an existing 6-ft left shoulder is a design exception when the shoulder is not being reconstructed and no other widening is required.

[10] For pavement type determination, see Chapter 520.

[11] Desirable width. Provide right of way width 10 ft desirable, 5 ft minimum, wider than the slope stake for fill and slope treatment for cut (see 440.15).

[12] In urban areas, make right of way widths not less than those required for necessary cross section elements.

[13] For minimum vertical clearance, see Chapter 1120.

[14] For median widths 26 ft or less, address bridge(s) in accordance with Chapter 1120.

[15] Grades 1% steeper may be provided in urban areas and mountainous terrain with critical right of way controls.

Geometric Design Data: Interstate

Figure 440-5

Design Class	Divided Multilane				Two-Lane						Undivided Multilane	
	P-1		P-2		P-3		P-4		P-5		P-6[1]	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
DHV in Design Year[2] NHS Non-NHS	Over 1500		Over 700[3]		Over 201[4] Over 301		61–200 101–300		60 and Under 100 and Under		Over 700[3]	
Access Control[5]	Full		Partial[6]									
Separate Cross Traffic Highways Railroads[7]	 All All		 Where Justified All		 Where Justified All[8]		 Where Justified Where Justified[9]		 Where Justified Where Justified[9]		 Where Justified Where Justified[9]	
Design Speed (mph)[10] Desirable[11] Minimum[12]	 80 60[13]		 70 50[14]		 70 50	 60 40[14]	 70 50	 60 40[14]	 60 40	 60 30[14]	 70 40	 60 30[14]
Traffic Lanes Number Width (ft)	 4 or more divided 12		 4 or 6 divided 12		 2 12		 2 12		 2 12		 4 12	 4 or 6 11[15]
Shoulder Width (ft)[16] Right of Traffic Left of Traffic	 10[17] Variable[19][20]		 10 Variable[19][20]		8		6		4		8	8[18]
Median Width (ft)	Minimum width is as required for shoulders and barrier (including required shy distance) or ditch. (See 440.10.)										(See 440.10)	
Parking Lanes Width (ft) – Minimum	None		None		None		None	10	None	10	None	10[21]
Pavement Type[22]	High				High or Intermediate							
Right of Way[23] – Width (ft)	[24]	[25]	[24]	[25]	120	80	120	80	100	80	150	80
Structures Width (ft)[26]	Full Roadway Width[27]				40		40		32		Full Roadway Width	
Other Design Considerations–Urban					[28]		[28]		[28]		[28]	

Type of Terrain	Rural – Design Speed (mph)									Urban – Design Speed (mph)					
	40	45	50	55	60	65	70	75	80	30	35	40	45	50	55	60[29]
	Grades (%)[30]															
Level	5	5	4	4	3	3	3	3	3	8	7	7	6	6	5	5
Rolling	6	6	5	5	4	4	4	4	4	9	8	8	7	7	6	6
Mountainous	8	7	7	6	6	5	5	5	5	11	10	10	9	9	8	8

Geometric Design Data: Principal Arterial
Figure 440-6

Principal Arterial Notes:

[1] Justify the selection of a P-6 design class on limited access highways.

[2] The design year is 20 years after the year the construction is scheduled to begin.

[3] When considering a multilane highway, perform an investigation to determine whether a truck-climbing lane or passing lane will satisfy the need (see Chapter 1010).

[4] Where DHV exceeds 700, consider 4 lanes. When the volume/capacity ratio is equal to or exceeds 0.75, consider the needs for a future 4-lane facility. When considering truck-climbing lanes on a P-3 design class highway, perform an investigation to determine whether a P-2 design class highway is justified.

[5] For access control requirements, see Chapters 1430 and 1435 and the Master Plan for Limited Access Highways. Contact the HQ Design Office Access & Hearings Unit for additional information.

[6] Full or modified access control may also be used.

[7] Contact the Rail Office of the Public Transportation and Rail Division for input on railroad needs.

[8] All main line and major spur railroad tracks will be separated. Consider allowing at-grade crossings at minor spur railroad tracks.

[9] Criteria for railroad grade separations are not clearly definable. Evaluate each site regarding the hazard potential. Provide justification for railroad gradeseparations.

[10] For new/reconstruction projects. (See 440.07 for existing roadways.)

[11] These are the design speeds for level and rolling terrain in rural design areas. They are the preferred design speeds for mountainous terrain and urban design areas. Higher design speeds may be selected, with justification.

[12] These design speeds may be selected in mountainous terrain, with a corridor analysis. Do not select a design speed that is less than the posted speed.

[13] In urbanized areas, with a corridor analysis, 50 mph may be used as the minimum design speed. Do not select a design speed that is less than the posted speed.

[14] In urban design areas, with a corridor analysis, these values may be used as the minimum design speed. Do not select a design speed that is less than the posted speed.

[15] 12-ft lanes are required when the truck DDHV is 150 or greater.

[16] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced up to 4 inches.

[17] 12-ft shoulders are desirable when the truck DDHV is 250 or greater.

[18] When curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 4 ft.

[19] Minimum left shoulder width is to be as follows: 4 lanes – 4 ft: 6 or more lanes – 10 ft. Consider 12-ft shoulders on facilities with 6 or more lanes and a truck DDHV of 250 or greater.

[20] For existing 6-lane roadways, an existing 6-ft left shoulder is a design exception when the shoulder is not being reconstructed and no other widening is required

[21] Restrict parking when DHV is over 1500.

[22] For pavement type determination, see Chapter 520.

[23] Desirable width. Provide right of way width 10 ft desirable, 5 ft minimum, wider than the slope stake for fill and slope treatment for cut (see 440.15).

[24] 63 ft from edge of traveled way.

[25] Make right of way widths not less than those required for necessary cross section elements.

[26] For the minimum vertical clearance, see Chapter 1120.

[27] For median widths 26 ft or less, address bridges in accordance with Chapter 1120.

[28] For bicycle requirements, see Chapter 1020. For pedestrian and sidewalk requirements, see Chapter 1025. Curb requirements are in 440.11. Lateral clearances from the face of curb to obstruction are in Chapter 700.

[29] For grades at design speeds greater than 60 mph in urban design areas, use rural criteria.

[30] Grades 1% steeper may be used in urban design areas and mountainous terrain with critical right of way controls.

Geometric Design Data: Principal Arterial
Figure 440-6 (continued)

Design Class	Divided Multilane		Two-Lane						Undivided Multilane	
	M-1		M-2		M-3		M-4		M-5[1]	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
DHV in Design Year[2] NHS	Over 700[3]		Over 201[4]		61–200		60 and Under		Over 700[3]	
Non-NHS			Over 401		201–400		200 and Under			
Access Control[5]	Partial[6]									
Separate Cross Traffic										
Highways	Where Justified		Where Justified		Where Justified		Where Justified		Where Justified	
Railroads[7]	All		All[8]		Where Justified[9]		Where Justified[9]		Where Justified[9]	
Design Speed (mph)[10]										
Desirable[11]	70		70	60	70	60	60	60	70	60
Minimum[12][13]	50		50	40	50	40	40	30	40	30
Traffic Lanes										
Number	4 or 6 divided		2		2		2		4	4 or 6
Width (ft)	12		12		12		12		12	11[14]
Shoulder Width (ft)[15]										
Right of Traffic	10		8		6		4		8	8[16]
Left of Traffic	Variable[17][18]									
Median Width (ft)	[19]								[19]	
Parking Lanes Width (ft) – Minimum	None		None		None	10	None	10	None	10[20]
Pavement Type[21]	High		As Required						High or Intermediate	
Right of Way[22] – Width (ft)	[23]	[24]	120	80	120	80	100	80	150	80
Structures Width (ft)[25]	Full Roadway Width[26]		40		40		32		Full Roadway Width	
Other Design Considerations–Urban			[27]		[27]		[27]		[27]	

Type of Terrain	Rural – Design Speed (mph)									Urban – Design Speed (mph)						
	40	45	50	55	60	65	70	75	80	30	35	40	45	50	55	60[28]
	Grades (%)[29]															
Level	5	5	4	4	3	3	3	3	3	8	7	7	6	6	5	5
Rolling	6	6	5	5	4	4	4	4	4	9	8	8	7	7	6	6
Mountainous	8	7	7	6	6	5	5	5	5	11	10	10	9	9	8	8

Geometric Design Data: Minor Arterial

Figure 440-7

Minor Arterial Notes:

[1] Justify the selection of an M-5 design class on limited access highways.

[2] The design year is 20 years after the year the construction is scheduled to begin.

[3] When considering a multilane highway, perform an investigation to determine whether a truck-climbing lane or passing lane will satisfy the need (see Chapter 1010).

[4] Where DHV exceeds 700, consider 4 lanes. When the volume/capacity ratio is equal to or exceeds 0.75, consider the needs for a future 4-lane facility. When considering truck-climbing lanes on an M-2 design class highway, perform an investigation to determine whether an M-1 design class highway is justified.

[5] For access control requirements, see Chapters 1430 and 1435 and the Master Plan for Limited Access Highways. Contact the HQ Design Office Access & Hearings Unit for additional information.

[6] Full or modified access control may also be used.

[7] Contact the Rail Office of the Public Transportation and Rail Division for input on railroad needs.

[8] All main line and major spur railroad tracks will be separated. Consider allowing at-grade crossings at minor spur railroad tracks.

[9] Criteria for railroad grade separations are not clearly definable. Evaluate each site regarding the hazard potential. Provide justification for railroad grade separations.

[10] For new/reconstruction projects. (See 440.07 for existing roadways.)

[11] These are the design speeds for level and rolling terrain in rural design areas. They are the preferred design speeds for mountainous terrain and urban design areas. Higher design speeds may be selected, with justification.

[12] In urban design areas, with a corridor analysis, these values may be used as the minimum design speed. Do not select a design speed that is less than the posted speed.

[13] These design speeds may be selected in mountainous terrain, with a corridor analysis. Do not select a design speed that is less than the posted speed.

[14] When the truck DDHV is 150 or greater, consider 12-ft lanes.

[15] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced up to 4 inches.

[16] When curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 4 ft.

[17] The minimum left shoulder width is 4 ft for 4 lanes and 10 ft for 6 or more lanes.

[18] For existing 6-lane roadways, an existing 6 ft left shoulder is a design exception when the shoulder is not being reconstructed and no other widening is required.

[19] Minimum median width is as required for shoulders and barrier (including required shy distance) or ditch (see 440.10).

[20] Restrict parking when DHV is over 1500.

[21] For pavement type determination, see Chapter 520.

[22] Desirable width. Provide right of way width 10 ft desirable, 5 ft minimum, wider than the slope stake for fill and slope treatment for cut (see 440.15).

[23] 63 ft from edge of traveled way.

[24] Make right of way widths not less than those required for necessary cross section elements.

[25] For the minimum vertical clearance, see Chapter 1120.

[26] For median widths 26 ft or less, address bridges in accordance with Chapter 1120.

[27] For bicycle requirements, see Chapter 1020. For pedestrian and sidewalk requirements, see Chapter 1025. Curb requirements are in 440.11. Lateral clearances from the face of curb to obstruction are in Chapter 700.

[28] For grades at design speeds greater than 60 mph in urban design areas, use rural criteria.

[29] Grades 1% steeper may be used in urban design areas and mountainous terrain with critical right of way controls.

Geometric Design Data: Minor Arterial
Figure 440-7 (continued)

Design Class	Undivided Multilane		Two-Lane					
	C-1		C-2		C-3		C-4	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
DHV in Design Year[1] NHS	Over 900[2]		Over 301[3]		201–300		200 and Under	
Non-NHS			Over 501		301–500		300 and Under	
Access Control	[4]		[4]		[4]		[4]	
Separate Cross Traffic								
Highways	Where Justified		Where Justified		Where Justified		Where Justified	
Railroads[5]	Where Justified[6]		All[6]		Where Justified[6]		Where Justified[6]	
Design Speed (mph)[7]								
Desirable[8]	70	60	70	60	70	60	60	60
Minimum[9][10]	40	30	50	40	50	40	40	30
Traffic Lanes								
Number	4	4 or 6	2		2		2	
Width (ft)	12	11[11]	12		12		12	
Shoulder Width (ft)[12]	8	8[13]	8		6		4	
Median Width (ft)	[14]							
Parking Lane Width (ft) – Minimum	None	10	None		None	10	None	10
Pavement Type[15]	High or Intermediate		As Required					
Right of Way (ft)[16]	150	80	120	80	120	80	100	80
Structures Width (ft)[17]	Full Roadway Width		40		40		32	
Other Design Considerations – Urban	[18]		[18]		[18]		[18]	

Type of Terrain	Rural – Design Speed (mph)										Urban – Design Speed (mph)								
	25	30	35	40	45	50	55	60	65	70	20	25	30	35	40	45	50	55	60[19]
	Grades (%)[20]																		
Level	7	7	7	7	7	6	6	5	5	4	9	9	9	9	9	8	7	7	6
Rolling	10	9	9	8	8	7	7	6	6	5	12	12	11	10	10	9	8	8	7
Mountainous	11	10	10	10	10	9	9	8	8	6	14	13	12	12	12	11	10	10	9

Geometric Design Data: Collector
Figure 440-8

Collector Notes:

[1] The design year is 20 years after the year the construction is scheduled to begin.

[2] When considering a multilane highway, perform an investigation to determine whether a truck-climbing lane or passing lane will satisfy the need (see Chapter 1010).

[3] Where DHV exceeds 900, consider 4 lanes. When the volume/capacity ratio is equal to or exceeds 0.85, consider the needs for a future 4-lane facility. When considering truck-climbing lanes on a C-2 design class highway, perform an investigation to determine whether a C-1 design class highway is justified.

[4] For access control requirements, see Chapters 1430 and 1435 and the Master Plan for Limited Access Highways. Contact the HQ Design Office Access & Hearings Unit for additional information.

[5] Contact the Rail Office of the Public Transportation and Rail Division for input on railroad needs.

[6] Criteria for railroad grade separations are not clearly definable. Evaluate each site regarding the hazard potential. Provide justification for railroad grade separations.

[7] For new/reconstruction projects. (See 440.07 for existing roadways.)

[8] These are the design speeds for level and rolling terrain in rural design areas. They are the preferred design speeds for mountainous terrain and urban design areas. Higher design speeds may be selected, with justification. Do not select a design speed that is less than the posted speed.

[9] In urban design areas, with a corridor analysis, these values may be used as the minimum design speed. Do not select a design speed that is less than the posted speed.

[10] These design speeds may be selected in mountainous terrain, with a corridor analysis. Do not select a design speed that is less than the posted speed.

[11] Consider 12-ft lanes when the truck DDHV is 200 or greater.

[12] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced up to 4 inches.

[13] When curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 4 ft.

[14] Minimum median width is as required for shoulders and barrier (including required shy distance) or ditch (see 440.10).

[15] For pavement type determination, see Chapter 520.

[16] Desirable width. Provide right of way width 10 ft desirable, 5 ft minimum, wider than the slope stake for fill and slope treatment for cut (see 440.15).

[17] For the minimum vertical clearance, see Chapter 1120.

[18] For bicycle requirements, see Chapter 1020. For pedestrian and sidewalk requirements, see Chapter 1025. Curb requirements are in 440.11. Lateral clearances from the face of curb to obstruction are in with Chapter 700.

[19] For grades at design speeds greater than 60 mph in urban design areas, use rural criteria.

[20] Grades 1% steeper may be used in urban design areas and mountainous terrain with critical right of way controls.

Geometric Design Data: Collector
Figure 440-8 (continued)

Design Class	Divided Multilane		Undivided Multilane		Two-Lane	
	$U_{M/A}$-1	$U_{M/A}$-2	$U_{M/A}$-3	$U_{M/A}$-4	$U_{M/A}$-5	$U_{M/A}$-6
DHV in Design Year[1]	Over 700	Over 700	700–2,500	Over 700	All	All
Design Speed (mph)	Greater than 45	45 or less	35 to 45	30 or less	Greater than 45	45 or less
Access	[2]	[2]	[2]	[2]	[2]	[2]
Traffic Lanes						
Number	4 or more	4 or more	4 or more	4 or more	2	2
Width (ft) NHS	12[3][4]	12[3]	12[3]	12[3]	12[3][6]	12[3]
Non-NHS	11[4]	11[5]	11[5]	11[5]	11[6]	11[7]
Shoulder Width (ft)[8]						
Right of Traffic[9]	10	10	8	8	8[10]	4
Left of Traffic	4	4				
Median Width (ft)[11]			[12]	[12]		
Parking Lane Width (ft)	None	10[13]	10[13]	8[14]	10[15]	8[14]
Structures Width (ft)[16]	Full Roadway Width[17]		Full Roadway Width		32	30
Other Design Considerations	[18]	[18]	[18]	[18]	[18]	[18]

Urban Managed Access Highways Notes:

[1] The design year is 20 years after the year the construction is scheduled to begin.

[2] The urban managed access highway design is only used on managed access highways (see Chapter 1435).

[3] May be reduced to 11 ft, with justification.

[4] Provide 12-ft lanes when truck DDHV is 200 or greater.

[5] Consider 12-ft lanes when truck DDHV is 200 or greater.

[6] Provide 12-ft lanes when truck DHV is 100 or greater.

[7] Consider 12-ft lanes when truck DHV is 100 or greater.

[8] When curb section is used, see Figure 440-3.

[9] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced up to 4 inches.

[10] When DHV is 200 or less, may be reduced to 4 ft.

[11] Minimum width is as required for shoulders and barrier (including required shy distance) or ditch (see 440.10).

[12] 2 ft desirable. When a TWLTL is present, 13 ft is desirable, 11 ft is minimum.

[13] Prohibit parking when DHV is over 1500.

[14] 10 ft is desirable.

[15] Prohibit parking when DHV is over 500.

[16] For minimum vertical clearance, see Chapter 1120.

[17] For median requirements, see Chapter 1120.

[18] For bicycle requirements, see Chapter 1020. For pedestrian and sidewalk requirements, see Chapter 1025. Lateral clearances from face of curb to obstruction are in Chapter 700. For railroad and other roadway grade separation, maximum grade, and pavement type for the functional class, see Figures 440-6 through 440-8. Make right of way widths not less than required for necessary cross section elements.

Geometric Design Data: Urban Managed Access Highways

Figure 440-9

Chapter 510 Investigation of Soils, Rock, and Surfacing Materials

510.01 General

It is WSDOT's responsibility to understand the characteristics of the soil and rock materials that support or are adjacent to a transportation facility to ensure that, when designed, constructed, and maintained, the facility will be adequate to safely carry the estimated traffic. It is also the responsibility of WSDOT to ensure the quality and quantity of all borrow, soils, rock, and surfacing materials used in the construction of transportation facilities. Specific requirements for geotechnical investigation, design, construction, and maintenance support to accomplish these things are set forth in the WSDOT *Geotechnical Design Manual*.

The following information serves as guidance in the above areas. When a project consists of a surface overlay of an existing highway, WSDOT Pavement Policy is used.

Before making project budget and schedule commitments to the Legislature, other agencies, and the public, it is necessary to identify the extent and estimated cost for a project. Contact the Region Materials Engineer (RME) and the Headquarters (HQ) Geotechnical Division as early as possible to obtain conceptual-level recommendations regarding how the project soil, rock, and groundwater conditions may affect the design of the project elements. The project soil, rock, and groundwater conditions, and the availability, quantity, and quality of borrow and surfacing materials, can affect the project scope, schedule, and budget.

The RME and the HQ Geotechnical Division will use existing subsurface information and their knowledge of the project area to assess the subsurface conditions within the project limits. If there is little information available or the information is poor, and the subsurface conditions have the potential to significantly affect the project budget or schedule, it may be necessary to obtain a limited number of geotechnical borings or test pits during Project Definition to assess soil, rock, and groundwater conditions within the project limits. Once the Project Definition has been developed and project funding secured, a more detailed geotechnical investigation follows during the design and Plans, Specifications, and Estimates (PS&E) phases.

Coordinate early in your project for Geotechnical reporting and design

It is essential to involve the RME and the HQ Geotechnical Division in the design as soon as possible once the need for geotechnical work is identified. (See 510.04(3) for time-estimate information.) Furthermore, if major changes occur as the project is developed, inform the RME and the HQ Geotechnical Division as soon as possible so that the geotechnical design can be adapted to the changes without significant delay to the project.

510.02 References

(1) Design Guidance

Construction Manual, M 41-01, WSDOT

Geotechnical Design Manual, M 46-03, WSDOT

Hydraulics Manual, M 23-03, WSDOT

Plans Preparation Manual, M 22-31, WSDOT

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

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

WSDOT Pavement Policy
www.wsdot.wa.gov/biz/mats/pavement/WSDOT_Volume1-PavementPolicy.pdf

510.03 Materials Sources

(1) General

The Region Project Development Engineer (RPDE) determines when a materials source is needed. The RME determines the best materials source for the project (see Figure 510-1). It is preferred that existing approved materials source sites be used when there are suitable sites available. When there are no approved sites available, the RME determines the locations for new materials sources. The RME contacts the HQ Geotechnical Division to provide a geotechnical investigation for the proposed site. The HQ Geotechnical Division provides geologic mapping of the site, develops a subsurface exploration plan and cost estimate, conducts the subsurface investigation, develops a subsurface geologic model including groundwater, evaluates slope stability issues, and makes recommendations. The HQ Geotechnical Division develops and provides a geotechnical report with materials source development recommendations to the RME. The RME uses this report and materials source recommendations to develop the Materials Source Report and to identify the quantity and quality of material that is intended for the life of the materials source.

Specific requirements for materials source investigations are set forth in the *Geotechnical Design Manual*, Chapter 21.

(2) Materials Source Approval

The HQ Geotechnical Division must review and approve the Materials Source Report produced by the RME to ensure consistency with the geotechnical report produced by the HQ Geotechnical Division.

The HQ Materials Office and the HQ Design Office must approve each pit or quarry site before it is purchased, leased, or acquired on a royalty basis. Until the approval process is complete, the project cannot be advertised for bids. Local and state permits are required for materials sources. To avoid delay in advertising the project, begin the site investigations and permitting process in the early stages of the Project Definition phase.

510.04 Geotechnical Investigation, Design, and Reporting

(1) General

A geotechnical investigation is conducted on all projects that involve significant grading quantities (including state-owned materials source development), unstable ground, foundations for structures, and groundwater impacts (including infiltration). The goal of the geotechnical investigation is to preserve the safety of the public who use the facility, as well as to preserve the economic investment by the state of Washington. Additional requirements regarding geotechnical investigations and who can conduct such investigations are set forth in the *Geotechnical Design Manual*, Chapter 1.

(2) Key Contacts for Initiating Geotechnical Work

For Regions, the RME is the first person to contact for geotechnical work. Projects with structures designed by the HQ Bridge and Structures Office, Washington State Ferries (WSF) projects, and Urban Corridors projects generally require the involvement of the HQ Geotechnical Division. These particular WSDOT offices should contact the HQ Geotechnical Division directly for their geotechnical project needs. The specific roles and responsibilities of the RME and HQ Geotechnical Division, including application to the Project Management Process (PMP), are set forth in the *Geotechnical Design Manual*, Chapter 1.

For information on retaining walls and noise walls, see Chapters 1130 and 1140, respectively. For geosynthetic design, see Chapter 530.

(3) Scheduling Considerations for Geotechnical Work

The Region Project Office, the HQ Bridge and Structures Office, the WSF, and the HQ Facilities Office are responsible for identifying the potential need for geotechnical work and requesting time and budget estimates from the RME or the HQ Geotechnical Division, as early as possible to prevent delays to the project.

Once the geotechnical design request and the site data are received by the RME or the HQ Geotechnical Division, it can take from two to six months, or more, to complete the geotechnical design. Design completion depends on the complexity of the project, whether or not test holes are needed, current workload, the need to give the work to consultants, and how long it takes to obtain environmental permits and rights of entry.

If a consultant must be used, the minimum time required to complete a design (for even a simple project) is typically two and a half months.

In true emergency situations (a highway blocked by a landslide or a collapsed bridge, for example), it is possible to get geotechnical design work completed (in-house or by consultants) more rapidly to at least provide a design for temporary mitigation.

Consider all of these factors when deciding how soon (in general, as early as possible) to initiate the geotechnical work for a project.

To incorporate geotechnical scheduling considerations into the overall project schedule, see Chapter 1 of the *Geotechnical Design Manual*, which provides a description and discussion of the Master Deliverables List (MDL) as it applies to geotechnical work.

(4) Site Data and Permits Needed to Initiate Geotechnical Work

To initiate geotechnical work on a project during the Project Definition phase, provide the following information:

(a) Project description.

(b) Plan view or description showing the proposed alignment or alignment alternative(s).

(c) Description of project scope as it relates to geotechnical features such as major cuts and fills, walls, structures, and potential stormwater facilities.

To initiate geotechnical work on a project during the design and PS&E phases, provide the following information:

(a) Project description.

(b) Plan sheets showing the following:
- Station and location of cuts, fills, walls, bridges, retention/detention ponds, or other geotechnical features to be designed
- Existing utilities (as-built plans are acceptable)
- Right of way limits
- Wetlands
- Drainage features
- Existing structures
- Other features or constraints that could affect the geotechnical design or investigation

(c) Electronic files, or cross sections every 50 feet or as appropriate, to define existing and new ground line above and below walls, cuts, fills, and other pertinent information.
- Show stationing
- Show locations of existing utilities, right of way lines, wetlands, and other constraints
- Show locations of existing structures that might contribute load to the cut, fill, wall, or other structure

(d) Right of entry agreements and permits required for geotechnical investigation.

(e) Due date and work order number.

(f) Contact person.

When the alignment and any constraints (as noted above) are staked, the stationing on the plans and in the field must be in the same units. Physical surveys are preferred to photogrammetric surveys to ensure adequate accuracy of the site data.

Permits and agreements to be supplied by the Region might include:
- HPA
- Shoreline permits
- Tribal lands and waters
- Railroad easement and right of way
- City, county, or local agency use permits
- Sensitive area ordinance permits

The Region Project Office is also responsible for providing survey locations of test holes once the test holes have been drilled. The survey information includes the station, offset, elevation, and test hole coordinates. Coordinates are the latitude and longitude or state plane coordinates (North or South as appropriate), but not project coordinates.

(5) Overview of Geotechnical Design Objectives for the Various Project Stages

Geotechnical design objectives for the various design phases are described in the *Geotechnical Design Manual*.

(6) Earthwork

(a) **Project Definition**. The designer contacts and meets with the RME (and the HQ Geotechnical Division as needed) at the project site to conduct a field review to help identify the geotechnical issues for the project.

In general, if soil/rock conditions are poor and/or large cuts or fills are anticipated, the RME requests that the HQ Geotechnical Division participate in the field review and reporting efforts.

The designer provides a description and location of the proposed earthwork to the RME.

- For widening of existing facilities, the anticipated width, length, and location of the widening, relative to the current facility, are provided.
- For realignments, the approximate new location proposed for the facility is provided.
- Locations in terms of length can be by milepost or stations.

A brief conceptual-level report that summarizes the results of the investigation is provided to the designer.

(b) **Project Design**. Geotechnical data necessary to allow completion of the PS&E-level design is compiled during the design phase. This includes soils borings, testing, and geotechnical design based on final geometric data. Detailed design of cut and fill slopes can be done once the roadway geometry is established and geotechnical data are available. The purpose of this design effort is to determine the maximum stable cut or fill slope and, for fills, the potential for short- and long-term settlement. Also, the usability of the cut materials and the type of borrow needed for the project, if any, are evaluated. Evaluate the use of soil bioengineering as an option for building steeper slopes or to prevent surface erosion. (See Chapter 1350, "Soil Bioengineering," for more information.)

The designer requests a geotechnical report from the RME. The site data indicated in 510.04(4), as applicable, is provided. It is important that the request for the geotechnical report be made as early as possible in the design phase. Cost and schedule requirements to generate the report are project specific and can vary widely. The time required to obtain permits and rights of entry must be considered when establishing schedule requirements.

The *Geotechnical Design Manual*, Chapter 24, summarizes the type of information and recommendations that are typically included in the geotechnical report for earthwork. The recommendations should include the background regarding analysis approach and any agreements with the Region or other customers regarding the definition of acceptable level of risk.

The Project Office uses the report to finalize design decisions for the project. To meet slope stability requirements, additional right of way might be required or a wall might be needed. Wall design is covered in Chapter 1130. Construction timing might require importing material rather than using cut materials. The report is used to address this and other constructibility issues. The report is also used to proceed with completion of the PS&E.

(c) **PS&E Development**. Adequate geotechnical design information to complete the PS&E is typically received during the design phase. Additional geotechnical work might be needed when right of way cannot be acquired, restrictions are included in permits, or other requirements are added that result in changes to the design.

Special provisions and plan details, if not received as part of the report provided during design, are developed with the assistance of the RME or the HQ Geotechnical Division. The designer uses this information, as well as the design phase report, to complete the PS&E documents. Both the Region Materials Section and the HQ Geotechnical Division can review (if requested) the contract plans before the PS&E review process begins. Otherwise, they will review the contract plans during the normal PS&E review process.

(7) Hydraulic Structures, Ponds, and Environmental Mitigation

(a) **Project Definition**. The designer provides a description and location of the proposed hydraulic/environmental improvements and other pertinent site information and discusses the extent of the improvements with both the RME and the HQ Hydraulics Branch to identify the geotechnical issues to be investigated. At this stage, only the identification and feasibility of the proposed hydraulic structures or environmental mitigation are investigated. The cost and schedule requirements for the geotechnical investigation are also determined at this time.

Examples of hydraulic structures include, but are not limited to, large culverts, pipe arches, underground detention vaults, and fish passage structures. Examples of environmental mitigation include, but are not limited to, detention/retention ponds, wetland creation, and environmental mitigation measures on fill slopes.

It is especially important to identify the potential to encounter high groundwater at the proposed hydraulic structure or pond location. In general, avoid high groundwater locations (see the *Highway Runoff Manual*) as groundwater can greatly affect design, constructibility, operations, performance, and maintenance.

(b) **Project Design**. The designer requests a geotechnical report from the RME. The site data indicated in 510.04(4), as applicable, is provided along with the following information:

- Pertinent field observations (such as unstable slopes, existing soft soils or boulders, evidence of high groundwater, or erosion around and damage to existing culverts or other drainage structures)
- Jurisdictional requirements for geotechnical design of berms/dams

It is important that the request for the geotechnical report be made as early as possible in the design phase. Cost and schedule requirements to generate the report are project specific and can vary widely. The time required to obtain permits and rights of entry must be considered when establishing schedule requirements. Furthermore, since the depth to groundwater can be critical to the feasibility of these types of facilities, and since seasonal variation of groundwater is typically important to know, it is essential to have adequate time to determine the effect of seasonal variations on groundwater.

The RME, with support from the HQ Geotechnical Division as needed, provides the following information in addition to the overall requirements specified in the *Geotechnical Design Manual*, when requested and where applicable, as part of the project geotechnical report:

- Soil boring logs
- Soil pH and resistivity
- Water table elevation
- Soil infiltration rates (highest rate for assessing spill containment/aquifer protection and long-term rate for determining pond capacity)
- Bearing capacity and settlement for hydraulic structure foundations
- Slope stability for ponds
- Retention berm/dam design
- Potential for and amount of differential settlement along culverts and pipe arches and the estimated time required for settlement to occur
- Soil pressures and properties (primarily for underground detention vaults)
- Erosion potential
- Geosynthetic design per Chapter 530
- Recommendations for mitigation of the effect of soft or unstable soil on the hydraulic structures
- Recommendations for construction

Note that retaining walls that are part of a pond, fish passage, etc., are designed per Chapter 1130 and the *Geotechnical Design Manual*.

The designer uses the geotechnical information to:

- Finalize design decisions.
- Evaluate and mitigate environmental issues.
- Proceed with completion of the PS&E design (includes determining the most cost-effective hydraulic structure/pond to meet the desired objectives; locating and sizing ponds and foundations for hydraulic structures; structural design; mitigating the effects of settlement; and satisfying local jurisdictional requirements for design).

(c) **PS&E Development**. During PS&E development, the designer uses the information provided in the geotechnical report to:

- Select pipe materials in accordance with corrosion, resistivity, and abrasion guidelines in the *Hydraulics Manual*.
- Consider and include construction recommendations.

Additional design and specification guidance and support from the RME or the HQ Geotechnical Division are sought as needed. Both sections provide careful review of the contract plans before the PS&E review process begins, if requested. Otherwise, they will review the contract plans during the normal PS&E review process.

(8) Signals, Sign Bridges, Cantilever Signs, and Luminaire Foundations

(a) **Project Definition and Design**. Geotechnical information is usually not required for signals, sign bridges, cantilever signs, and luminaires during Project Definition.

The Region Traffic Design Office contacts the RME for conceptual foundation recommendations. The conceptual recommendations are based on existing information in the area and identify whether *Standard Plan* foundations are feasible or whether special design foundations are required. If good soils are anticipated or the foundations will be placed in fill, *Standard Plan* foundations can be assumed. If special design foundations are required, additional time and money can be included in the project to accommodate increased field exploration for foundation design, HQ Geotechnical Division involvement, and structural design by the HQ Bridge and Structures Office.

(b) **PS&E Development**. Foundation recommendations are made by either the RME or the HQ Geotechnical Division. The recommendations provide all necessary geotechnical information to complete the PS&E.

The Region Traffic Design Office (or Region Project Engineer in some cases) is responsible for delivering the following project information to the RME:

- Plan sheet showing the location of the structures (station and offset) and the planned structure type
- Applicable values for: XYZ, strain pole class, sign bridge span length, luminaire height, variable message sign weight, wind load, CCTV pole height, and known utility information in the area

The RME provides the following information to the requester if *Standard Plan* foundation types can be used:

- Allowable lateral bearing capacity of the soil
- Results of all field explorations
- Groundwater elevation
- Foundation constructibility

The Region uses this information to complete the plan sheets and prepare any special provisions. If utilities are identified during the field investigation that could conflict with the foundations, the Region pursues moving or accommodating the utility. Accommodation could require special foundation designs.

If special designs are required, the RME notifies the requester that special designs are required and forwards the information received from the Region to the HQ Geotechnical Division. The HQ Geotechnical Division provides the HQ Bridge and Structures Office with the necessary geotechnical recommendations to complete the foundation designs. The Region coordinates with the HQ Bridge and Structures Office to ensure that they have all the information necessary to complete the design. Depending on the structure type and complexity, the HQ Bridge and Structures Office might produce the plan sheets and special provisions for the foundations, or they might provide the Region with information so that they can complete the plan sheets and special provisions.

Additional guidelines and requirements for design of foundations for these types of structures are contained in the *Geotechnical Design Manual*.

(9) Buildings, Park and Ride Lots, Communication Towers, and Rest Areas

In general, the RME functions as the clearing house for the geotechnical work to be conducted in each of the phases, for technical review of the work if it is performed by consultants or for getting the work done in-house. For sites and designs that are more geotechnically complex, the RME contacts the HQ Geotechnical Division for assistance. (See the *Geotechnical Design Manual* for geotechnical investigation and design requirements for these types of facilities.)

Detailed geotechnical investigation guidance is provided in Facilities Operating Procedure 9.18, "Site Development." In summary, this guidance addresses the following phases of design:

(a) **Site Selection**. Conceptual geotechnical investigation (based on historical data and minimal subsurface investigation) of several alternative sites is performed in which the geotechnical feasibility of each site for its intended use is evaluated, allowing the sites to be ranked. In this phase, geological hazards (such as landslides, rockfall, compressible soils, and liquefaction) are identified, and geotechnical data adequate to determine a preliminary cost to develop and build on the site is gathered.

(b) **Schematic Design**. For the selected site, the best locations for structures, utilities, and other elements of the project are determined based on site constraints and ground conditions. In this phase, the site is characterized more thoroughly than in the site selection phase, but subsurface exploration is not structure specific.

(c) **Design Development**. The final locations of each of the project structures, utilities, and other project elements determined from the schematic design phase are identified. Once these final locations are available, a geotechnical investigation is conducted that is adequate to complete the final design of each of the project elements, such as structure foundations, detention/retention facilities, utilities, parking lots, roadways, and site grading. From this investigation and design, the final PS&E is developed.

(10) Retaining Walls, Reinforced Slopes, and Noise Walls

(a) **Project Definition**. The designer provides the RME with a description and location of the proposed walls or reinforced slopes, including the potential size of the proposed structures and other pertinent site information. At this stage, only the identification and feasibility of the proposed walls or reinforced slopes are investigated. A field review may also be conducted at this time as part of the investigation effort. In general, if soil/rock conditions are poor and/or large walls or reinforced slopes are anticipated, the RME requests that the HQ Geotechnical Division participate in the field review and reporting efforts. The cost and schedule requirements for the geotechnical investigation are also determined at this time.

A brief conceptual-level report that summarizes the results of the investigation may be provided to the designer at this time, depending on the complexity of the geotechnical issues.

(b) **Project Design and PS&E Development**. Geotechnical data necessary to allow completion of the PS&E-level design for walls and reinforced slopes are compiled during the design and PS&E development phases. These include soils borings, testing, and final geometric data. Detailed designs of walls and reinforced slopes can be done once the roadway geometry is established and geotechnical data are available. The purpose of this design effort is to determine the wall and slope geometry needed for stability; noise wall and retaining wall foundation requirements; and the potential for short- and long-term settlement.

The designer requests a geotechnical report from the RME for retaining walls, noise walls, and reinforced slopes that are not part of the bridge preliminary plan. For walls that are part of the bridge preliminary plan, the HQ Bridge and Structures Office requests the geotechnical report for the walls from the HQ Geotechnical Division. (See Chapter 1130 for the detailed design process for retaining walls and reinforced slopes, Chapter 1140 for the detailed design process for noise walls, and the *Geotechnical Design Manual* for design requirements for all walls.) It is important that requests for a geotechnical report be made as early as possible in the design phase. The time required to obtain permits and rights of entry must be considered when establishing schedule requirements.

For retaining walls and reinforced slopes, the site data to be provided with the request for a geotechnical report are as indicated in Chapter 1130. Supply right of entry agreements and permits required for the geotechnical investigation. The site data indicated in 510.04(4), as applicable, are provided for noise walls.

The RME or the HQ Geotechnical Division provides the information (see Chapter 1130 or 1140 for specific responsibilities for design) specified in the *Geotechnical Design Manual* as part of the project geotechnical report.

The recommendations may also include the background regarding analysis approach and any agreements with the Region or other customers regarding the definition of acceptable level of risk. Additional details and design issues to be considered in the geotechnical report are as provided in Chapter 1130 for retaining walls and reinforced slopes and in Chapter 1140 for noise walls. The designer uses this information for final wall/reinforced slope selection and to complete the PS&E.

For final PS&E preparation, special provisions and plan details (if not received as part of the report provided during design) are developed with the assistance of the Region Materials Section or the HQ Geotechnical Division. Both the Region Materials Section and the HQ Geotechnical Division can review the contract plans before the PS&E review process begins, if requested. Otherwise, they will review the contract plans during the normal PS&E review process.

(11) Unstable Slopes

Unstable slope mitigation includes the stabilization of known landslides and rockfall that occur on slopes adjacent to the WSDOT transportation system and that have been programmed under the P3 Unstable Slope Program.

(a) **Project Definition**. The Region Project Office provides the RME with a description and location of the proposed unstable slope mitigation work. Location of the proposed work can be milepost limits or stationing. The designer meets at the project site with the RME and HQ Geotechnical Division to conduct a field review, discuss project requirements, and identify geotechnical issues associated with the unstable slope project. The RME requests that the HQ Geotechnical Division participate in the field review and Project Definition reporting.

The level of work in the Project Definition phase for unstable slopes is conceptual in nature, not a final design. The geotechnical investigation generally consists of a field review, a more detailed assessment of the unstable slope, review of the conceptual mitigation developed during the programming phase of the project, and proposed modification (if any) to the original conceptual-level unstable slope mitigation. The design phase geotechnical services cost and schedule, including any required permits, are determined at this time. A brief conceptual-level report is provided to the designer that summarizes the results of the Project Definition investigation.

(b) **Project Design**. Geotechnical information and field data necessary to complete the unstable slope mitigation design is compiled during this design phase. This work includes, depending on the nature of the unstable slope problem, test borings, rock structure mapping, geotechnical field instrumentation, laboratory testing, and slope stability analysis. The purpose of this design effort is to provide design-level geotechnical recommendations to stabilize the known unstable slope.

The designer requests a geotechnical report from the HQ Geotechnical Division through the RME. The site data indicated in 510.04(4), as applicable, is provided along with the following information:

- Plan sheet showing the station and location of the proposed unstable slope mitigation project
- If requested, Digital Terrain Model (DTM) files necessary to define the on-ground topography of the project site (the limits of the DTM will have been defined during the Project Definition phase)

It is important that the request for the geotechnical report be made as early as possible in the design phase. Cost and schedule requirements to generate the report are project specific and can vary widely. Unstable slope design investigations might require geotechnical monitoring of ground movement and groundwater over an extended period of time to develop the required field information for the unstable slope mitigation design. The time required to obtain rights of entry and other permits, as well as the long-term monitoring data, must be considered when establishing schedule requirements for the geotechnical report.

In addition to the geotechnical report requirements specified in the *Geotechnical Design Manual*, the HQ Geotechnical Division provides the following information as part of the project geotechnical report (as applicable):

- Unstable slope design analysis and mitigation recommendations
- Constructibility issues associated with the unstable slope mitigation
- Appropriate special provisions for inclusion in the contact plans

The Region Project Office uses the geotechnical report to finalize the design decisions for the project and the completion of the PS&E design.

(c) **PS&E Development**. Adequate geotechnical design information to complete the PS&E is typically obtained during the project design phase. Additional geotechnical work might be needed when right of way cannot be acquired, restrictions are included in permits, or other requirements are added that result in changes to the design.

Special provisions, special project elements, and design details (if not received as part of the design phase geotechnical report) are developed with the assistance of the RME and the HQ Geotechnical Division. The designer uses this information in conjunction with the design phase geotechnical report to complete the PS&E document. The RME and the HQ Geotechnical Division can review the contract plans before the PS&E review begins, if requested. Otherwise, they will review the contract plans during the normal PS&E review process.

(12) Rockslope Design

(a) **Project Definition**. The Region Project Office provides the RME with a description and location of the proposed rock excavation work. For widening of existing rock cuts, the anticipated width and length of the proposed cut in relationship to the existing cut are provided. For new alignments, the approximate location and depth of the cut are provided. Location of the proposed cut(s) can be milepost limits or stationing. The designer meets at the project site with the RME and the HQ Geotechnical Division to conduct a field review, discuss project requirements, and identify any geotechnical issues associated with the proposed rock cuts. The RME requests that the HQ Geotechnical Division participate in the field review and Project Definition reporting.

The level of rock slope design work for the Project Definition phase is conceptual in nature. The geotechnical investigation generally consists of the field review, review of existing records, an assessment of existing rockslope stability, and preliminary geologic structure mapping. The focus of this investigation is to assess the feasibility of the rock cuts for the proposed widening or realignment, not final design. A brief conceptual-level report that summarizes the result of the Project Definition investigation is provided to the designer.

(b) **Project Design**. Detailed rockslope design is done once the roadway geometrics have been established. The rockslope design cannot be finalized until the roadway geometrics have been finalized. Geotechnical information and field data necessary to complete the rockslope design are compiled during this design phase. This work includes rock structure mapping, test borings, laboratory testing, and slope stability analysis. The purpose of this design effort is to determine the maximum stable cut slope angle and any additional rockslope stabilization measures that could be required.

The designer requests a geotechnical report from the HQ Geotechnical Division through the RME. The site data indicated in 510.04(4), as applicable, is provided.

It is important that the request for the geotechnical report be made as early as possible in the design phase. Cost and schedule requirements to generate the report are project specific and can vary widely. The time required to obtain permits and rights of entry must be considered when establishing schedule requirements.

In addition to the geotechnical report requirements specified in the *Geotechnical Design Manual*, the HQ Geotechnical Division provides the following information as part of the project geotechnical report pertaining to rock slope design analysis and recommendations.

- Type of rockslope design analysis conducted and limitation of the analysis (also included will be any agreements with the Region and other customers regarding the definition of "acceptable risk")
- The slope(s) required for stability
- Additional slope stabilization requirements (rock bolts, rock dowels, etc.)
- Rockslope ditch criteria (see Chapter 640)
- Assessment of rippability
- Blasting requirements including limitations on peak ground vibrations and air blast over-pressure (if required)
- Usability of the excavated material (including estimates of shrink and swell)
- Constructibility issues associated with the rock excavation

The Project Office uses the geotechnical report to finalize the design decisions for the project and the completion of the PS&E design for the rockslope elements of the project.

(c) **PS&E Development**. Adequate geotechnical design information to complete the PS&E is typically obtained during the design phase. Additional geotechnical work might be needed when right of way cannot be acquired, restrictions are included in permits, or other requirements are added that result in change to the design.

Special provisions, special blasting requirements, and plan details, if not received as part of the design phase geotechnical report, are developed with the assistance of the RME or the HQ Geotechnical Division. The designer uses this information in conjunction with the design phase geotechnical report to complete the PS&E documents. The RME and the HQ Geotechnical Division review (if requested) the contract plans before the PS&E review begins. Otherwise, they will review the contract plans during the normal PS&E review process.

(13) Bridge Foundations

(a) **Project Definition**. The HQ Geotechnical Division supports the development of reasonably accurate estimates of bridge substructure costs beginning with the Project Definition phase. A field review is recommended for major projects and projects that are located in areas with little or no existing geotechnical information. The Region office responsible for Project Definition coordinates field reviews. Subsurface exploration (drilling) is usually not required at this time, but might be needed if cost estimates cannot be prepared within an acceptable range of certainty.

Once it has received the necessary site data from the Region Project Office, the HQ Bridge and Structures Office is responsible for delivering the following project information to the HQ Geotechnical Division:

- Alternative alignments and/or locations of bridge structures
- A preliminary estimate of channelization (structure width)
- Known environmental constraints

The HQ Geotechnical Division provides the following to the HQ Bridge and Structures and Region offices:

- Summary of existing geotechnical information
- Identification of geotechnical hazards (slides, liquefiable soils, soft soil deposits, etc.)
- Identification of permits that might be required for subsurface exploration (drilling)
- Conceptual foundation types and depths
- If requested, an estimated cost and time to complete a geotechnical foundation report

The HQ Bridge and Structures Office uses this information to refine preliminary bridge costs. The Region Project Office uses the estimated cost and time to complete a geotechnical foundation report to develop the project delivery cost and schedule.

(b) **Project Design**. The HQ Geotechnical Division assists the HQ Bridge and Structures Office with preparation of the bridge preliminary plan. Geotechnical information gathered for Project Definition will normally be adequate for this phase, as test holes for the final bridge design cannot be drilled until accurate pier location information is available. For selected major projects, a type, size, and location (TS&L) report might be prepared, which usually requires some subsurface exploration to provide a more detailed, though not final, estimate of foundation requirements.

The HQ Bridge and Structures Office is responsible for delivering the following project information, based on bridge site data received from the Region Project Office, to the HQ Geotechnical Division:

- Anticipated pier locations
- Approach fill heights
- For TS&L, alternate locations/alignments/structure types

The HQ Bridge and Structures Office can expect to receive the following:

- Conceptual foundation types, depths, and capacities
- Permissible slopes for bridge approaches
- For TS&L, a summary of site geology and subsurface conditions, and more detailed preliminary foundation design parameters and needs
- If applicable or requested, potential impact of erosion or scour potential (determined by the HQ Hydraulics Office) on foundation requirements

The HQ Bridge and Structures Office uses this information to complete the bridge preliminary plan. The Region Project Office confirms right of way needs for approach embankments. For TS&L, the geotechnical information provided is used for cost estimating and preferred alternate selection. The preliminary plans are used by the HQ Geotechnical Division to develop the site subsurface exploration plan.

(c) **PS&E Development**. During this phase, or as soon as a 95% preliminary plan is available, subsurface exploration (drilling) is performed and a geotechnical foundation report is prepared to provide all necessary geotechnical recommendations needed to complete the bridge PS&E.

The HQ Bridge and Structures Office is responsible for delivering the following project information to the HQ Geotechnical Division:

- 95% preliminary plans (concurrent with distribution for Region approval)
- Estimated foundation loads and allowable settlement criteria for the structure, when requested

The HQ Bridge and Structures Office can expect to receive:

- Bridge geotechnical foundation report

The HQ Bridge and Structures Office uses this information to complete the bridge PS&E. The Region Project Office reviews the geotechnical foundation report for construction considerations and recommendations that might affect Region items, estimates, staging, construction schedule, or other items.

Upon receipt of the structure PS&E review set, the HQ Geotechnical Division provides the HQ Bridge and Structures Office with a Summary of Geotechnical Conditions for inclusion in Appendix B of the contract.

(14) Geosynthetics

For geosynthetic design guidance, see Chapter 530.

(15) Washington State Ferries Projects

(a) **Project Design**. The HQ Geotechnical Division assists the Washington State Ferries (WSF) division with determining the geotechnical feasibility of all offshore facilities, terminal facility foundations, and bulkhead walls. For upland retaining walls and grading, utility trenches, and pavement design, the RME assists WSF with determining geotechnical feasibility.

In addition to the site data identified in Section 510.04(4), as applicable, the following information is supplied by WSF to the HQ Geotechnical Division or the RME, as appropriate, with the request for the project geotechnical report:

- A plan showing anticipated structure locations as well as existing structures
- Relevant historical data for the site
- A plan showing utility trench locations
- Anticipated utility trench depths
- Proposed roadway profiles

WSF can expect to receive the following:

- Results of any borings or laboratory tests conducted
- A description of geotechnical site conditions
- Conceptual foundation types, depths, and capacities
- Conceptual wall types
- Assessment of constructibility issues that affect feasibility
- Surfacing depths and/or pavement repair and drainage schemes
- If applicable or requested, potential impact of erosion or scour potential (determined by the HQ Hydraulics Office) on foundation requirements

WSF uses this information to complete the design report, design decisions, and estimated budget and schedule.

WSF is responsible for obtaining any necessary permits or right of entry agreements needed to access structure locations for the purpose of subsurface exploration (for example, test hole drilling). The time required for obtaining permits and rights of entry must be considered when developing project schedules. Possible permits and agreements might include but are not limited to:

- City, county, or local agency use permits.
- Sensitive area ordinance permits.

(b) **PS&E Development**. Subsurface exploration (drilling) is performed and a geotechnical foundation report is prepared to provide all necessary geotechnical recommendations needed to complete the PS&E.

The designer requests a geotechnical report from the HQ Geotechnical Division or the RME, as appropriate. The site data indicated in 510.04(4), as applicable, is provided along with the following information:

- A plan showing final structure locations as well as existing structures
- Proposed structure loadings

WSF can expect to receive the following:

- Results of any borings or laboratory tests conducted
- A description of geotechnical site conditions
- Final foundation types, depths, and capacities
- Final wall types and geotechnical designs/parameters for each wall
- Assessment of constructibility issues to be considered in foundation selection and when assembling the PS&E
- Pile driving information: driving resistance and estimated overdrive
- Surfacing depths and/or pavement repair and drainage schemes

WSF uses this information to complete the PS&E.

Upon receipt of the WSF PS&E review set, the HQ Geotechnical Division provides WSF with a Summary of Geotechnical Conditions for inclusion in Appendix B of the Contract. A Final Geotechnical Project Documentation package is assembled by the HQ Geotechnical Division and sent to WSF or the Plans Branch, as appropriate, for reproduction and sale to prospective bidders.

510.05 Use of Geotechnical Consultants

Prior to authorizing a consultant to conduct the geotechnical investigation for a project, the Region Project Office, the HQ Geotechnical Division, and the RME determine the scope of work and schedule for the project and whether or not the project will go to a geotechnical consultant.

Once the decision has been made to have a consultant conduct the geotechnical investigation for a project, the HQ Geotechnical Division or the RME assists in developing the geotechnical scope and estimate for the project (Consultant Services assists in this process). A team meeting between the consultant team, the Region or Washington State Ferries (depending on whose project it is), and the HQ Geotechnical Division/RME is conducted early in the project to develop technical communication lines and relationships. Good proactive communication between all members of the project team is crucial to the success of the project due to the complex supplier-client relationships.

Additional guidelines on the use of geotechnical consultants and the development of a scope of work for the consultant are provided in the *Geotechnical Design Manual*, Chapter 1.

510.06 Geotechnical Work by Others

Geotechnical design work conducted for the design of structures, or other engineering works by other agencies or private developers within the right of way, is subject to the same geotechnical engineering requirements as for engineering works performed by WSDOT. Therefore, the provisions contained within this chapter also apply in principle to such work. All geotechnical work conducted for engineering works within the WSDOT right of way or that otherwise directly impacts WSDOT facilities must be reviewed and approved by the HQ Geotechnical Division or the RME, depending on the nature of the work.

Additional requirements for geotechnical work by others that impacts WSDOT facilities and land within the WSDOT right of way are set forth in the *Geotechnical Design Manual*, Chapter 1.

510.07 Surfacing Report

Detailed criteria and methods that govern pavement rehabilitation can be found in WSDOT Pavement Policy. The RME provides the surfacing report to the Region Project Office. This report provides recommended pavement types, surfacing depths, pavement drainage recommendations, and pavement repair recommendations.

510.08 Documentation

(1) Design Documentation

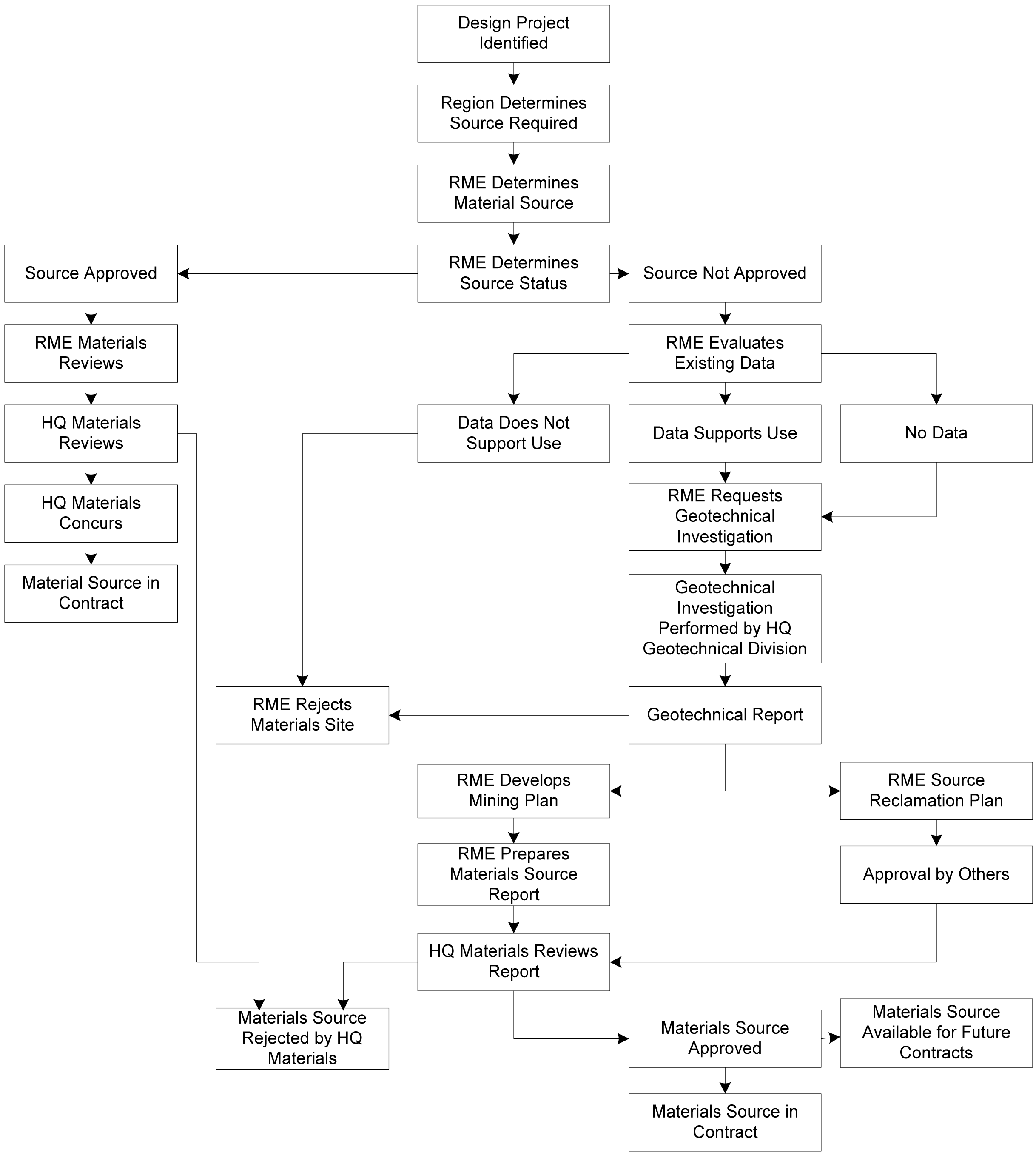
For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

(2) Final Geotechnical Project Documentation and Geotechnical Information Included as Part of the Construction Contract

Once a project PS&E is near completion, all of the geotechnical design memorandums and reports are compiled together to form the Final Geotechnical Project Documentation, to be published for the use of prospective bidders. The detailed process for this is located in the *Plans Preparation Manual*.

Geotechnical information included in the contract consists of the final project boring logs, and, as appropriate for the project, a Summary of Geotechnical Conditions. The boring logs from the geotechnical reports are incorporated into the contract by the Region, WSF, or UCO offices. The Summary of Geotechnical Conditions is provided to the Region, WSF, or UCO by the HQ Geotechnical Division and/or RME.

Additional geotechnical project documentation requirements are set forth in the *Geotechnical Design Manual*.



Material Source Development
Figure 510-1

Chapter 520 Design of Pavement Structure

520.01 Introduction

Detailed criteria and methods that govern pavement design are in the WSDOT Pavement Policy:
www.wsdot.wa.gov/biz/mats/pavement/WSDOT_Pavement_Policy.pdf

Preliminary pavement reports for all design-build project RFPs will be conducted by the State Materials Lab, Pavement Division, with the final report prepared by the design-builder.

520.02 Estimating Tables

Figures 520-1 through 520-5h are to be used when detailed estimates are required. They are for pavement sections, shoulder sections, stockpiles, and asphalt distribution. Prime coats and fog seal are in Figure 520-2a.

Unit Dry Weight				
Type of Material	**Truck Measure**		**Compacted on Roadway**	
	lb/cy	**T/cy**	**lb/cy**	**T/cy**
Ballast	3100	1.55	3900	1.95
Crushed Surfacing Top Course	2850	1.43	3700	1.85
Crushed Surfacing Base Course	2950	1.48	3700	1.85
Screened Gravel Surfacing			3700	1.85
**Gravel Base			3400 – 3800	1.70 – 1.90
Shoulder Ballast			2800	1.40
Maintenance Sand ⅜” – 0	2900	1.45		
Mineral Aggregate 2” – 1”	2600	1.30		
Mineral Aggregate 1¾” – ¾”	2600	1.30		
Mineral Aggregate 1½” – ¾”	2550	1.28		
Mineral Aggregate 1” – ¾”	2500	1.25		
Mineral Aggregate ¾” – ½”	2400	1.20		
Mineral Aggregate 1¼” – ¼’”	2600	1.30		
Mineral Aggregate 1” – ¼”	2600	1.30		
Mineral Aggregate ⅞” – ¼”	2550	1.28		
Mineral Aggregate ¾” – ¼”	2500	1.25		
Mineral Aggregate ⅝” – ¼”	2650	1.33		
Mineral Aggregate ½” – ¼” or #4	2600	1.30		
Mineral Aggregate ¼” or #4 – 0	2900	1.45		
Concrete Aggr. No. 2 (1 1/4” - #4)	3000	1.50		
Concrete Sand (Fine Aggregate)	2900	1.45		
Crushed Cover Stone	2850	1.43		
** 3,700 lb/cy (1.85 tons/cy) is recommended as the most suitable factor; however, if the grading approaches the coarseness of ballast, the factor would approach 3,800 lb/cy (1.90 tons/cy), and if the grading contains more than 45% sand, the factor would decrease, approaching 3,400 lb/cy (1.70 tons/cy) for material that is essentially all sand.				

General Notes:

Weights shown are dry weights and corrections are required for water contents.

The tabulated weights for the materials are reasonably close; however, apply corrections in the following order:

For specific gravity:

$$\text{Wt.} = \frac{\text{tabular wt. x specific gravity on surface report}}{2.65}$$

For water content:

Wt. = tabular wt. x (1 + free water % in decimals)

If they are to be stockpiled, increase required quantities by 10% to allow for waste.

Direct attention to the inclusion of crushed surfacing top course material that may be required for keystone when estimating quantities for projects having ballast course.

Estimating – Miscellaneous Tables
Figure 520-1

General Data[1][2][3]							
Hot Mix Asphalt Pavement							
Complete Mix							
Class of Mix	Depth (ft)	Spread per sy		sy per ton	Tons/Mile Width (ft)		
		lb	ton		10	11	12
HMA	0.10	137	0.0685	14.60	402	442	482

Prime Coats and Fog Seal															
Asphalt							**Aggregate**								
Application	Type of Asphalt[4]	Application gal[5] per sy	Tons[5] per sy	Tons/Mile Width (ft)			Application lb per sy	Tons/Mile Width (ft)			cy per sy	cy/Mile Width (ft)			
				10	11	12		10	11	12		10	11	12	
Prime Coat	MC-250	0.25	0.001004	5.9	6.5	7.1	30	88	97	106	0.0105	62	68	74	
Fog Seal	CSS-1	0.04	0.000167	1.0	1.1	1.2									

Specific Data[1][2][3]														
Hot Mix Asphalt Paving Quantities (tons/mile)*														
Width (ft)	**Depth of Pavement (ft)**													
	0.10	**0.15**	**0.20**	**0.25**	**0.30**	**0.35**	**0.40**	**0.45**	**0.50**	**0.55**	**0.60**	**0.65**	**0.70**	**0.75**
4	161	241	321	402	482	563	643	723	804	884	964	1045	1125	1206
6	241	362	482	603	723	844	964	1085	1206	1326	1447	1567	1688	1808
8	321	482	643	804	964	1125	1286	1447	1607	1768	1929	2090	2250	2411
10	402	603	804	1005	1206	1407	1607	1808	2009	2210	2411	2612	2813	3014
11	442	663	884	1105	1326	1547	1768	1989	2210	2431	2652	2873	3094	3315
12	482	723	964	1206	1447	1688	1929	2170	2411	2652	2893	3135	3376	3617
22	884	1326	1768	2210	2652	3094	3536	3978	4421	4863	5305	5747	6189	6631
24	964	1447	1929	2411	2893	3376	3858	4340	4822	5305	5787	6269	6751	7234
* Based on 137 lbs/sy of 0.10 ft compacted depth = 2.05 tons/cy														

Notes:

[1] The specific gravity of the aggregate will affect the weight of aggregate in the completed mix.

[2] The percentage of fine mineral in the coarse aggregate will affect the ratio of coarse to fine. If the coarse aggregate produced contains an excessive amount of fines (¼" to 0), increase the percentage of coarse aggregate and decrease the fines accordingly.

[3] Quantities shown do not provide for widening, waste from stockpile, or thickened edges.

[4] The column "Type of Asphalt" is shown for the purpose of conversion to proper weights for the asphalt being used and does not imply that the particular grade shown is required for the respective treatment.

[5] Quantities shown are retained (residual) asphalt.

Estimating – Hot Mix Asphalt Pavement and Asphalt Distribution Tables
Figure 520-2a

Asphalt Distribution (tons/mile)[1]																						
Asphalt Grade	Gal/ton @ 60° F	Width (ft)	Rate of Application (Gal./cy)																			
			0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00
SC, MC, RC 70	253	10	1.16	2.32	3.48	4.64	5.80	6.96	8.12	9.28	10.46	11.59	12.79	13.91	15.07	16.23	17.39	18.55	19.71	20.87	22.03	23.19
		11	1.28	2.55	3.83	5.10	6.38	7.65	8.93	10.20	11.48	12.75	14.03	15.30	16.58	17.86	19.13	20.41	21.68	22.96	24.23	25.51
		12	1.39	2.78	4.17	5.57	6.96	8.35	9.74	11.13	12.52	13.91	15.30	16.70	18.09	19.48	20.87	22.26	23.65	25.04	26.43	27.83
SC, MC, RC 250	249	10	1.18	2.36	3.53	4.71	5.89	7.07	8.25	9.42	10.60	11.78	12.96	14.14	15.31	16.49	17.67	18.85	20.03	21.20	22.38	23.56
		11	1.30	2.59	3.89	5.18	6.48	7.78	9.07	10.37	11.66	12.96	14.25	15.55	16.85	18.14	19.44	20.73	22.03	23.33	24.62	25.92
		12	1.41	2.83	4.24	5.65	7.07	8.48	9.90	11.31	12.72	14.14	15.55	16.96	18.38	19.79	21.20	22.62	24.03	25.45	26.86	28.27
SC, MC, RC 800	245	10	1.20	2.39	3.59	4.79	5.99	7.18	8.38	9.58	10.78	11.97	13.17	14.37	15.56	16.76	17.96	19.16	20.35	21.55	22.75	23.95
		11	1.30	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.85	13.17	14.49	15.80	17.12	18.44	19.79	21.07	22.39	23.71	25.02	26.34
		12	1.44	2.87	4.31	5.75	7.18	8.62	10.06	11.49	12.93	14.37	15.80	17.24	18.68	20.11	21.55	22.99	24.42	25.86	27.30	28.73
SC, MC, RC 3000	241	10	1.22	2.44	3.66	4.87	6.09	7.31	8.53	9.75	10.97	12.19	13.41	14.62	15.84	17.06	18.28	19.50	20.72	21.94	23.15	24.37
		11	1.34	2.68	4.02	5.36	6.69	8.03	9.37	10.71	12.05	13.39	14.73	16.07	17.41	18.74	20.08	21.42	22.76	24.10	25.44	26.78
		12	1.46	2.92	4.38	5.84	7.30	8.76	10.22	11.68	13.15	14.61	16.07	17.53	18.99	20.45	21.91	23.37	24.83	26.29	27.75	29.21
Paving Asphalt 200-300 PEN.	239	10	1.23	2.45	3.68	4.91	6.14	7.36	8.59	9.82	11.05	12.27	13.50	14.73	15.96	17.18	18.41	19.64	20.86	22.09	23.32	24.55
		11	1.35	2.70	4.05	5.40	6.75	8.10	9.45	10.80	12.15	13.50	14.85	16.20	17.55	18.90	20.25	21.60	22.95	24.30	25.65	27.00
		12	1.47	2.95	4.42	5.89	7.36	8.84	10.31	11.78	13.26	14.73	16.20	17.67	19.15	20.62	22.09	23.56	25.04	26.51	27.98	29.46
Emulsified Asphalt	240	10	1.22	2.44	3.67	4.89	6.11	7.33	8.56	9.77	11.00	12.22	13.44	14.67	15.89	17.11	18.33	19.56	20.78	22.00	23.22	24.44
		11	1.34	2.67	4.03	5.38	6.72	8.07	9.41	10.76	12.10	13.45	14.79	16.13	17.48	18.82	20.17	21.51	22.86	24.20	25.54	26.89
		12	1.47	2.93	4.40	5.87	7.33	8.80	10.27	11.73	13.20	14.67	16.13	17.60	19.07	20.53	22.00	23.47	24.93	26.40	27.87	29.33

Note:

[1] Quantities of asphalt shown are based on 60° F temperature. Recompute to the application temperature for the particular grade.

Estimating – Asphalt Distribution Tables
Figure 520-2b

Bituminous Surface Treatment[1]																	
Class of Mix	Type of Application	Average Application		Mineral Aggregate						Average Spread	Asphalt[2][4][5]						Basic[3] Asphalt Used
				10 ft		11 ft		12 ft			10 ft		11 ft		12 ft		
		lb/sy	cy/sy	T/mi	cy/mi	T/mi	cy/mi	T/mi	cy/mi	gal/sy	gal/mi	T/mi	gal/mi	T/mi	gal/mi	T/mi	
A	Prime Coat									0.48	2787	11.2	3065	12.3	3344	13.4	MC-250
	Crushed Screenings ¾" – ½"	35	0.0146	103	86	113	94	123	103								
	Tack Coat									0.43	2493	10.4	2743	11.4	2992	12.5	CRS-2
	Crushed Screenings ½" – ¼"	28	0.0106	81	62	89	68	97	74								
	Crushed Screenings ¼" – 0"	5	0.0017	15	10	16	11	18	12								
	Totals	68	0.0269	199	158	218	173	238	189	0.91	5280	21.6	5808	23.7	6336	25.9	
B	Seal Coat									0.50	2933	12.2	3227	13.4	3520	14.7	CRS-2
	Crushed Screenings ⅝" – ¼"	33	0.0123	95	72	105	79	114	86								
	Crushed Screenings ¼" – 0"	5	0.0017	15	10	16	11	18	12								
	Totals	38	0.0140	110	82	121	90	132	98	0.50	2933	12.2	3227	13.4	3520	14.7	
C	Seal Coat									0.45	2640	11.0	2904	12.1	3168	13.2	CRS-2
	Crushed Screenings ½" – ¼"	28	0.0106	81	62	89	68	97	74								
	Crushed Screenings ¼" – 0"	5	0.0017	15	10	16	11	18	12								
	Totals	33	0.0123	96	72	105	79	115	86	0.45	2640	11.0	2904	12.1	3168	13.2	
D	Seal Coat									0.43	2493	10.4	2743	11.4	2992	12.5	CRS-2
	Crushed Screenings ⅜" - #10	25	0.0088	73	51	81	57	88	62								
Preseal for B, C & D	Preseal									0.18	1027	4.3	1129	4.7	1232	5.1	CRS-2
	Crushed Screenings ¼" – 0"	12	0.0040	34	23	37	26	40	28								

Notes:

[1] Quantities shown do not provide for widening, waste from stockpile, or thickened edges.

[2] Quantities of asphalt shown are based on 60°F temperature. Recompute to the application temperature for the particular grade.

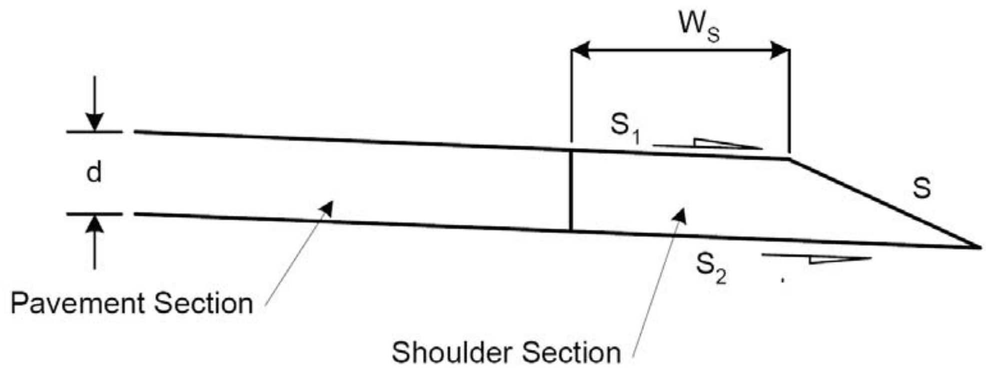
[3] The column "Basic Asphalt Used" is shown for the purpose of conversion to proper weights for the asphalt being used and does not imply that the particular grade shown is required for the respective treatment.

[4] For cutbacks, decrease asphalt by 25%.

[5] For stress absorbing membrane (rubberized asphalt), increase asphalt by 25%.

Estimating – Bituminous Surface Treatment

Figure 520-3



W_S = Shoulder Width (Varies 4 ft, 6 ft, 8 ft, 10 ft, 12 ft)
D = Depth of Section (Varies 0.05 ft to 2 ft)
S = Side Slope (H:V) (Varies 2:1, 3:1, 4:1, and 6:1)
S_1 = Top Shoulder Slope (Varies –0.02 ft/ft or –0.05 ft/ft)
S_2 = Bottom Shoulder Slope (Varies –0.02 ft/ft or –0.05 ft/ft)

Formula for Shoulder Section		
Tons/mile = (A)(K) K=(5280/27)(1.85 tons/cy) $A = \frac{[d + W_S(1/S - S_1)]^2 S}{2(1 - SS_2)} - \frac{W_S^2}{2}(1/S - S_1)$		
Case 1	$S_1 = S_2 = -0.02$ ft/ft	$A = \frac{[d + W_S(1/S - 0.02)]^2 S}{2(1 - 0.02S)} - \frac{W_S^2}{2}(1/S - 0.02)$
Case 2	$S_1 = -0.02$ ft/ft, $S_2 = -0.05$ ft/ft	$A = \frac{[d + W_S(1/S - 0.02)]^2 S}{2(1 - 0.05S)} - \frac{W_S^2}{2}(1/S - 0.02)$
Case 3	$S_1 = -0.05$ ft/ft, $S_2 = -0.02$ ft/ft	$A = \frac{[d + W_S(1/S - 0.05)]^2 S}{2(1 - 0.02S)} - \frac{W_S^2}{2}(1/S - 0.05)$ *
Case 4	$S_1 = S_2 = -0.05$ ft/ft	$A = \frac{[d + W_S(1/S - 0.05)]^2 S}{2(1 - 0.05S)} - \frac{W_S^2}{2}(1/S - 0.05)$
*Limit: Positive Values of A only when $d = W_S(0.03)$		

EXAMPLE: Shoulder Section

Given:

Shoulder Width	8 ft
Top Course	0.25 ft
Base Course	0.80 ft
Total Depth	1.05 ft
Side Slope	3:1
Shoulder Slope	-0.05
Subgrade Slope	-0.02

Depth	1.05 ft (Case 3)	=	3070 tons/mile
Top Course	0.25 ft (Case 4)	=	-763 tons/mile
Base Course		=	2307 tons/mile
Top Course		=	763 tons/mile
Base Course		=	2307 tons/mile

Estimating – Base and Surfacing Typical Section
Formulae and Example
Figure 520-4

Shoulder Section												
Shldr. Width W_s(ft)	Side Slope S:1	Case	Quantity in Tons Per Mile*									
			Surfacing Depth (ft)									
			0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
4	2	1	73	148	226	304	385	468	553	639	728	818
		2	171	251	333	417	504	592	682	774	869	965
		3	N/A	N/A	131	205	281	360	440	522	605	691
		4	73	149	226	306	387	470	556	643	733	824
	3	1	74	150	230	313	398	486	577	671	768	868
		2	178	262	350	442	536	634	734	838	945	1056
		3	N/A	N/A	131	206	285	366	450	537	627	720
		4	74	151	231	315	402	492	585	681	780	883
	4	1	74	153	235	321	411	505	603	705	810	920
		2	185	275	370	469	572	681	793	910	1032	1158
		3	N/A	N/A	131	208	288	373	461	554	650	750
		4	75	154	237	326	418	516	617	724	834	950
	6	1	75	157	245	339	439	545	658	776	901	1032
		2	204	307	417	535	661	794	936	1085	1242	1406
		3	N/A	N/A	131	210	296	387	485	589	699	815
		4	76	160	252	351	459	574	696	827	965	1111
6	2	1	109	221	334	449	566	685	806	929	1053	1180
		2	325	444	565	688	812	939	1068	1199	1332	1467
		3	N/A	N/A	N/A	239	349	461	575	691	809	929
		4	110	221	335	450	568	687	809	933	1058	1186
	3	1	110	223	339	457	579	703	830	961	1094	1230
		2	338	462	590	722	856	994	1134	1278	1426	1576
		3	N/A	N/A	N/A	239	350	464	581	701	824	949
		4	110	223	340	460	583	709	838	970	1106	1245
	4	1	110	225	343	466	592	722	856	994	1136	1282
		2	352	483	619	760	905	1055	1209	1368	1531	1699
		3	N/A	N/A	N/A	239	351	467	587	711	839	971
		4	111	226	346	470	599	733	871	1013	1160	1311
	6	1	112	229	353	483	620	762	911	1066	1227	1394
		2	386	534	690	853	1025	1204	1391	1585	1788	1998
		3	N/A	N/A	N/A	239	353	474	600	733	871	1016
		4	112	233	360	496	640	791	950	1116	1291	1473
8	2	1	146	293	443	594	747	902	1059	1218	1379	1541
		2	526	683	843	1004	1167	1333	1500	1670	1841	2015
		3	N/A	N/A	N/A	N/A	376	522	670	820	972	1125
		4	146	293	443	595	749	904	1062	1222	1384	1548
	3	1	146	295	447	602	760	920	1084	1250	1419	1591
		2	546	711	879	1050	1224	1402	1583	1766	1954	2144
		3	N/A	N/A	N/A	N/A	376	523	673	825	981	1139
		4	146	296	448	604	763	926	1091	1260	1432	1607
	4	1	147	297	452	610	773	939	1109	1284	1462	1644
		2	568	741	919	1101	1288	1479	1675	1875	2080	2290
		3	N/A	N/A	N/A	N/A	376	524	675	831	990	1153
		4	147	298	454	615	780	950	1124	1302	1486	1673
	6	1	148	302	462	628	801	979	1164	1355	1552	1755
		2	622	816	1017	1226	1443	1668	1900	2140	2388	2643
		3	N/A	N/A	N/A	N/A	376	525	681	842	1009	1183
		4	149	305	469	641	820	1008	1203	1406	1616	1835

Estimating – Base and Surfacing Quantities

Figure 520-5a

Shoulder Section												
Shldr. Width W_s(ft)	Side Slope S:1	Case	Quantity in Tons Per Mile*									
			Surfacing Depth (ft)									
			0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00
4	2	1	910	1004	1100	1198	1297	1399	1502	1608	1715	1824
		2	1063	1163	1266	1370	1476	1585	1695	1807	1922	2038
		3	779	868	960	1053	1148	1245	1344	1445	1548	1652
		4	918	1013	1110	1210	1311	1415	1520	1628	1738	1849
	3	1	971	1076	1185	1296	1410	1527	1647	1770	1896	2024
		2	1169	1286	1406	1529	1655	1785	1918	2053	2193	2335
		3	816	914	1016	1120	1228	1338	1451	1567	1686	1807
		4	989	1098	1210	1326	1444	1566	1691	1820	1951	2086
	4	1	1034	1151	1273	1398	1528	1661	1798	1939	2085	2234
		2	1289	1424	1564	1708	1857	2010	2168	2330	2497	2668
		3	855	963	1075	1191	1311	1435	1562	1694	1830	1969
		4	1070	1194	1323	1456	1594	1737	1884	2035	2191	2352
	6	1	1169	1312	1462	1617	1779	1947	2121	2301	2488	2680
		2	1579	1759	1947	2142	2346	2557	2776	3002	3237	3479
		3	937	1066	1200	1341	1488	1641	1800	1966	2138	2315
		4	1265	1426	1596	1773	1957	2150	2350	2558	2774	2998
6	2	1	1308	1438	1570	1704	1840	1978	2117	2259	2402	2548
		2	1603	1742	1883	2026	2171	2318	2467	2618	2771	2926
		3	1050	1174	1299	1426	1555	1686	1819	1954	2090	2229
		4	1315	1447	1581	1716	1854	1994	2135	2279	2425	2573
	3	1	1369	1510	1655	1802	1953	2106	2262	2421	2583	2748
		2	1729	1886	2046	2209	2376	2545	2718	2894	3073	3255
		3	1078	1209	1343	1480	1620	1763	1909	2058	2209	2363
		4	1387	1532	1681	1832	1987	2145	2306	2471	2638	2809
	4	1	1432	1586	1743	1905	2070	2240	2413	2591	2772	2957
		2	1871	2048	2229	2415	2606	2801	3000	3204	3412	3625
		3	1106	1246	1389	1537	1688	1843	2003	2166	2333	2504
		4	1467	1628	1793	1963	2137	2315	2499	2686	2878	3075
	6	1	1567	1746	1932	2124	2322	2526	2736	2953	3175	3404
		2	2215	2441	2674	2916	3164	3421	3685	3957	4237	4525
		3	1167	1325	1488	1658	1833	2015	2203	2398	2598	2805
		4	1663	1861	2066	2279	2500	2729	2965	3209	3461	3721
8	2	1	1706	1872	2040	2211	2383	2557	2732	2910	3090	3271
		2	2190	2367	2547	2728	2912	3097	3285	3475	3666	3860
		3	1281	1438	1597	1758	1921	2086	2253	2422	2592	2765
		4	1713	1881	2051	2223	2397	2573	2751	2930	3112	3296
	3	1	1766	1944	2125	2309	2495	2685	2877	3072	3271	3472
		2	2338	2534	2734	2937	3144	3353	3566	3782	4001	4223
		3	1300	1464	1631	1801	1974	2149	2328	2509	2693	2880
		4	1785	1966	2151	2339	2530	2724	2921	3122	3326	3533
	4	1	1830	2020	2214	2411	2613	2819	3028	3242	3459	3681
		2	2504	2722	2945	3172	3404	3641	3882	4128	4378	4632
		3	1320	1491	1666	1845	2028	2215	2405	2600	2799	3001
		4	1865	2062	2263	2469	2679	2894	3114	3337	3566	3799
	6	1	1965	2181	2402	2630	2864	3105	3351	3604	3863	4128
		2	2907	3178	3457	3743	4038	4340	4650	4967	5292	5626
		3	1363	1549	1741	1940	2144	2355	2572	2795	3024	3259
		4	2061	2295	2536	2786	3043	3308	3580	3861	4149	4445

Estimating – Base and Surfacing Quantities

Figure 520-5b

Shoulder Section												
Shldr. Width W_s(ft)	**Side Slope S:1**	**Case**	**Quantity in Tons Per Mile***									
			Surfacing Depth (ft)									
			0.05	**0.10**	**0.15**	**0.20**	**0.25**	**0.30**	**0.35**	**0.40**	**0.45**	**0.50**
10	2	1	182	366	551	739	928	1119	1312	1507	1704	1903
		2	773	969	1167	1367	1569	1773	1979	2187	2397	2609
		3	N/A	N/A	N/A	N/A	N/A	543	724	908	1094	1281
		4	182	366	552	740	930	1122	1315	1511	1709	1909
	3	1	182	368	556	747	941	1137	1337	1539	1745	1953
		2	802	1007	1215	1426	1640	1858	2079	2303	2530	2760
		3	N/A	N/A	N/A	N/A	N/A	543	725	910	1098	1289
		4	182	368	557	749	944	1143	1344	1549	1757	1968
	4	1	183	370	560	755	954	1156	1363	1573	1787	2006
		2	834	1049	1268	1492	1721	1954	2191	2433	2679	2930
		3	N/A	N/A	N/A	N/A	N/A	543	726	912	1103	1298
		4	183	371	563	760	961	1167	1377	1592	1811	2035
	6	1	184	374	570	773	982	1196	1417	1644	1878	2117
		2	913	1153	1399	1654	1916	2186	2464	2750	3043	3344
		3	N/A	N/A	N/A	N/A	N/A	543	727	917	1113	1316
		4	185	377	578	786	1001	1225	1456	1695	1942	2197
12	2	1	218	438	660	883	1109	1336	1566	1797	2030	2265
		2	1066	1301	1537	1776	2016	2259	2504	2750	2999	3249
		3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	956	1175	1397
		4	218	438	660	884	1110	1339	1569	1801	2035	2271
	3	1	219	440	664	891	1121	1354	1590	1829	2071	2315
		2	1106	1351	1599	1850	2104	2362	2623	2887	3154	3424
		3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	956	1177	1401
		4	219	441	666	894	1125	1360	1598	1839	2083	2330
	4	1	219	442	669	900	1134	1373	1616	1862	2113	2367
		2	1151	1407	1668	1933	2203	2478	2757	3040	3328	3621
		3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	956	1179	1405
		4	219	443	672	904	1142	1384	1630	1881	2137	2397
	6	1	220	446	679	918	1162	1413	1671	1934	2203	2479
		2	1259	1544	1836	2136	2444	2759	3083	3414	3752	4099
		3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	957	1182	1413
		4	221	450	686	930	1182	1442	1709	1985	2268	2558
Pavement Section												
Width W_P (ft)			**0.05**	**0.10**	**0.15**	**0.20**	**0.25**	**0.30**	**0.35**	**0.40**	**0.45**	**0.50**
11			199	398	597	796	995	1194	1393	1592	1791	1990
12			217	434	651	868	1085	1302	1519	1737	1954	2171
22			398	796	1194	1592	1990	2388	2786	3184	3582	3980
24			434	868	1302	1737	2171	2605	3039	3473	3907	4341

* Tabulated quantities are based on compacted weight of 1.85 tons/yd^3

Estimating – Base and Surfacing Quantities
Figure 520-5c

Shoulder Section

Shldr. Width W_s(ft)	Side Slope S:1	Case	Quantity in Tons Per Mile* — Surfacing Depth (ft) 0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00
10	2	1	2104	2306	2511	2717	2925	3135	3347	3561	3777	3995
		2	2823	3039	3257	3477	3699	3923	4149	4378	4608	4840
		3	1471	1662	1855	2050	2247	2446	2646	2849	3053	3260
		4	2111	2315	2521	2729	2939	3151	3366	3582	3800	4020
	3	1	2164	2378	2595	2815	3038	3264	3492	3724	3958	4195
		2	2994	3230	3470	3714	3960	4209	4462	4718	4977	5239
		3	1483	1680	1880	2082	2288	2496	2707	2921	3138	3358
		4	2183	2401	2621	2845	3072	3303	3536	3773	4013	4256
	4	1	2228	2454	2684	2918	3156	3398	3643	3893	4147	4404
		2	3186	3446	3710	3980	4253	4531	4814	5101	5393	5689
		3	1496	1699	1905	2116	2330	2548	2770	2996	3227	3460
		4	2263	2496	2734	2976	3222	3473	3729	3989	4253	4522
	6	1	2363	2615	2873	3137	3407	3684	3966	4255	4550	4851
		2	3653	3969	4294	4626	4965	5313	5668	6031	6402	6781
		3	1524	1739	1960	2187	2420	2660	2906	3157	3415	3679
		4	2459	2729	3007	3292	3585	3887	4195	4512	4836	5168
12	2	1	2502	2740	2981	3224	3468	3714	3962	4212	4464	4718
		2	3502	3757	4013	4272	4533	4795	5060	5327	5596	5866
		3	1620	1845	2072	2301	2532	2765	2999	3236	3474	3714
		4	2509	2750	2992	3236	3482	3730	3981	4233	4487	4743
	3	1	2562	2813	3066	3322	3581	3843	4107	4375	4645	4919
		2	3698	3975	4255	4538	4824	5114	5406	5702	6001	6304
		3	1627	1857	2089	2324	2562	2803	3047	3294	3544	3796
		4	2581	2835	3092	3352	3615	3882	4151	4424	4700	4980
	4	1	2626	2888	3154	3424	3698	3976	4258	4544	4834	5128
		2	3918	4220	4526	4837	5152	5472	5796	6125	6458	6796
		3	1635	1869	2107	2348	2594	2844	3098	3355	3617	3882
		4	2661	2930	3204	3482	3765	4052	4344	4640	4941	5246
	6	1	2761	3049	3343	3643	3950	4262	4581	4906	5237	5575
		2	4453	4815	5185	5562	5948	6341	6742	7150	7566	7991
		3	1651	1894	2144	2400	2662	2930	3205	3485	3772	4065
		4	2857	3163	3477	3799	4128	4465	4810	5163	5524	5892

Pavement Section

Width W_P (ft)	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00
11	2189	2388	2587	2786	2985	3184	3383	3582	3781	3980
12	2388	2605	2822	3039	3256	3473	3690	3907	4124	4341
22	4378	4775	5173	5571	5969	6367	6765	7163	7561	7959
24	4775	5210	5644	6078	6512	6946	7380	7814	8249	8683

* Tabulated quantities are based on compacted weight of 1.85 tons/yd^3

Estimating – Base and Surfacing Quantities
Figure 520-5d

Shoulder Section												
Shldr. Width W_s(ft)	Side Slope S:1	Case	Quantity in Tons Per Mile*									
			Surfacing Depth (ft)									
			1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50
4	2	1	1935	2048	2163	2279	2398	2518	2640	2765	2891	3019
		2	2157	2277	2399	2524	2650	2779	2909	3042	3176	3312
		3	1759	1867	1977	2089	2203	2319	2437	2557	2678	2802
		4	1963	2078	2196	2315	2437	2561	2686	2814	2943	3075
	3	1	2156	2290	2428	2568	2711	2857	3006	3157	3312	3470
		2	2480	2629	2781	2936	3094	3255	3420	3588	3759	3933
		3	1932	2059	2190	2323	2459	2598	2740	2885	3033	3183
		4	2223	2364	2509	2656	2806	2960	3117	3277	3441	3607
	4	1	2387	2543	2704	2869	3038	3210	3387	3567	3752	3940
		2	2844	3025	3210	3399	3593	3792	3995	4202	4415	4631
		3	2113	2260	2412	2567	2726	2890	3057	3228	3403	3582
		4	2517	2686	2860	3039	3222	3410	3602	3799	4000	4206
	6	1	2879	3084	3295	3513	3736	3966	4201	4443	4691	4946
		2	3729	3986	4252	4525	4806	5094	5391	5695	6007	6327
		3	2499	2689	2886	3088	3297	3512	3733	3960	4193	4433
		4	3229	3468	3715	3969	4232	4502	4779	5065	5358	5659
6	2	1	2695	2844	2995	3147	3302	3459	3617	3778	3940	4104
		2	3083	3242	3403	3566	3731	3898	4067	4238	4411	4586
		3	2369	2511	2655	2802	2949	3099	3251	3404	3560	3717
		4	2722	2874	3028	3184	3341	3501	3663	3827	3993	4160
	3	1	2916	3086	3260	3436	3615	3798	3983	4170	4361	4555
		2	3440	3629	3821	4016	4214	4416	4620	4828	5039	5253
		3	2521	2681	2844	3010	3179	3351	3525	3703	3883	4067
		4	2983	3160	3341	3524	3711	3901	4094	4290	4490	4692
	4	1	3146	3339	3536	3737	3942	4151	4364	4580	4801	5026
		2	3843	4065	4291	4523	4758	4998	5243	5492	5746	6004
		3	2679	2858	3041	3228	3418	3613	3812	4014	4221	4431
		4	3276	3482	3692	3907	4127	4350	4579	4812	5049	5291
	6	1	3639	3880	4127	4381	4640	4906	5178	5456	5741	6031
		2	4820	5123	5434	5753	6079	6413	6755	7105	7462	7827
		3	3017	3236	3461	3693	3930	4174	4423	4679	4941	5210
		4	3989	4264	4547	4837	5136	5442	5756	6078	6407	6745
8	2	1	3454	3640	3827	4016	4207	4399	4594	4791	4989	5189
		2	4055	4253	4452	4654	4858	5063	5271	5480	5692	5906
		3	2939	3115	3293	3473	3655	3839	4024	4212	4401	4592
		4	3482	3670	3860	4052	4246	4442	4640	4840	5042	5246
	3	1	3675	3882	4092	4304	4520	4738	4959	5183	5410	5640
		2	4449	4677	4909	5144	5382	5624	5869	6116	6367	6622
		3	3070	3263	3459	3658	3859	4064	4271	4481	4695	4911
		4	3743	3956	4173	4392	4615	4841	5071	5303	5539	5778
	4	1	3906	4135	4368	4606	4847	5092	5341	5593	5850	6111
		2	4891	5155	5423	5696	5973	6255	6541	6832	7127	7427
		3	3208	3418	3632	3851	4073	4299	4529	4763	5001	5243
		4	4036	4278	4524	4775	5031	5291	5556	5825	6098	6376
	6	1	4399	4676	4959	5249	5545	5847	6155	6469	6790	7116
		2	5966	6315	6671	7035	7407	7787	8174	8569	8972	9383
		3	3501	3749	4002	4262	4529	4801	5079	5364	5655	5952
		4	4748	5060	5379	5706	6040	6383	6733	7091	7456	7830

Estimating – Base and Surfacing Quantities

Figure 520-5e

Shoulder Section												
Shldr. Width W_s(ft)	Side Slope S:1	Case	Quantity in Tons Per Mile*									
			Surfacing Depth (ft)									
			1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00
4	2	1	3148	3280	3414	3549	3687	3826	3967	4110	4255	4402
		2	3451	3591	3734	3878	4025	4173	4324	4477	4631	4788
		3	2927	3054	3183	3314	3447	3582	3718	3857	3997	4139
		4	3209	3344	3482	3622	3763	3907	4053	4201	4350	4502
	3	1	3630	3793	3959	4129	4300	4475	4653	4834	5017	5203
		2	4110	4291	4475	4662	4852	5045	5242	5441	5644	5850
		3	3337	3493	3652	3814	3979	4147	4318	4492	4668	4848
		4	3777	3950	4126	4305	4488	4673	4862	5054	5250	5448
	4	1	4133	4329	4529	4733	4941	5153	5369	5589	5812	6040
		2	4852	5078	5308	5543	5782	6026	6274	6527	6784	7046
		3	3764	3951	4142	4337	4535	4738	4944	5155	5369	5587
		4	4416	4631	4850	5074	5302	5535	5773	6015	6261	6512
	6	1	5206	5473	5745	6024	6310	6601	6898	7202	7512	7828
		2	6654	6989	7332	7683	8041	8407	8781	9163	9552	9950
		3	4678	4930	5188	5452	5722	5999	6282	6570	6865	7166
		4	5968	6285	6609	6941	7281	7628	7984	8347	8718	9096
6	2	1	4270	4438	4608	4779	4953	5128	5306	5485	5666	5849
		2	4763	4942	5123	5306	5491	5678	5868	6059	6252	6447
		3	3876	4038	4201	4365	4532	4701	4871	5044	5218	5394
		4	4330	4502	4676	4852	5030	5210	5391	5575	5761	5949
	3	1	4752	4951	5153	5359	5567	5778	5992	6208	6428	6651
		2	5471	5691	5915	6142	6372	6605	6842	7082	7325	7571
		3	4253	4442	4634	4829	5026	5227	5430	5637	5846	6058
		4	4898	5107	5320	5535	5754	5976	6201	6429	6660	6895
	4	1	5254	5486	5723	5963	6207	6455	6707	6963	7223	7487
		2	6267	6534	6806	7082	7363	7648	7938	8233	8532	8835
		3	4645	4864	5086	5312	5542	5776	6014	6256	6501	6751
		4	5537	5788	6044	6304	6569	6838	7111	7389	7672	7959
	6	1	6328	6630	6939	7254	7576	7903	8237	8577	8923	9275
		2	8200	8581	8969	9365	9769	10181	10600	11028	11463	11905
		3	5484	5765	6051	6344	6643	6949	7260	7578	7901	8231
		4	7090	7442	7803	8171	8547	8931	9322	9721	10128	10543
8	2	1	5391	5595	5801	6009	6219	6431	6644	6859	7077	7296
		2	6121	6339	6559	6780	7004	7230	7457	7687	7919	8153
		3	4785	4980	5177	5376	5577	5779	5984	6190	6398	6608
		4	5452	5660	5870	6082	6296	6512	6730	6950	7172	7396
	3	1	5873	6109	6347	6589	6833	7080	7330	7583	7839	8098
		2	6879	7140	7403	7670	7940	8214	8490	8770	9053	9339
		3	5129	5351	5576	5803	6034	6267	6503	6743	6985	7229
		4	6020	6265	6514	6765	7020	7278	7539	7804	8071	8342
	4	1	6376	6644	6917	7193	7473	7758	8046	8338	8634	8934
		2	7731	8040	8354	8671	8994	9321	9652	9988	10329	10674
		3	5488	5738	5992	6249	6511	6776	7046	7319	7596	7877
		4	6659	6946	7238	7534	7835	8140	8450	8764	9083	9406
	6	1	7449	7788	8133	8485	8842	9206	9575	9951	10333	10722
		2	9801	10227	10661	11103	11552	12009	12474	12947	13427	13915
		3	6255	6565	6880	7202	7530	7864	8204	8550	8903	9262
		4	8211	8600	8997	9401	9813	10233	10661	11096	11539	11990

Estimating – Base and Surfacing Quantities

Figure 520-5f

Shoulder Section												
Shldr. Width W_s(ft)	**Side Slope S:1**	**Case**	**Quantity in Tons Per Mile***									
			Surfacing Depth (ft)									
			1.05	**1.10**	**1.15**	**1.20**	**1.25**	**1.30**	**1.35**	**1.40**	**1.45**	**1.50**
10	2	1	4214	4436	4659	4884	5111	5340	5571	5804	6038	6275
		2	5074	5310	5548	5788	6031	6275	6521	6769	7019	7272
		3	3468	3678	3890	4104	4320	4537	4757	4978	5201	5427
		4	4242	4466	4692	4920	5150	5382	5617	5853	6091	6331
	3	1	4435	4678	4924	5173	5424	5679	5936	6196	6460	6726
		2	5505	5774	6045	6320	6599	6880	7165	7453	7744	8038
		3	3581	3806	4035	4266	4501	4738	4978	5221	5467	5715
		4	4503	4752	5005	5261	5520	5782	6048	6316	6588	6863
	4	1	4666	4931	5201	5474	5751	6032	6317	6606	6899	7196
		2	5990	6295	6605	6919	7238	7561	7889	8221	8558	8900
		3	3698	3940	4186	4436	4689	4947	5208	5474	5743	6017
		4	4796	5074	5357	5644	5935	6232	6532	6838	7147	7462
	6	1	5158	5472	5792	6117	6449	6787	7132	7482	7839	8202
		2	7167	7561	7963	8373	8790	9215	9648	10088	10537	10993
		3	3950	4226	4509	4798	5093	5394	5701	6015	6334	6660
		4	5508	5856	6211	6574	6945	7323	7710	8104	8506	8915
12	2	1	4974	5231	5491	5752	6015	6281	6548	6816	7087	7360
		2	6139	6414	6691	6969	7250	7533	7818	8104	8393	8684
		3	3956	4200	4446	4694	4944	5195	5449	5704	5961	6220
		4	5002	5262	5524	5788	6055	6323	6593	6866	7140	7416
	3	1	5195	5474	5756	6041	6329	6619	6913	7209	7509	7811
		2	6609	6918	7230	7545	7863	8184	8509	8837	9168	9502
		3	4052	4310	4571	4836	5103	5372	5645	5921	6199	6481
		4	5262	5548	5837	6129	6424	6723	7024	7329	7637	7948
	4	1	5425	5727	6033	6342	6656	6973	7294	7619	7948	8282
		2	7138	7485	7836	8192	8553	8917	9287	9661	10039	10422
		3	4151	4425	4702	4983	5268	5557	5850	6147	6448	6753
		4	5556	5870	6189	6512	6840	7172	7509	7851	8197	8547
	6	1	5918	6268	6624	6986	7354	7728	8109	8495	8888	9287
		2	8422	8862	9309	9764	10227	10698	11176	11662	12156	12657
		3	4364	4669	4981	5298	5622	5952	6288	6630	6979	7333
		4	6268	6652	7043	7442	7849	8264	8687	9117	9555	10001
Pavement Section												
Width W_P (ft)			**1.05**	**1.10**	**1.15**	**1.20**	**1.25**	**1.30**	**1.35**	**1.40**	**1.45**	**1.50**
11			4179	4378	4576	4775	4974	5173	5372	5571	5770	5969
12			4558	4775	4993	5210	5427	5644	5861	6078	6295	6512
22			8357	8755	9153	9551	9949	10347	10745	11143	11541	11939
24			9117	9551	9985	10419	10853	11287	11722	12156	12590	13024
* Tabulated quantities are based on compacted weight of 1.85 tons/yd^3												

Estimating – Base and Surfacing Quantities
Figure 520-5g

Shoulder Section												
Shldr. Width W_s(ft)	Side Slope S:1	Case	Quantity in Tons Per Mile*									
			Surfacing Depth (ft)									
			1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00
10	2	1	6513	6753	6995	7239	7485	7733	7983	8234	8488	8743
		2	7526	7782	8041	8301	8563	8827	9094	9362	9632	9905
		3	5654	5883	6113	6346	6581	6817	7056	7296	7538	7782
		4	6573	6818	7064	7312	7562	7814	8069	8325	8583	8843
	3	1	6995	7266	7541	7819	8099	8382	8669	8958	9250	9545
		2	8335	8636	8940	9247	9557	9870	10187	10506	10829	11156
		3	5967	6221	6479	6739	7002	7268	7537	7809	8084	8361
		4	7141	7423	7707	7995	8286	8581	8878	9179	9482	9789
	4	1	7497	7802	8111	8423	8740	9060	9385	9713	10045	10381
		2	9246	9596	9951	10311	10675	11043	11416	11794	12176	12563
		3	6294	6575	6860	7149	7442	7739	8040	8344	8653	8966
		4	7780	8104	8432	8764	9101	9442	9788	10139	10494	10853
	6	1	8571	8946	9327	9715	10108	10508	10914	11326	11744	12169
		2	11457	11928	12408	12895	13390	13892	14403	14921	15447	15980
		3	6992	7330	7674	8025	8382	8744	9113	9488	9870	10257
		4	9333	9758	10191	10631	11079	11536	11999	12471	12950	13437
12	2	1	7634	7911	8189	8469	8751	9035	9321	9609	9899	10190
		2	8977	9272	9569	9868	10168	10471	10776	11083	11392	11703
		3	6481	6744	7009	7276	7544	7814	8087	8361	8637	8915
		4	7695	7975	8258	8542	8828	9117	9407	9700	9994	10291
	3	1	8116	8424	8735	9049	9365	9685	10007	10333	10661	10992
		2	9840	10180	10524	10871	11221	11575	11931	12291	12654	13020
		3	6765	7052	7342	7635	7931	8230	8532	8836	9144	9454
		4	8263	8581	8901	9225	9553	9883	10216	10553	10893	11236
	4	1	8619	8960	9304	9653	10006	10363	10723	11088	11456	11829
		2	10810	11202	11599	12000	12405	12816	13230	13650	14073	14502
		3	7061	7374	7691	8011	8335	8664	8996	9332	9672	10017
		4	8902	9262	9626	9994	10367	10745	11127	11514	11905	12300
	6	1	9692	10103	10521	10945	11374	11810	12253	12701	13155	13616
		2	13167	13684	14209	14741	15282	15830	16386	16949	17521	18100
		3	7694	8061	8434	8813	9199	9590	9988	10392	10802	11218
		4	10454	10915	11384	11861	12346	12838	13338	13846	14361	14885
Pavement Section												
Width W_P (ft)			1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00
11			6168	6367	6566	6765	6964	7163	7362	7561	7760	7959
12			6729	6946	7163	7380	7597	7814	8031	8249	8466	8683
22			12337	12735	13133	13530	13928	14326	14724	14122	15520	15918
24			13458	13892	14326	14761	15195	15629	16063	16497	16931	17365
* Tabulated quantities are based on compacted weight of 1.85 tons/yd^3												

Estimating – Base and Surfacing Quantities
Figure 520-5h

Chapter 530 Geosynthetics

530.01 General

Geosynthetics include a variety of manufactured products that are used in drainage, earthwork, erosion control, and soil reinforcement applications.

Several geosynthetic applications are addressed in the *Standard Specifications for Road, Bridge, and Municipal Construction* (Standard Specifications). These applications are as follows:

- Low survivability underground drainage
- Moderate survivability underground drainage
- Separation
- Soil stabilization
- Moderate survivability permanent erosion control
- High survivability permanent erosion control
- Ditch lining
- Temporary silt fence

The Standard Specifications address geosynthetic properties as well as installation requirements and are not site specific. Geosynthetic properties provided in the Standard Specifications are based on the range of soil conditions likely to be encountered in the state of Washington for the applications defined. Other applications, such as prefabricated edge drains, pond liners, and geotextile retaining walls, are currently handled by special provision.

Design responsibilities are discussed in 530.05 below and illustrated in Figures 530-4 and 5.

This chapter does not address applications where geosynthetics are used to help establish vegetation through temporary prevention of erosion (vegetation mats).

530.02 References

Highway Runoff Manual, M 31-15, WSDOT

Hydraulics Manual, M 23-03, WSDOT

<u>*WSDOT*</u> *Pavement* <u>*Policy*</u>

Plans Preparation Manual, M 22-31, WSDOT

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

530.03 Geosynthetic Types and Characteristics

Geosynthetics include woven and nonwoven geotextiles, geogrids, geonets, geomembranes, and geocomposites. Terms used in the past for these construction materials include *fabrics*, *filter fabric*, or *filter cloth* which are for the most part synonymous with the newer term *geotextile*.

Photographs of the various types of geosynthetics are provided in Figure 530-6.

Woven geotextiles consist of slit polymer tapes, monofilament fibers, fibrillated yarns, or multifilament yarns simply woven into a mat. Woven geotextiles generally have relatively high strength and stiffness and, except for the monofilament wovens, relatively poor drainage characteristics.

Nonwoven geotextiles consist of a sheet of continuous or staple fibers entangled randomly into a felt in the case of needle-punched nonwovens, and pressed and melted together at the fiber contact points in the case of heat-bonded nonwovens. Nonwoven geotextiles tend to have low to medium strength and stiffness with high elongation at failure, and relatively good drainage characteristics. The high elongation characteristic gives them superior ability to deform around stones and sticks.

Geogrids consist of a polymer grid mat constructed either of coated yarns or punched and stretched polymer sheet and usually have high strength and stiffness. They are used primarily for soil reinforcement.

Geonets are similar to geogrids but are typically lighter weight, weaker, and have smaller mesh openings. They are used in light reinforcement applications or are combined with drainage geotextiles to form a drainage structure.

Geomembranes consist of impervious polymer sheets that are typically used to line ponds or landfills, or in some cases are placed over moisture sensitive swelling clays to control moisture.

Geocomposites include prefabricated edge drains, wall drains, and sheet drains, that consist typically of a cuspated or dimpled polyethylene drainage core wrapped in a geotextile. The geotextile wrap keeps the core clean so that water can freely flow through the drainage core. The drainage core acts as a conduit. Prefabricated edge drains are used in place of shallow geotextile wrapped trench drains at the edges of the roadway to provide subgrade and base drainage. Wall drains and sheet drains are typically placed between the back of the wall and the soil to drain the soil retained by the wall.

530.04 Geosynthetic Function Definitions and Applications

The function of the geosynthetic varies with the application. See Figure 530-7 for pictorial representations of the various applications. The geosynthetic must be designed with its function(s) in the given application in mind. Typical geosynthetic functions include filtration, drainage, separation, reinforcement, and erosion control. Definitions of these functions and examples of applications where these functions are dominant are as follows:

Geosynthetic filtration is defined as the passage of water through the geosynthetic relatively unimpeded (permeability or permittivity) without allowing passage of soil through the geosynthetic (retention). This is the primary function of geotextiles in underground drainage applications.

Drainage is defined as the carrying of water in the plane of the geosynthetic as a conduit (transmissivity). This is a primary function of geocomposite drains and in some cases thick nonwoven needle-punched geotextiles placed in underground drainage applications where water must be transported away from a given location by the geosynthetic itself.

Separation is defined as the prevention of the mixing of two dissimilar materials. This is a primary function of geotextiles placed between a fine-grained subgrade and a granular base course beneath a roadway.

Reinforcement is defined as the strengthening of a soil mass by the inclusion of elements (geosynthetics) that have tensile strength. This is the primary function of high strength geotextiles and geogrids in geosynthetic reinforced wall or slope applications, or in roadways placed over very soft subgrade soils that are inadequate to support the weight of the construction equipment or even the embankment itself.

Geosynthetic erosion control is defined as the minimizing of surficial soil particle movement due to the flow of water over the surface of bare soil or due to the disturbance of soil caused by construction activities under or near bodies of water. This is the primary function of geotextiles used as silt fences or placed beneath riprap or other stones on soil slopes. Silt fences keep eroded soil particles on the construction site, whereas geotextiles placed beneath riprap or other stones on soil slopes prevent erosion from taking place at all. In general, the permanent erosion control methods described in this chapter are only used where more natural means (such as the use of biodegradable vegetation mats to establish vegetation to prevent erosion) are not feasible.

These functions control some of the geosynthetic properties, such as apparent opening size (AOS) and permittivity, and in some cases load-strain characteristics.

The application will also affect the geosynthetic installation conditions. These installation conditions influence the remaining geosynthetic properties needed, based on the *survivability* level required.

Geosynthetic survivability is defined as the ability of the geosynthetic to resist installation conditions without significant damage, such that the geosynthetic can function as intended. Survivability affects the strength properties of the geosynthetic required.

530.05 Design Approach for Geosynthetics

Four questions must be answered to complete a geosynthetic design:

- Is a geosynthetic really needed?
- What geosynthetic properties will ensure that the geosynthetic functions as intended?
- Where should the geosynthetic be located?
- Will maintenance of the geosynthetic, or the structure of which it is a part, be needed? And, if so, how will it be maintained?

The site conditions and purpose for the geotextile are reviewed to determine whether or not a geotextile is needed.

- For most drainage, separation, soil stabilization, permanent erosion control, and silt fence applications, if a geotextile is needed the geotextile properties in the Standard Specifications can be used.
- In some situations where soil conditions are especially troublesome or in critical or high risk applications, a project specific design may be needed.
- The location of the geosynthetic will depend on how it is intended to function. (See Figure 530-7 for examples.)
- Consider the flow path of any ground water or surface water when locating the geotextile as well as selecting the geotextile to be used. For example, in permanent erosion control applications, water may flow to the geotextile from the existing ground as well as from the surface through wave action, stream flow, or overland sheet flow. For saturated fine sandy or silty subgrades, water must be able to flow from the subgrade through the geotextile soil stabilization layer during the pumping action caused by traffic loads.

Background information and the answers to each of these questions, or at least guidance to obtaining the answers to these questions, are provided for each Standard Specification application as follows:

(1) Underground Drainage, Low and Moderate Survivability

Geotextile used for underground drainage must provide filtration to allow water to reach the drain aggregate without allowing the aggregate to be contaminated by finer soil particles.

Geotextile filtration properties are a function of the soil type. For underground drainage applications, if the subgrade soil is relatively clean gravel or coarse sand, a geotextile is probably not required. At issue is whether or not there are enough fines in the surrounding soil to eventually clog the drain rock or drain pipe if unrestricted flow toward the drain is allowed.

To approximately match the geotextile filtration properties to various soil types, specifications for three classes of Construction Geotextile for Underground Drainage are available in the Standard Specifications. For underground drainage applications, use the gradation of the soil, specifically the percent by weight passing the #200 sieve, to select the drainage geotextile class required. Base selection of the appropriate class of geotextile on the following table:

Percent Passing the #200 Sieve	Geotextile Class
Less than 15%	A
15% to 50%	B
Greater than 50%	C

Selection Criteria for Geotextile Class
Figure 530-1

Obtain soil samples for geotextile underdrain design every 300 ft along the roadway alignment, using hand holes, and at major soil type transitions. This may be spread to every 1,000 ft if the soil conditions appear to be uniform. Use existing soil data where feasible instead of taking new soil samples.

If soil conditions vary widely along the alignment where underground drainage geotextile is anticipated, different classes of drainage geotextile may be required for specific sections of a continuous system.

Strength properties for the underground drainage geotextile depend on the survivability level required to resist installation stresses.

Low survivability designates that the installation stresses placed on the geotextile will be relatively low, requiring only moderate geotextile strength to resist potentially damaging installation conditions. Examples of low survivability level underground drainage applications include:

- Trench drains
- Drains placed behind walls or other structures to drain the backfill
- A geotextile filter sheet placed behind a gabion wall to prevent fines from being washed through the gabion wall face. Trench depths, or the height of the geotextile filter sheet behind gabion walls, must be less than or equal to 6 ft for the low survivability level.

In moderate survivability applications, significant installation stresses may occur, requiring higher geotextile strength. Examples of the moderate survivability application include:

- Trench drains with a depth of greater than 6 ft
- A geotextile filter sheet behind a gabion wall with a height greater than 6 ft
- Any area drain

An area drain is defined as a geotextile placed over or under a horizontal to moderately sloping (1.5H:1V or flatter slope) layer of drainage aggregate. Examples of area drains include:

- Drainage layers over cut-and-cover tunnels
- Rock buttress drainage
- Permeable base beneath highway pavement (see the WSDOT *Pavement Policy* for additional information on permeable bases)
- A parking lot drainage layer

Note that pipe wrapping (the geotextile is wrapped around the surface of the pipe) is not included as an underground drainage application.

Locate the geotextile such that it will function as intended. For example, if the objective is to keep the drainage aggregate surrounding a drain pipe clean, locate the geotextile such that it completely separates the drainage aggregate from more silty surrounding soils, which may include native soils as well as relatively silty roadway base or fill materials.

Consider the flow path of any ground water or surface water when locating the geotextile.

The flow path from the geotextile, as part of the ground water drainage, is typically directed to a surface water conveyance system. Design of surface water conveyance is guided by the *Hydraulics Manual*. The surface water conveyance must be low enough to prevent backflow and charging of the ground water drainage; typically by matching inverts of ground water drainage to crowns of surface water conveyance pipes. A 1 ft allowance is usually applied when connecting to open water or ditches.

(2) Separation

Geotextile used for separation must prevent penetration of relatively fine grained subgrade soil into the ballast or other roadway or parking lot surfacing material to prevent contamination of the surfacing material (the separation function). This application may also apply to situations other than beneath roadway or parking lot surfacing where it is not necessary for water to drain through the geotextile unimpeded (filtration), but where separation of two dissimilar materials is required.

Chapter 640 Geometric Cross Section

640.01 General

Geometric cross sections for state highways are governed by functional classification criteria, traffic volume, and whether the highway is in a rural or an urban area. (See Chapter 440 for information on functional class.)

High Occupancy Vehicle (HOV) lanes must be considered when continuous through lanes are to be added within the limits of an urban area with a population over 200,000. (See Chapter 1050.)

When a state highway within an incorporated city or town is a portion of a city street, the design features must be developed in cooperation with the local agency. (See Chapter 440 for guidance on geometric design data when a state highway within an incorporated city or town is a portion of a city street.)

For additional information, see the following chapters:

Chapter	Subject
430	Roadway widths and cross slopes for modified design level
440	Minimum lane and shoulder widths for full design level
440	Shoulder widths at curbs
510	Geotechnical investigation
520	Pavement type
641	Turning roadway width
642	Superelevation
910	Requirements for islands
940	Lane and shoulder widths for ramps
960	Median crossovers

640.02 References

Design Guidance

Highway Runoff Manual, M 31-16, WSDOT

Local Agency Guidelines (LAG), M 36-63, WSDOT

Plans Preparation Manual, M 22-31, WSDOT

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

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

640.03 Definitions

auxiliary lane The portion of the roadway adjoining the through lanes for parking, speed change, turning, storage for turning, weaving, truck climbing, and other purposes supplementary to through-traffic movement.

divided multilane A roadway with two or more through lanes in each direction and a median that physically or legally prohibits left turns, except at designated locations.

freeway A divided highway that has a minimum of two lanes in each direction, for the exclusive use of traffic, and with full control of access.

high pavement type Portland cement concrete pavement or hot mix asphalt (HMA) pavement on a treated base.

intermediate pavement type Hot mix asphalt pavement on an untreated base.

lane A strip of roadway used for a single line of vehicles.

lane width The lateral design width for a single lane, striped as shown in the Standard Plans and the Standard Specifications.

low pavement type Bituminous surface treatment (BST).

median The portion of a highway separating the traveled ways for traffic in opposite directions.

outer separation The area between the outside edge of the traveled way for through traffic and the nearest edge of the traveled way of a frontage road or a collector-distributor road.

roadway The portion of a highway, including shoulders, for vehicular use.

rural design area An area that meets none of the conditions to be an urban design area.

shoulder The portion of the roadway contiguous with the traveled way, primarily for accommodation of stopped vehicles, emergency use, lateral support of the traveled way, and use by pedestrians.

shoulder width The lateral width of the shoulder, measured from the outside edge of the outside lane to the edge of the roadway.

superelevation The rotation of the roadway cross section in such a manner as to overcome part of the centrifugal force that acts on a vehicle traversing a curve.

traveled way The portion of the roadway intended for the movement of vehicles, exclusive of shoulders and lanes for parking, turning, and storage for turning.

turning roadway A curve on an open highway, a ramp, or the connecting portion of the roadway between two intersecting legs of an intersection.

undivided multilane A roadway with two or more through lanes in each direction on which left turns are not controlled.

urban area An area designated by the Washington State Department of Transportation (WSDOT) in cooperation with the Transportation Improvement Board and regional transportation planning organizations, subject to the approval of the FHWA.

urban design area An area where urban design criteria is appropriate, that is defined by one or more of the following:

- An urban area.
- An area within the limits of an incorporated city or town.
- An area characterized by intensive use of the land for the location of structures, that receives such urban services as sewer, water, and other public utilities, as well as services normally associated with an incorporated city or town. This may include an urban growth area defined under the Growth Management Act (see Chapter 36.70A RCW, Growth management – planning by selected counties and cities), but outside the city limits.
- An area with not more than 25% undeveloped land.

640.04 Roadways

The cross sections shown in Figures 640-1, 2, 3, 4a, and 4b represent minimum values for full design level. (See Chapter 440 for additional design information for full design level and Chapter 430 for cross sections and design information for modified design level.)

(1) Traveled Way Cross Slope

The cross slope on tangents and curves is a main element in roadway design. The cross slope or crown on tangent sections and large radius curves is complicated by two contradicting controls. Reasonably steep cross slopes are desirable to aid in water runoff and to minimize ponding as a result of pavement imperfections and unequal settlement. However, steep cross slopes are undesirable on tangents because of the tendency for vehicles to drift to the low side of the roadway. Steeper cross slopes are noticeable in steering, and they increase susceptibility to sliding to the side on icy or wet pavements.

A 2% cross slope is normally used for tangents and large radius curves on high and intermediate pavement types. With justification, cross slopes may vary by ± 0.5% from the target 2% cross slope. Do not design cross slopes flatter than 1.5%.

On low pavement types, the cross slope may be increased to 3% to allow for reduced construction control and greater settlement.

Superelevation on curves is a function of the design speed and the radius of the curve. (See Chapter 642 for guidance on superelevation design.)

642.01 General

To maintain the desired design speed, highway and ramp curves are usually superelevated to overcome part of the centrifugal force that acts on a vehicle.

For additional information, see the following chapters:

Chapter	**Subject**
430	Roadway widths and cross slopes for modified design level
440	Minimum lane and shoulder widths for full design level
940	Lane and shoulder widths for ramps

642.02 References

(1) Design Guidance

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

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

(2) Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

642.03 Definitions

lane A strip of roadway used for a single line of vehicles.

lane width The lateral design width for a single lane, striped as shown in the *Standard Plans* and the *Standard Specifications*.

median The portion of a highway separating the traveled ways for traffic in opposite directions.

roadway The portion of a highway, including shoulders, for vehicular use.

superelevation (super) The rotation of the roadway cross section in such a manner as to overcome part of the centrifugal force that acts on a vehicle traversing a curve.

superelevation runoff The length of highway needed to accomplish the change in cross slope from a section with adverse crown removed (level) to a fully superelevated section, or vice versa.

superelevation transition length The length of highway needed to change the cross slope from normal crown or normal pavement slope to full superelevation.

tangent runout The length of highway needed to change the cross slope from normal crown to a section with adverse crown removed (level).

traveled way The portion of the roadway intended for the movement of vehicles, exclusive of shoulders and lanes for parking, turning, and storage for turning.

turning roadway A curve on an open highway, a ramp, or the connecting portion of roadway between two intersecting legs of an intersection.

642.04 Superelevation Rate Selection

The maximum superelevation rate allowed is 10%.

Depending on design speed, construct large-radius curves with a normal crown section. The minimum radii for normal crown sections are shown in Figure 642-1. Superelevate curves with smaller radii as follows:

- Figure 642-4a (e_{max}=10%) is preferred for all open highways, ramps, and long-term detours (especially when associated with a main line detour).
- Figure 642-4b (e_{max}=8%) may be used for freeways in urban design areas and areas where the e_{max}=6% rate is allowed but e_{max}=8% is preferred.
- Figure 642-4c (e_{max}=6% Max) may be used, with justification, for nonfreeways in urban design areas, in mountainous areas, and for short-term detours (generally implemented and removed in one construction season).
- Figure 642-5 may be used for turning roadways at intersections, for urban managed access highways with a design speed of 40 mph or less, and, with justification, for ramps in urban areas with a design speed of 40 mph or less.

When selecting superelevation for a curve, consider the existing curves on the corridor. To maintain route continuity and driver expectance on open highways, select the chart (see Figure 643-4a, 4b, or 4c) that best matches the superelevation on the existing curves.

In locations that experience regular accumulations of snow and ice, limit superelevation from the selected chart to 6% or less. In these areas, justification is required for superelevation rates greater than 6%. Vehicles moving at slow speeds or stopped on curves with supers greater than 6% tend to slide inward on the radius (downslope).

Round the selected superelevation rate to the nearest full percent.

Design Speed (mph)	Minimum Radius for Normal Crown Section (ft)
15	945
20	1,680
25	2,430
30	3,325
35	4,360
40	5,545
45	6,860
50	8,315
55	9,920
60	11,675
65	13,130
70	14,675
75	16,325
80	18,065

Minimum Radius for Normal Crown Section
Figure 642-1

642.05 Existing Curves

Evaluate the superelevation on an existing curve to determine its adequacy. Use the equation in Figure 642-2 to determine the minimum radius for a given superelevation and design speed. Superelevation is deficient when the existing radius is less than the minimum from the equation.

$$R = \frac{6.68V^2}{e + f}$$

Where:

R	=	The minimum allowable radius of the curve (ft)
V	=	Design speed (mph)
e	=	Superelevation rate (%)
f	=	Side friction factor from Figure 642-3

Minimum Radius for Existing Curves
Figure 642-2

For Preservation projects where the existing pavement is to remain in place, the superelevation on existing curves may be evaluated with a ball banking analysis.

Corrective action is required to address deficient superelevation when the existing radius is less than the minimum radius calculated using the equation or when the maximum speed determined by a ball banking analysis is less than the design speed. Provide superelevation as given in 642.04.

Design Speed (mph)	Side Friction Factor (f)
15	32
20	27
25	23
30	20
35	18
40	16
45	15
50	14
55	13
60	12
65	11
70	10
75	9
80	8

Side Friction Factor
Figure 642-3

642.06 Turning Movements at Intersections

Curves associated with the turning movements at intersections are superelevated using the rates for low-speed urban roadway curves. Use superelevation rates as high as feasible, consistent with curve length and climatic conditions. Figure 642-5 shows the minimum superelevation for the given design speed and radius. Use judgment in considering local conditions such as snow and ice. When using high superelevation rates on short curves, provide smooth transitions with merging ramps or roadways.

642.07 Runoff for Highway Curves

For added comfort and safety, provide uniform superelevation runoff over a length adequate for the likely operating speeds. The length of the runoff is based on a maximum allowable difference between the grades on the pivot point and the outer edge of traveled way for one 12-foot lane.

Provide transitions for all superelevated highway curves as specified in Figures 642-6a through 6e. Which transition to use depends on the location of the pivot point, the direction of the curve, and the roadway cross slope.

Pay close attention to the profile of the edge of traveled way created by the superelevation runoff; do not let it appear distorted. The combination of superelevation transition and grade may result in a hump or dip in the profile of the edge of traveled way. When this happens, the transition may be lengthened to eliminate the hump or dip. If the hump and dip cannot be eliminated this way, pay special attention to drainage in the low areas to prevent ponding. Locating the pivot point at the centerline of the roadway will also help to minimize humps and dips at the edge of the traveled lane and will reduce the required superelevation runoff length.

When reverse curves are necessary, provide sufficient tangent length for complete superelevation runoff for both curves (that is, from full superelevation of the first curve to level to full superelevation of the second curve). If tangent length is longer than this but not sufficient to provide full super transitions (that is, from full superelevation of the first curve to normal crown to full superelevation of the second curve), increase the superelevation runoff lengths until they abut. This provides one continuous transition, without a normal crown section, similar to Designs C^2 and D^2 in Figures 642-6c and 6d, except that full super will be attained rather than the normal pavement slope as shown.

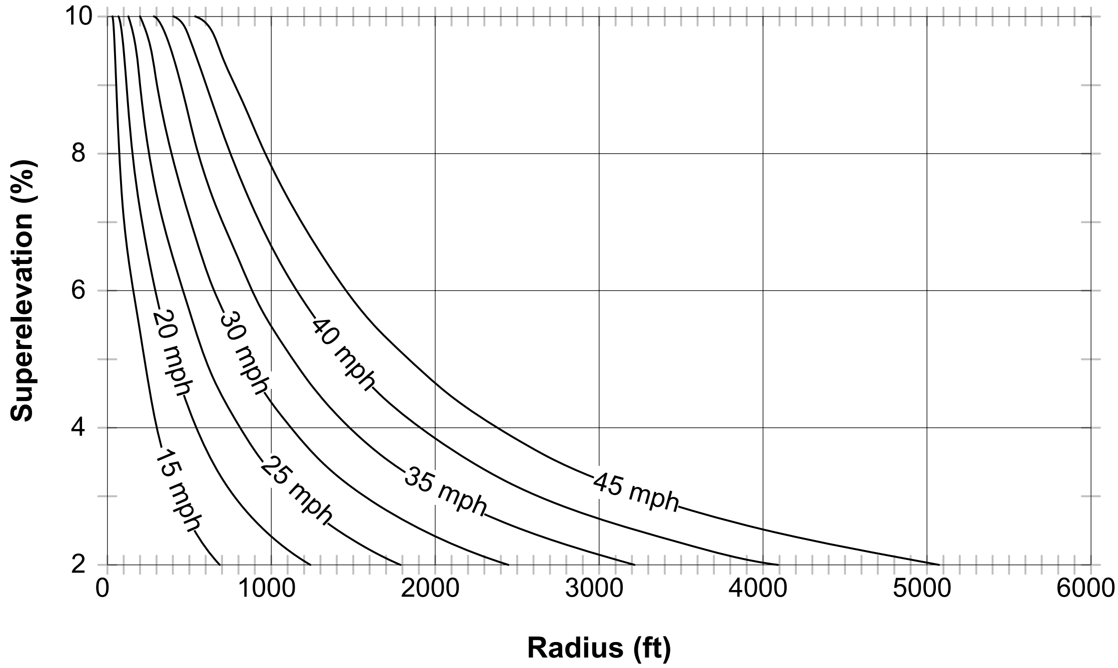
Superelevation runoff is permissible on structures but not desirable. Whenever feasible, strive for full super or normal crown slopes on structures.

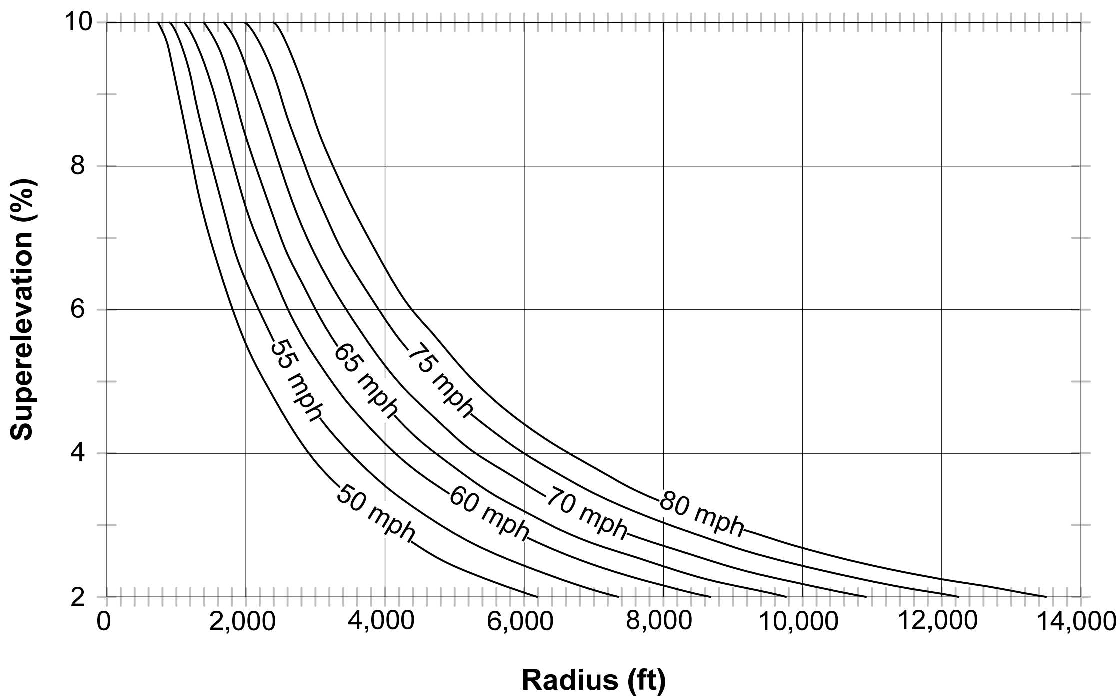
642.08 Runoff for Ramp Curves

Superelevation runoff for ramps use the same maximum relative slopes as the specific design speeds used for highway curves. Multilane ramps have a width similar to the width for highway lanes; therefore, Figures 642-6a through 6e are used to determine the superelevation runoff for ramps. Single-lane ramps have a lane width of 15 feet in curves, requiring the runoff length to be adjusted. Superelevation transition lengths (L_T) for single-lane ramps are given in Figures 642-7a and 7b. Additional runoff length for turning roadway widening is not required.

642.09 Documentation

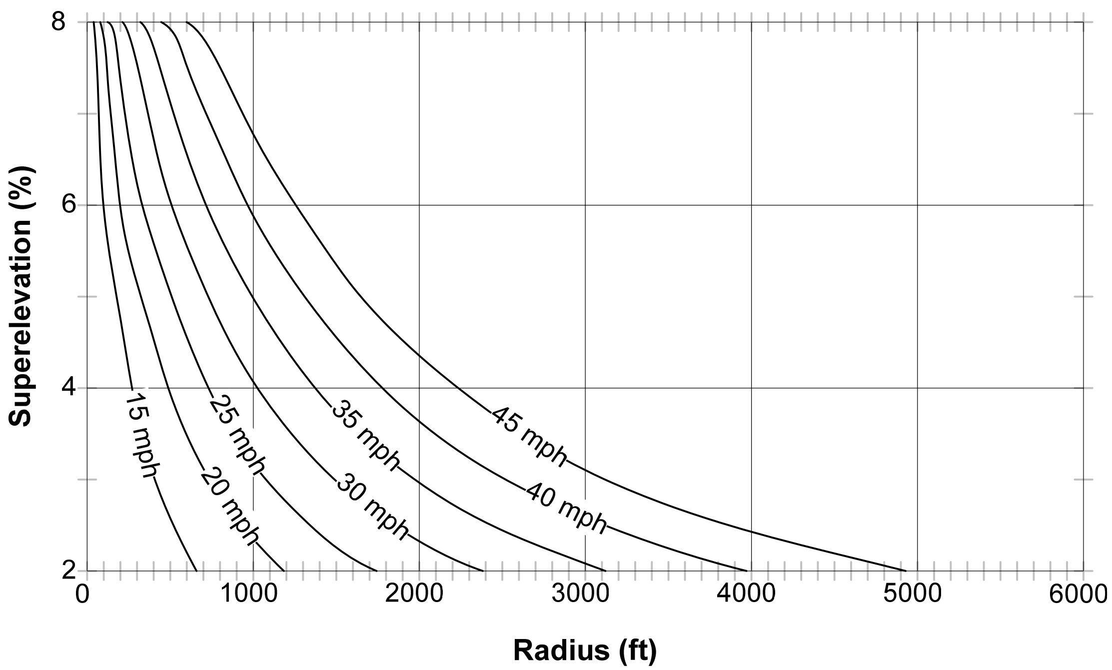
For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

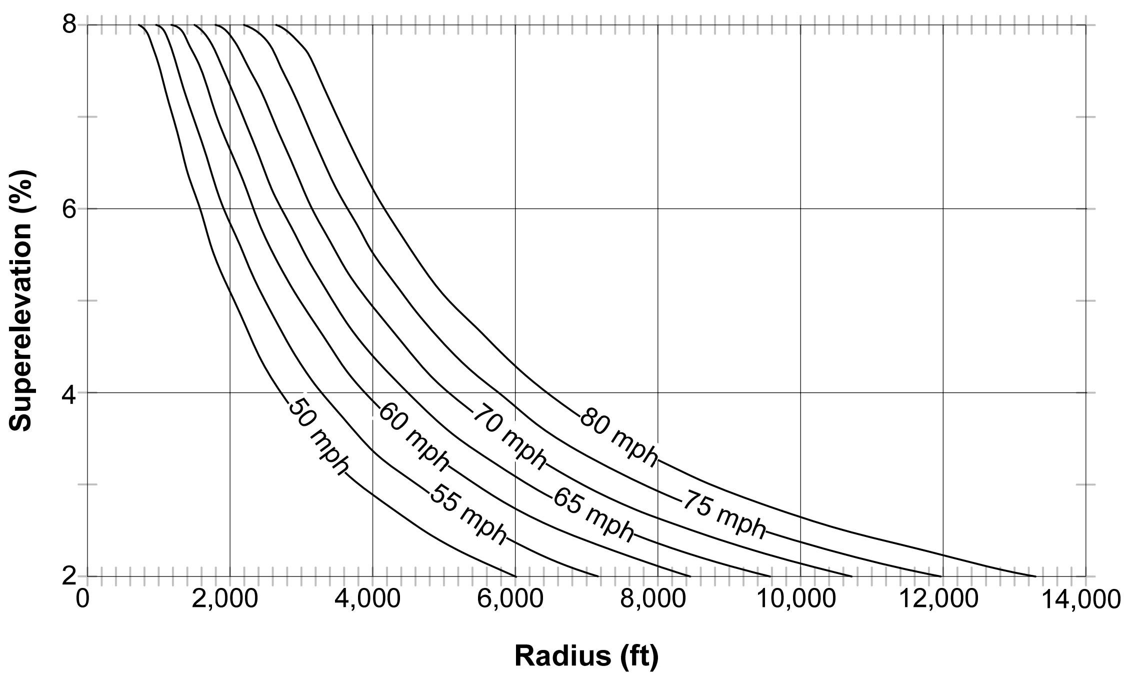




Design Speed (mph)	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Minimum Radius (ft)	40	75	130	205	295	415	545	700	880	1095	1345	1640	1980	2380

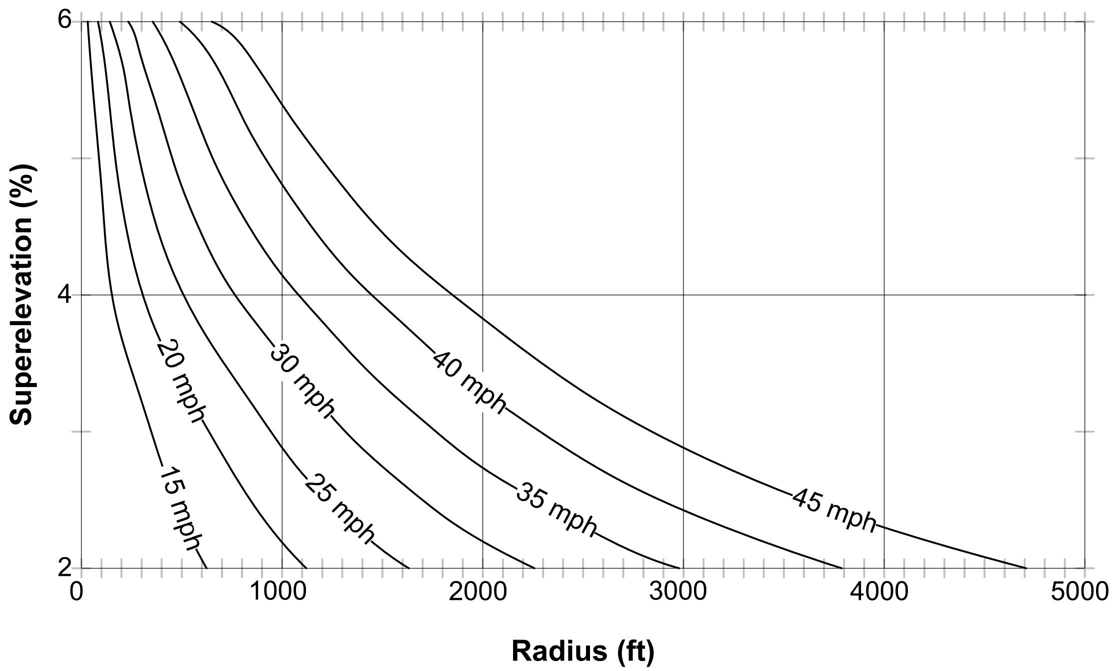
Superelevation Rates (10% max)
Figure 642-4a

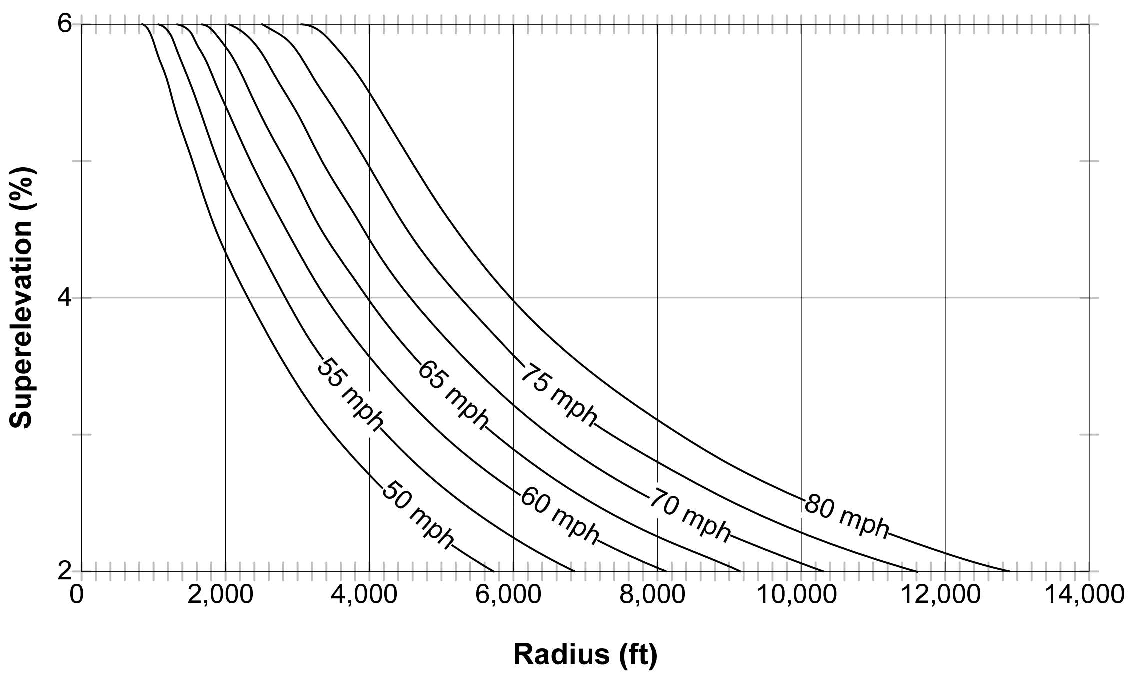




Design Speed (mph)	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Minimum Radius (ft)	40	80	135	215	315	450	590	760	965	1205	1490	1820	2215	2675

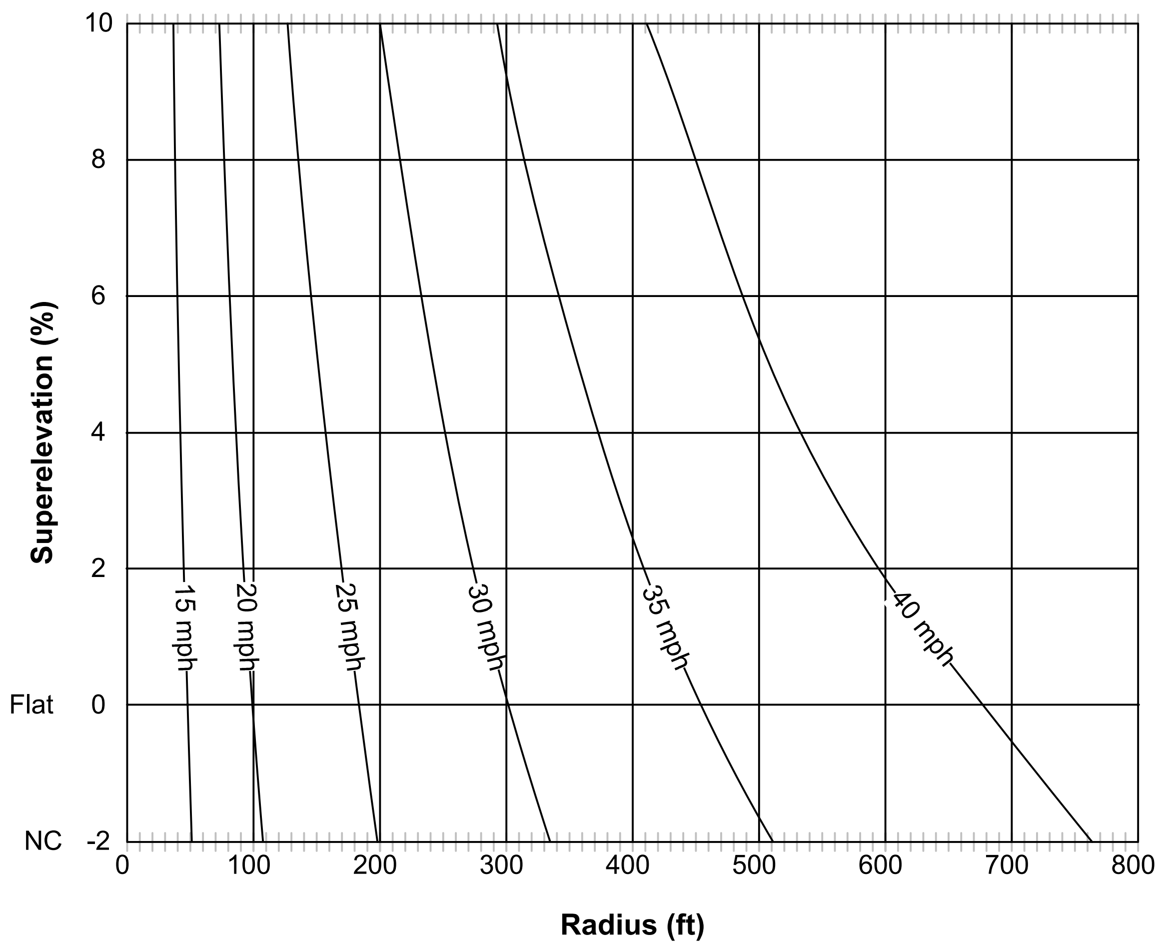
Superelevation Rates (8% max)
Figure 642-4b





Design Speed (mph)	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Minimum Radius (ft)	40	85	145	235	345	490	645	840	1065	1340	1665	2050	2510	3055

Superelevation Rates (6% max)
Figure 642-4c



NC = Normal crown

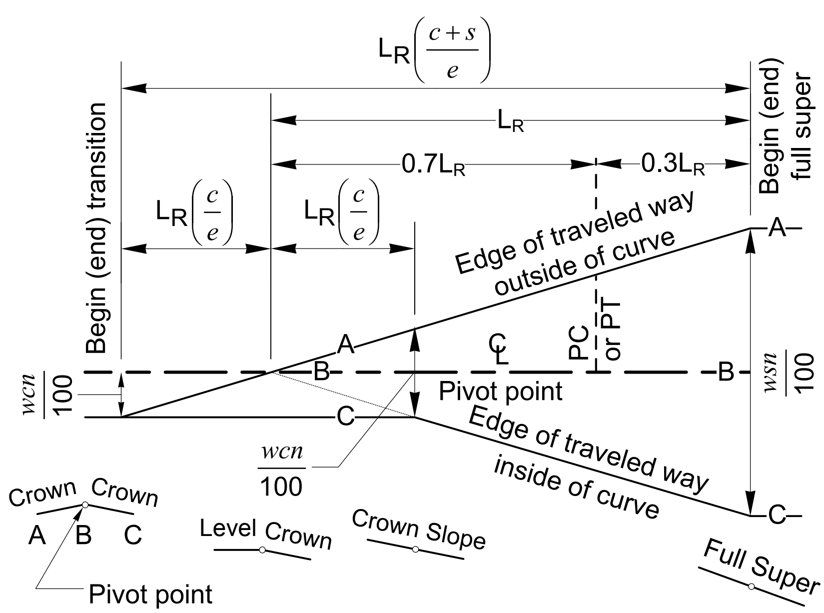
Superelevation Rates for Intersections and Low-Speed Urban Roadways
Figure 642-5

e (%)	LB=Basic Runoff in Feet for Design Speed													
	15 mph	**20 mph**	**25 mph**	**30 mph**	**35 mph**	**40 mph**	**45 mph**	**50 mph**	**55 mph**	**60 mph**	**65 mph**	**70 mph**	**75 mph**	**80 mph**
2	30	30	35	35	40	40	45	50	50	55	55	60	65	70
3	45	50	50	55	60	60	65	70	75	80	85	90	95	105
4	60	65	70	75	75	85	90	95	100	105	110	120	125	135
5	75	80	85	90	95	105	110	120	130	135	140	150	160	170
6	90	95	105	110	115	125	135	145	155	160	170	180	190	205
7	110	115	120	130	135	145	155	170	180	185	195	210	220	240
8	125	130	135	145	155	165	180	190	205	215	225	240	250	275
9	140	145	155	165	175	185	200	215	230	240	250	270	285	310
10	155	160	170	180	195	205	220	240	255	265	280	300	315	345

* Based on one 12-ft lane between the pivot point and the edge of traveled way. When the distance exceeds 12 ft, use the following equation to obtain L_R: $L_R = L_B(1+0.04167X)$

Where:

X = The distance in excess of 12 ft between the pivot point and the farthest edge of traveled way, in ft



Design A – Pivot Point on Centerline Crown Section

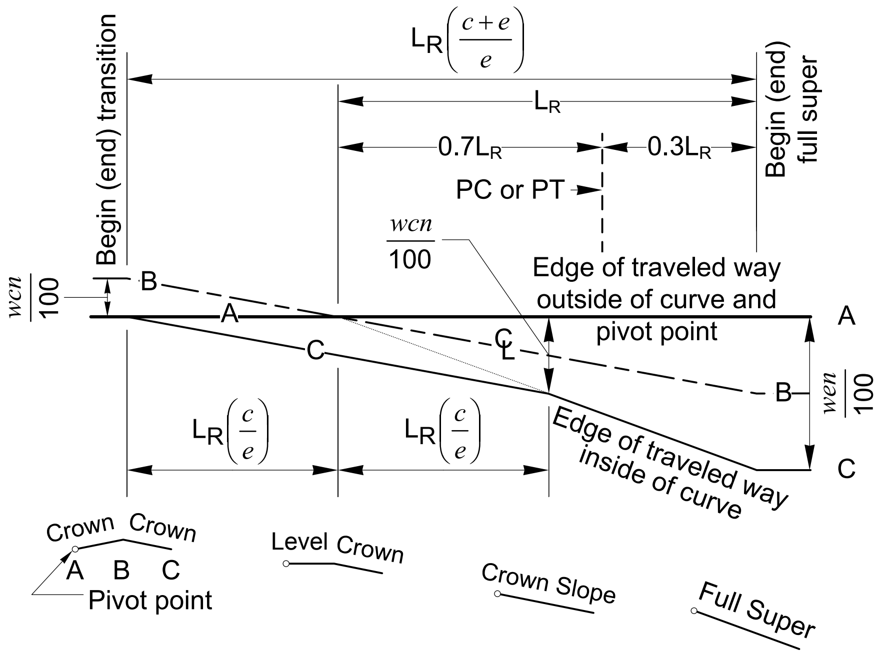
c = Normal crown (%)

e = Superelevation rate (%)

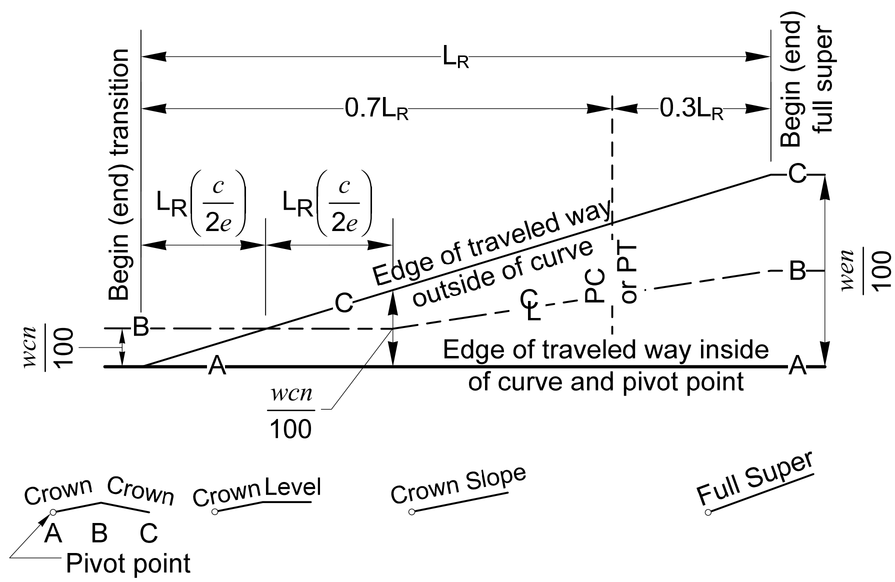
n = Number of lanes between points

w = Width of lane

Superelevation Transitions for Highway Curves
Figure 642-6a



Design B[1] – Pivot Point on Edge of Traveled Way: Outside of Curve Crowned Section



Design B[2] – Pivot Point on Edge of Traveled Way: Inside of Curve Crowned Section

c = Normal crown (%)

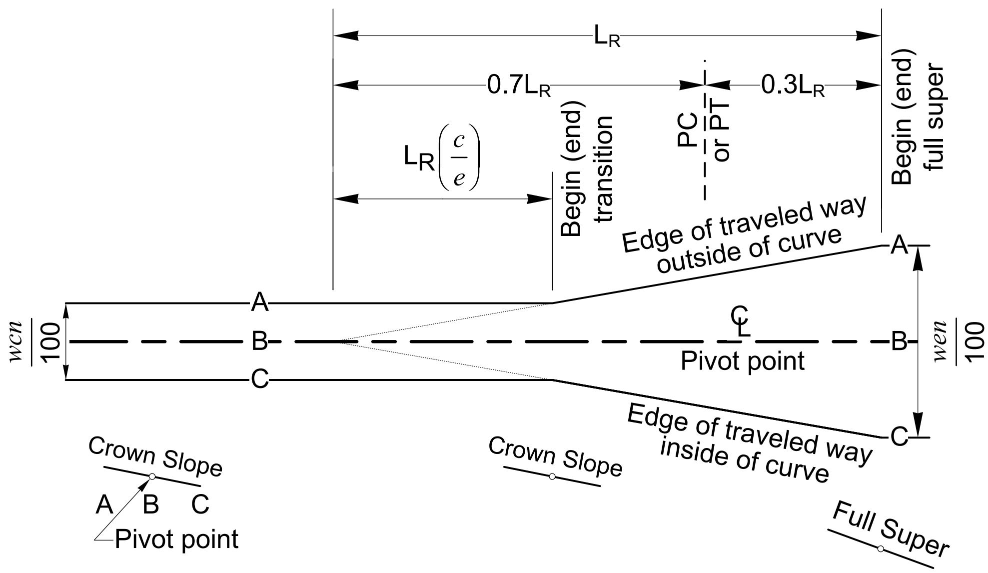
e = Superelevation rate (%)

n = Number of lanes between points

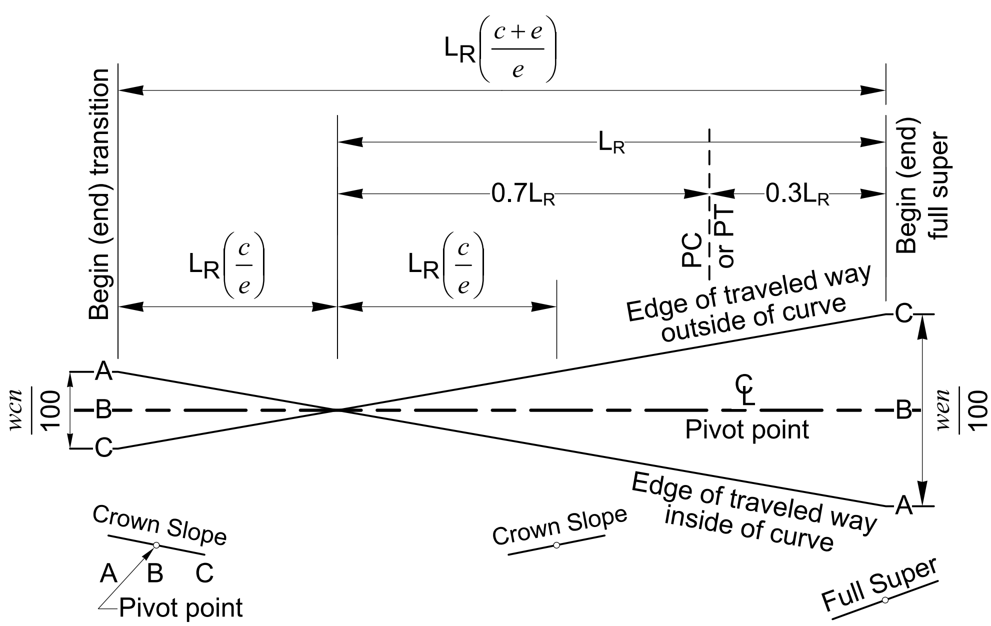
w = Width of lane

Superelevation Transitions for Highway Curves

Figure 642-6b



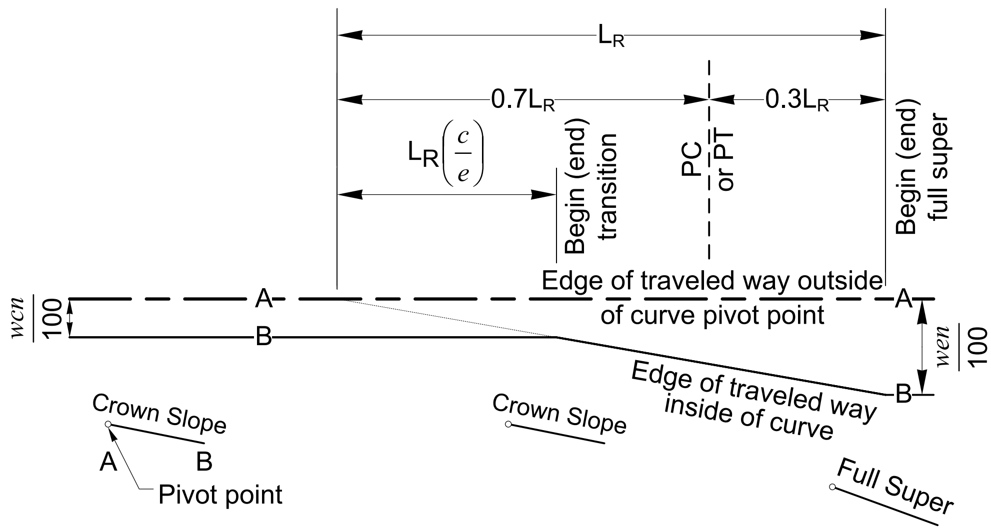
Design C¹ – Pivot Point on Centerline Curve in Direction of Normal Pavement Slope: Plane Section



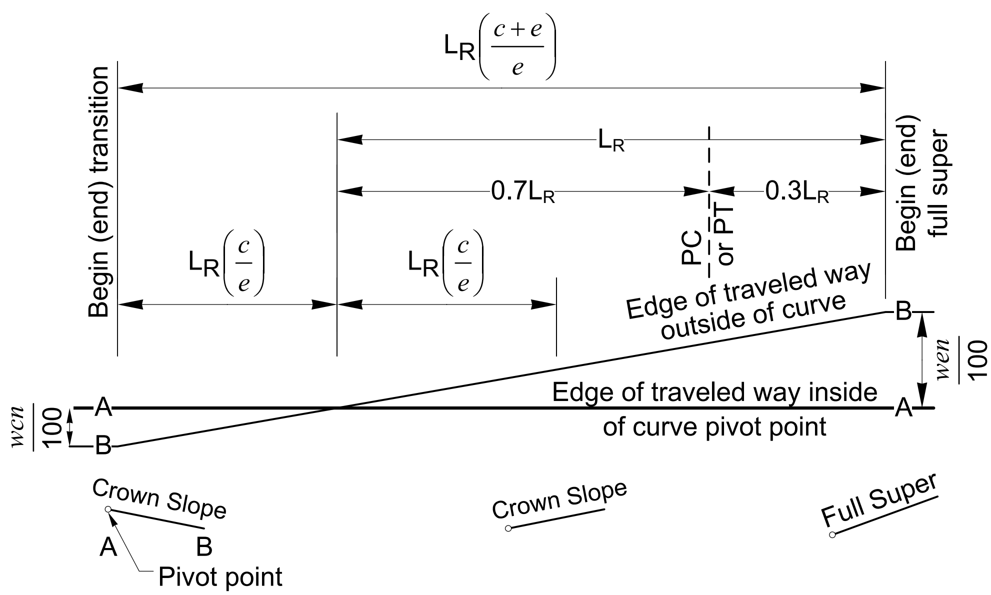
Design C² – Pivot Point on Centerline Curve Opposite to Normal Pavement Slope: Plane Section

c = Normal crown (%)
e = Superelevation rate (%)
n = Number of lanes between points
w = Width of lane

Superelevation Transitions for Highway Curves
Figure 642-6c



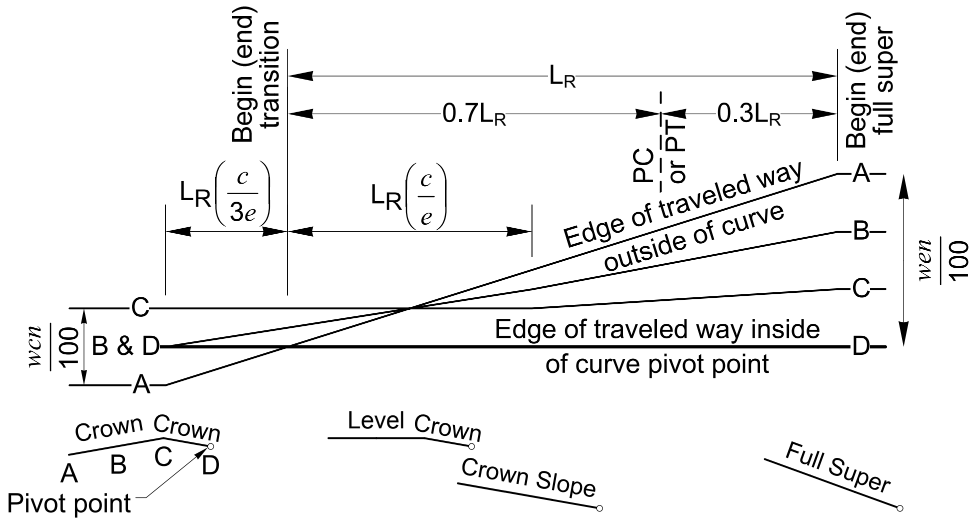
Design D[1] – Pivot Point on Edge of Traveled Way Curve in Direction of Normal Pavement Slope: Plane Section



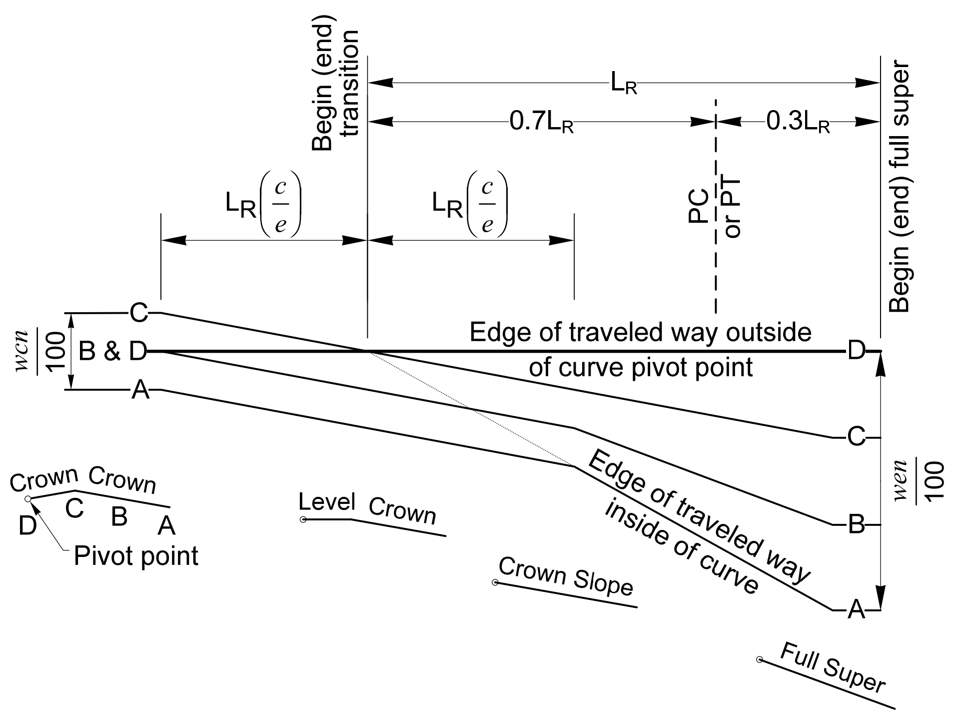
Design D[2] – Pivot Point on Edge of Traveled Way Curve Opposite to Normal Pavement Slope: Plane Section

c = Normal crown (%)
e = Superelevation rate (%)
n = Number of lanes between points
w = Width of lane

Superelevation Transitions for Highway Curves
Figure 642-6d



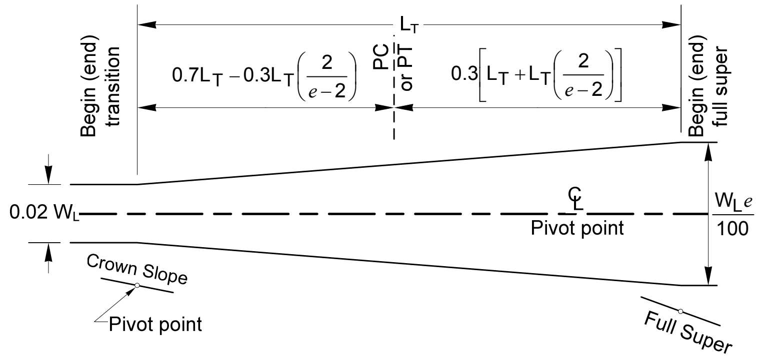
Design E[1] – Six Lane With Median, Pivot Point on Edge of Traveled Way: Inside of Curve Crown Section



Design E[2] – Six Lane With Median, Pivot Point on Edge of Traveled Way: Outside of Curve Crown Section

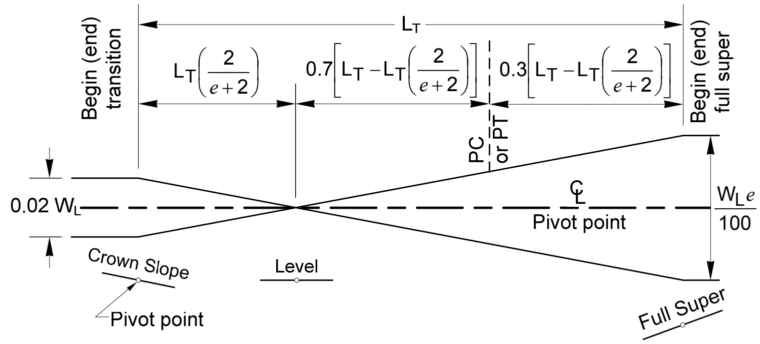
c = Normal crown (%)
e = Superelevation rate (%)
n = Number of lanes between points
w = Width of lane

Superelevation Transitions for Highway Curves
Figure 642-6e



e (%)	Length of Transition in Feet for Design Speed							
	20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph
	L_T	L_T	L_T	L_T	L_T	L_T	L_T	L_T
3	10	15	15	15	15	15	15	15
4	20	25	25	25	25	30	30	35
5	30	35	35	35	40	45	45	50
6	40	45	45	50	55	55	60	65
7	50	55	55	60	65	70	75	80
8	60	65	70	75	80	85	90	95
9	70	75	80	85	95	100	105	110
10	80	85	90	100	105	115	120	130

Table 1 Pivot Point on Centerline – Curve in Direction of Normal Pavement Slope



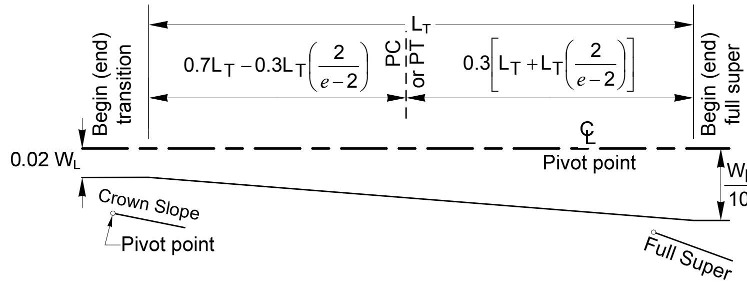
e (%)	Length of Transition in Feet for Design Speed							
	20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph
	L_T	L_T	L_T	L_T	L_T	L_T	L_T	L_T
2	40	40	45	50	55	55	60	65
3	50	55	55	60	65	70	75	80
4	60	65	70	75	80	85	90	95
5	70	75	80	85	90	100	105	110
6	80	85	90	95	105	115	120	130
7	90	95	100	110	120	125	135	145
8	100	105	115	120	130	140	150	160
9	110	120	125	135	145	155	165	175
10	120	130	135	145	160	170	180	190

Table 2 Pivot Point on Centerline – Curve in Direction Opposite to Normal Pavement Slope

W_L = width of ramp lane

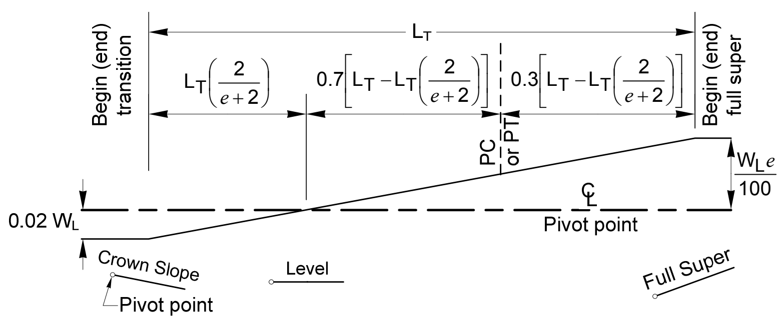
Superelevation Transitions for Ramp Curves

Figure 642-7a



e (%)	Length of Transition in Feet for Design Speed							
	20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph
	L_T	L_T	L_T	L_T	L_T	L_T	L_T	L_T
3	20	25	25	25	25	30	30	35
4	40	45	45	50	55	55	60	65
5	60	65	70	75	80	85	90	95
6	80	85	90	100	105	115	120	130
7	100	105	115	120	130	140	150	160
8	120	130	135	145	160	170	180	190
9	140	150	160	170	185	195	210	225
10	160	170	180	195	210	225	240	255

Table 3 Pivot point on edge of traveled way – Curve in direction of normal pavement slope



e (%)	Length of Transition in Feet for Design Speed							
	20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph
	L_T	L_T	L_T	L_T	L_T	L_T	L_T	L_T
2	80	85	90	100	105	115	120	130
3	100	105	115	120	130	140	150	160
4	120	130	135	145	160	170	180	190
5	140	150	160	170	185	195	210	225
6	160	170	180	195	210	225	240	255
7	180	190	205	220	235	255	270	290
8	200	210	225	245	265	280	300	320
9	220	235	250	265	290	310	330	350
10	240	255	270	290	315	340	360	385

Table 4 Pivot point on edge of traveled way – Curve in direction opposite to normal pavement slope
W_L = width of ramp lane

Superelevation Transitions for Ramp Curves
Figure 642-7b

Chapter 820 Signing

820.01 General

Signing is a primary mechanism for regulating, warning, and guiding traffic. Signing must be in place when any section of highway is open to the motoring public. Each highway project has unique and specific signing requirements. For statewide signing uniformity and continuity, it is sometimes necessary to provide signing beyond the project limits. Design characteristics of the facility determine the size and legend for a sign. As the design speed increases, larger sign sizes are necessary to provide adequate message comprehension time. The MUTCD, the *Traffic Manual*, and the *Sign Fabrication Manual* contain standard sign dimensions, specific legends, and reflective sheeting types for all new signs.

Guide signing provides the motorist with directional information to destinations. This information is always presented in a consistent manner. In some cases, there are specific laws, regulations, and policies governing the content of the messages on these signs. All proposed guide signs for a project require the approval of the Region Traffic Engineer. The use of nonstandard signs is strongly discouraged and their use requires the approval of the State Traffic Engineer.

The design matrices in Chapter 325 identify the design levels for signing on all Preservation and Improvement projects. These levels are indicated in the column "Signing" for Interstate main line and the column "Signing, Delineation, and Illumination" for all other routes.

Review and update existing signing within the limits of all Preservation and Improvement projects as indicated in the matrices. Provide standard signing on projects with either a "B" (basic design level) or "EU" (evaluate upgrade) matrix designation. Apply the following criteria when determining whether to replace or modify existing signs:

- Lack of nighttime retroreflectivity
- Substantial damage, vandalism, or deterioration
- Age of signs (seven to ten years old)
- A change in sign use policy
- Improper location
- Message or destination changes necessary to satisfy commitments to public or local agencies
- Substandard mounting height
- Change in jurisdiction (for example, a county road becomes a state route)

Address sign support breakaway features when identified in the "Clear Zone" columns of the matrices. When the "F" (full design level) matrix designation is present, the preceding criteria are still applicable and all existing signing is required to conform to the current policy for reflective sign sheeting requirements. Remove or replace signing not conforming to this policy.

820.02 References

(1) Federal/State Laws and Codes

23 CFR 655, Traffic Operations to Section 820.02(1)

Directive D 32-20, "State Route Mileposts," WSDOT

RCW 47.36, Traffic control devices

(2) Design Guidance

Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), 2003 Edition, FHWA, 2003, including the Washington State Modifications to the MUTCD, M 24-01, 2003

Plans Preparation Manual, M 22-31, WSDOT

Sign Fabrication Manual, M 55-05, WSDOT

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

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 4^{th} Edition, Washington DC, AASHTO, 2001

Traffic Manual, M 51-02, WSDOT

820.03 Design Components

(1) Location

The MUTCD contains the guidelines for positioning signs. Check sign locations to ensure that the motorist's view of the sign is not obscured by other roadside appurtenances. Also, determine whether the proposed sign will obstruct the view of other signs or limit the motorist's sight distance of the roadway. Reposition existing signs, when necessary, to satisfy these visibility requirements. Where possible, locate signs behind existing traffic barriers, on grade separation structures, or where terrain features will minimize their exposure to errant vehicles.

(2) Longitudinal Placement

The MUTCD and the *Traffic Manual* provide guidelines for the longitudinal placement of signs that are dependent on the type of sign. Select a location to fit the existing conditions to ensure visibility and adequate response time. In most cases, signs can be shifted longitudinally to enhance safety without compromising their intended purpose.

(3) Lateral Clearance

The *Standard Plans* and the MUTCD contain minimum requirements for the lateral placement of signs. Where possible, position the signs at the maximum feasible lateral clearance for safety and reduced maintenance costs. Locate large guide signs and motorist information signs beyond the Design Clear Zone (see Chapter 700) when limited right of way or other physical constraints are not a factor. On steep fill slopes, an errant vehicle is likely to be partially airborne from the slope break near the edge of shoulder to a point 12 feet down the slope. When signs are placed on fill slopes steeper than 6H:1V, locate the support at least 12 feet beyond the slope break.

Use breakaway sign support features, when required, for signs located within the Design Clear Zone and for signs located beyond this zone where there is a possibility they might be struck by an errant vehicle. Breakaway features are not necessary on signposts located behind traffic barriers. Install longitudinal barriers to shield signs without breakaway features located within the Design Clear Zone when no other options are available.

Sign bridges and cantilever sign structures have limited span lengths. Locate the vertical components of these structures as far from the traveled way as possible and, where appropriate, install traffic barriers (see Chapter 710).

Do not locate signposts in the bottom of a ditch or where the posts will straddle the ditch. The preferred location is beyond the ditch or on the ditch backslope (see the *Standard Plans*). In high fill areas, where conditions require placement of a sign behind a traffic barrier, consider adding embankment material to reduce the length of the sign supports.

(4) Sign Heights

For ground-mounted signs installed at the side of the road, provide a mounting height of at least 7 feet, measured from the bottom of the sign to the edge of traveled way. Supplemental plaques, when used, are mounted directly below the primary sign. At these locations, the minimum mounting height of the plaque is 5 feet.

Do not attach supplemental guide signs to the posts below the hinge mechanism or the saw cut notch on multiple-post installations. The location of these hinges or saw cuts on the sign supports are shown in the *Standard Plans*.

A minimum 7-foot vertical height from the bottom of the sign to the ground directly below the sign is necessary for the breakaway features of the sign support to function properly when struck by a vehicle. The minimum mounting height for new signs located behind longitudinal barriers is 7 feet, measured from the bottom of the sign to the edge of traveled way. A lower mounting height of 5 feet may be used when replacing a sign panel on an existing sign assembly located behind the longitudinal barrier. The *Standard Plans* shows typical sign installations.

For ground-mounted signs installed on multiple posts that are a minimum of 12 feet from the edge of traveled way in cut sections, the minimum height clearance between the sign and the ground for the post farther from the edge of traveled way is as follows:

- For slopes 2H:1V and steeper, the minimum height clearance is 2 feet
- For slopes 3H:1V or flatter, the minimum height clearance is 7 feet

Signs used to reserve parking for people with disabilities are installed at each designated parking stall and are mounted 7 feet above the surface at the sign location.

(5) Foundations

Foundation details for timber and steel ground-mounted sign supports are shown in the *Standard Plans*, which also contains foundation designs for truss-type sign bridges and cantilever sign structures. Three designs, Types 1, 2, and 3, are shown for each structure.

An investigation of the foundation material is necessary to determine the appropriate foundation design. Use the data obtained from the geotechnical report to select the foundation type.

- The Type 1 foundation design uses a large concrete shaft and is the preferred installation when the lateral bearing pressure of the soil is 2500 psf or greater.
- The Type 2 foundation design has a large rectangular footing design and is an alternative to the Type 1 foundation when the concrete shaft is not suitable.
- The Type 3 foundation design is used in poorer soil conditions where the lateral bearing pressure of the soil is between 1500 psf and 2500 psf.

If a nonstandard foundation or monotube structure design is planned, forward the report to the Headquarters (HQ) Bridge and Structures Office for use in developing a suitable foundation design (see Chapter 510).

(6) Signposts

Ground-mounted signs are installed on either timber posts, laminated wood box posts, or steel posts. The size and number of posts required for a sign installation are based on the height and surface area of the sign, or signs, being supported. Use the information in Figures 820-2, 820-3, and 820-4 and the *Standard Plans* to determine the posts required for each installation. Coordinate with the Region Maintenance Office concerning signpost installation.

Use steel posts with breakaway supports that are multidirectional if the support is likely to be hit from more than one direction. For any wide flange multiple-steel post installations located within the Design Clear Zone, the total weight of all the posts in a 7-foot-wide path shall not exceed a combined post weight of 34 lbs/foot. Use the Wide Flange Beam Weights table in Figure 820-3 to determine wide flange steel post weights. If the proposed sign configuration does not meet the weight criterion, relocate, resize, or provide barrier protection for the proposed installation.

All signposts are to be designed to 90 mph wind loads. Design features of breakaway supports are shown in the *Standard Plans*. Steel signposts commonly used are: Perforated Square Steel Tube (PSST); Square Steel Tube (SST); Round Pipe (RP); and Wide Flange “H-Beam.” Steel posts with Type TP-A, TP-B, PL, PL-T, PL-U, AS, AP, SB-1, and SB-2 bases have multidirectional breakaway features.

820.04 Overhead Installation

Conditions justifying the use of overhead sign installations are noted in the MUTCD. Where possible, mount overhead signs on grade separation structures rather than sign bridges or cantilever supports.

Details for the construction of truss-type sign bridges and cantilever sign supports are shown in the *Standard Plans*.

The HQ Bridge and Structures Office designs structure-mounted sign mountings, monotube sign bridges, and monotube cantilever sign supports. For overhead sign installation designs, provide sign dimensions, horizontal location in relation to the roadway, and location of the lighting fixtures to facilitate design of the mounting components by the HQ Bridge and Structures Office.

(1) Illumination

The retroreflectivity of currently approved sign sheeting removes the need to provide illumination for most sign installations. Ground-mounted signing, regardless of sign type or message content, does not require sign lighting for nighttime legibility. Only overhead-mounted signs with "EXIT ONLY" panels in noncontinuous illumination areas or overhead-mounted guide signs for left side exits in all areas are illuminated.

The sign lights for existing illuminated overhead and ground-mounted signs can only be de-energized and removed if the retroreflective sheeting is adequate for nighttime legibility. A nighttime assessment of all nonilluminated overhead signs within the project limits is required. Replace all signs that have inadequate retroreflectivity (contact the Region Traffic Office). In situations where a nonhighway light source interferes with a sign's legibility, consider relocating the sign or providing sign lights.

Flashing beacon signs are used to alert a motorist of an unusual or unexpected driving condition ahead. Sign lights are unnecessary on flashing beacon signs when appropriate sign sheeting, full circle or tunnel signal head visors, and automatic dimmer devices are used.

All other overhead signs are illuminated only when one of the following conditions is present:

- Sign visibility is less than 800 feet due to intervening sight obstructions such as highway structures or roadside features
- Signs directly adjacent to other overhead signs have sign lights

Overhead Sign Type	Continuous or Noncontinuous Illumination	Sign Lighting Required	Sheeting Type (Background)	Sheeting Type (Legend & Border)
EXIT ONLY guide sign	Continuous	No	IV*	VIII or IX
EXIT ONLY guide sign	Noncontinuous	Yes	II	III or IV
Guide signs for left side exits	Both	Yes	II	III or IV
Other guide signs	Both	No	III or IV	VIII or IX
Regulatory signs	Both	No	IV	n/a
Warning signs	Both	No	VIII or IX	n/a

Note:
Full (Continuous) Illumination is when light standards (luminaires) exist between interchanges.
* For Yellow Background Sheeting, use Type VIII or IX Fluorescent Sheeting.

Reflective Sheeting Requirements for Overhead Signs
Figure 820-1

(2) Vertical Clearance

The minimum vertical clearance from the roadway surface to the lowest point of an overhead sign assembly is 17 feet 6 inches. The minimum vertical clearance from the roadway surface to the lowest point of an overhead sign assembly without sign light(s) is 19 feet 6 inches. The maximum clearance is 21 feet. Contact the HQ Traffic Office regarding signs under bridges and in tunnels.

(3) Horizontal Placement

Consider roadway geometrics and anticipated traffic characteristics when locating signs above the lane, or lanes, to which they apply. Install advance guide signs and exit direction signs that require an EXIT ONLY and “down arrow” panel directly above the drop lanes. To reduce driver confusion about which lane is being dropped, avoid locating a sign with an EXIT ONLY panel on a horizontal curve.

(4) Service Walkways

Walkways are provided on structure-mounted signs, truss-type sign bridges, and truss-type cantilever sign supports where roadway and traffic conditions prohibit normal sign maintenance activities. Monotube sign bridges and cantilever sign supports normally do not have service walkways.

Vandalism of signs, particularly in the form of graffiti, can be a major problem in some areas. Vandals sometimes use the service walkways. Maintenance costs for cleaning or replacing vandalized signs at these locations can exceed the benefit of providing the service walkway.

820.05 State Highway Route Numbers

For state routes, RCW 47.36.095 authorizes WSDOT to sign state highways using a system of state route numbers assigned to eliminate duplication of numbers. This numbering system follows the system employed by the federal government in the assignment of interstate and U.S. routes: odd numbers indicate general north-south routes and even numbers indicate general east-west routes.

820.06 Mileposts

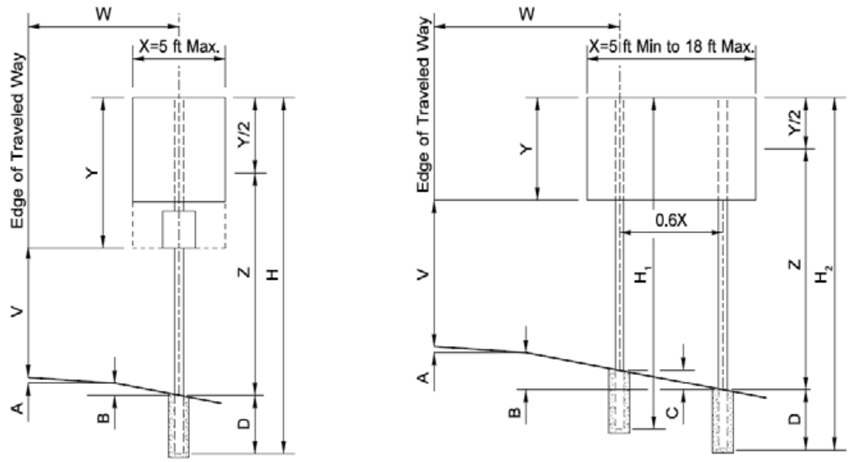
Milepost markers are a part of a statewide system for all state highways and are installed in accordance with Directive D 32-20, State Route Mileposts.

820.07 Guide Sign Plan

A preliminary guide sign plan is developed to identify existing and proposed guide signing on state highways and is reviewed by the Region Traffic Engineer. Preliminary guide signs for interstate routes are to be furnished to the HQ Traffic Operations Office for review and concurrence. The plan provides an easily understood graphic representation of the signing and its continuity to motorist destinations, activities, and services. It is also used to identify deficiencies or poorly defined routes of travel. A guide sign plan for safety and mobility improvement projects is desirable. When proposed highway work affects signing to a city or town, the guide sign plan can be furnished to the official governing body for review and consideration. The guide sign plan is reviewed and approved by the Region Traffic Engineer.

820.08 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
🖰 www.wsdot.wa.gov/design/projectdev/



Notes:

The following designs are *not permitted* when a sign is to be located in or outside the design clear zone in an area where it is likely to be struck by an errant vehicle:

1. A sign with any post larger than 6x8 inches
2. A 2-post, 3-post, or 4-post sign that uses 6-inch or larger posts and has two posts spaced less than 7 ft apart on center.

Table 1 Timber Post Selection

Post Size (in)	(X)(Y)(Z) (ft^3)				D (ft)
	Number of Posts				
	1	2	3	4	
4 x 4	60	115	175	235	3
4 x 6	125	335	500	675	4
6 x 6	200	415	620	815	4
6 x 8	330	695	1150	1515	5
6 x 10	670	1355	2030	2700	6
8 x 10	835	1685	2515	3360	6
6 x 12	985	2005	2965	3945	7

Values shown are the maximum permitted.

For timber grade requirements, see the *Standard Specifications*, 9-09.2.

Foundation depths are based on allowable lateral bearing pressure in excess of 2500 psf.

If the value (X)(Y)(Z) amount exceeds the limit for 6x12 post(s), use steel post(s) for sign installation.

A = Vertical distance from edge of traveled way to edge of shoulder

B = Vertical distance from slope catch point to centerline of longest post

C = Vertical distance between adjacent posts

X & Y = Single sign or back-to-back signs: overall dimensions of the sign – Multiple signs: dimensions of the area within the perimeter of a rectangle enclosing the extremities of the sign

Z = Height from ground line to midheight of sign at the centerline of the longest post

D = Embedment depth

H = Total post height

V = Vertical clearance from edge of traveled way

W = Distance from edge of traveled way to the centerline of the post nearest the roadway

Design Example – Single Post

Given:

Sign 3 ft wide, 3.5 ft high; a secondary sign 1.5 ft wide, 2 ft high, mounted 3 inches (0.25 ft) below; 8-ft shoulder with 2% slope; 6H:1V embankment; W = 15 ft; V = 5 ft

Solution:

X = 3 ft
Y = 3.5 + 2 + 0.25 = 5.75 ft
A = (0.02)(8) = 0.16
B = (W-8)/6 = (15-8)/6 = 1.17
Z = Y/2 + V + A + B
= (5.75/2) + 5 + 0.16 + 1.17 = 9.2 ft
(X)(Y)(Z) = (3)(5.75)(9.2) = 158.7 ft^3
Since 159 ft^3 < 200 ft^3, from Table 1, select 6x6 post

H = 9.2 + (5.75/2) + 4 = 16.1 ft

Design Example – Double Post

Given:

Sign 12 ft wide, 4 ft high; 10-ft shoulder with 2% slope; 6H:1V embankment; W = 25 ft; V = 7 ft

Solution:

X = 12 ft; Y = 4 ft
A = (0.02)(10) = 0.2
B = [(W-10) + (0.6X)]/6 = [(25-10) + (0.6)(12)]/6 = 3.7
C = (0.6)(12)/6 = 1.2
Z = Y/2 + V + A + B = 4/2+7 + 0.2 + 3.7 12.9 ft
(X)(Y)(Z) = (12)(4)(12.9) = 619 ft^3

Since 619 ft^3 < 695 ft^3, select two 6x8 posts.

H_2 = Y/2 + Z + D = 4/2 + 12.9 + 5 = 19.9 ft

H_1 = H_2-C = 19.9-1.2 = 18.7 ft

Note: 6x6 and larger posts require 7-ft spacing. Sign may be installed within the Design Clear Zone.

Timber Posts
Figure 820-2

X & Y = Single sign or back-to-back signs: overall dimensions of the sign – Multiple signs: dimensions of the area within the perimeter of a rectangle enclosing the extremities of the signs

Z = Height from the base connection (2½ inches above the post foundation for wide flange beams) to the midheight of the sign at the centerline of the longest post

H = Post length

V = Vertical clearance from the edge of traveled way

W = Distance from the edge of traveled way to the centerline of the longest post nearest the roadway

Design Example – Steel Post Selection

Given:

Sign 22 ft wide, 12 ft high; 10-ft shoulder with 2% slope; 3H:1V embankment; W = 32 ft; V = 7ft.

Solution:

X = 22
Y = 12
A = (0.02)(10) = 0.2
B = [(W-10)+(0.7)(X/3)] = [(32-10)+(0.7x22)]/3 = 12.5
C = (0.35)(22)/3 = 2.6
Z = Y/2 + V + A + B-0.21
= 12/2 + 7 + 0.2 + 12.5-0.21 = 25.5 ft
(X)(Y)(Z) = (22)(12)(25.5) = 6729 ft^3
Since 6729 ft^3 < 9480 ft^3, select three W10x26 (ASTM A36) or W10x22 (ASTM A992) (See the *Standard Plans*.)

H3 = 12/2 + 25.5 = 31.5 ft

H2 = H3-C = 31.5-2.6 = 28.9 ft

H1 = H2-C = 28.9-2.6 = 26.3 ft

Table 1 Wide Flange Steel Post Selection

Wide Flange Beam			
Post Size		(X)(Y)(Z) (ft^3)	
		Number of Posts	
ASTM A992	ASTM A36	2	3
W6x9	W6x12	1570	2355
W6x12	W6x16	2340	3510
W8x18	W8x21	4120	6180
W10x22	W10x26	6320	9480
W12x26	W12x30	8700	- - -

Table 2 Wide Flange Beam Weights

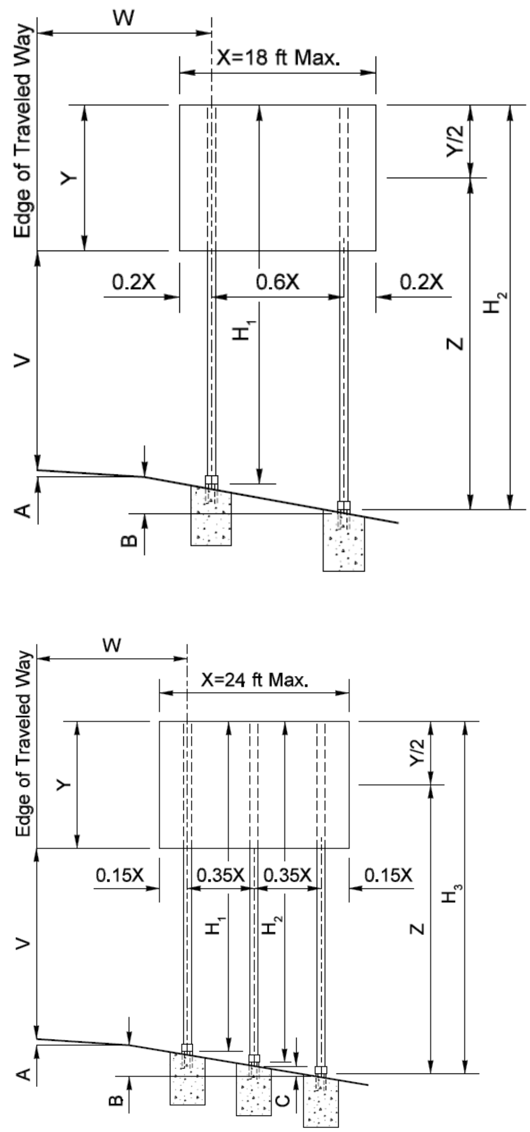
Beam Size	Weight lbs/ft	Beam Size	Weight lbs/ft
W6x9	9	W8x21	21
W6x12	12	W10x22	22
W6x16	16	W10x26	26
W6x18	18	W12x26	26
		W10x30	30

Notes:

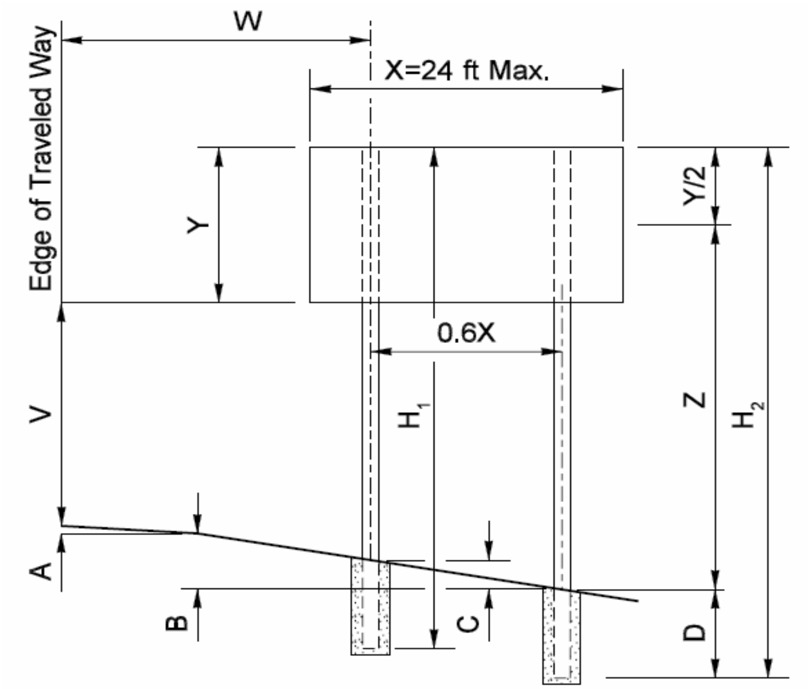
Values shown in Table 1 are the maximum permitted. A single-wide flange post installation is not allowed.

Consider using one of the following: perforated square steel tube posts, solid steel tube posts, or round steel posts.

For post selection for other than wide flange beam supports and a single-post assembly, see the *Standard Plans*. To determine post sizes for these types of posts, use the wind load charts at:
www.wsdot.wa.gov/design/traffic/signing
(See the *Standard Plans* for additional information.)



Wide Flange Steel Posts
Figure 820-3



X & Y = Single sign or back-to-back signs: overall dimensions of the sign – Multiple signs: dimensions of the area within the perimeter of a rectangle enclosing the extremities of the signs

Z = Height from ground line to the midheight of the sign at the centerline of the longest post

D = Embedment depth

H = Post length

V = Vertical clearance from edge of traveled way

W = Distance from edge of traveled way to the centerline of the post nearest the roadway. (See the *Standard Plans*.)

Design Example – M Post Selection

Given:

Two-post assembly sign 16 ft wide, 6 ft high; 10-ft shld with 2% slope; 6H:1V embankment; W = 25 ft.; V = 7 ft.

Solution:

X = 16
Y = 6
A = (0.02)(10) = 0.2
B = [(W-10) + 0.6X]/6
= [(25-10) + (0.6)(16)]/6 = 4.1
C = (0.6X)/6 = (0.6)(16)/6 = 1.6
Z = Y/2 + V + A + B = 6/2 + 7 + 0.2+4.1 = 14.3 ft
(X)(Y)(Z) = (16)(6)(14.3) = 1373 ft^3
Since 1373 ft^3 < 1661 ft^3 from Table 1, select a post type M.

H2 = Y/2 + Z + D = 6/2 + 14.3 + 6 = 23.3 ft

H1 = H2-C = 23.3-1.6 = 21.7 ft

Table 1 Laminated Wood Box Post Selection

Post Type	Size (in)	Z (ft)	(X)(Y)(Z) ft^3
M	7⅞ x 7⅞	15 < Z≤ 26	1329
M	7⅞ x 7⅞	Z ≤ 15	1661
L	7⅞ x 14⅞	15 < Z ≤ 26	3502
L	7⅞ x 14⅞	Z ≤ 15	4378

Table 2 Embedment Depth (D)

Z (ft)	Sign Area Feet ^{2}					
	Up to 50	51 to 100	101 to 150	151 to 200	201 to 250	251 to 290
9 to 12	6	6	7	8	9	10
13 to 15	6	6	7.5	9	10	
16 to 18	7	7.5	9			
19 to 22	7	8	10			
23 to 26	7.5	8.5				

Design Example – L Post Selection

Given:

Two-post assembly sign 18 ft wide, 8 ft high;10-ft shld with 2% slope; 6H:1V embankment W = 25 ft; V = 7 ft.

Solution:

X = 18
Y = 8
A = (0.02)(10) = 0.2
B = [(W-10)+(0.6X)]/6 = [(25-10)+(0.6)(18)]/6 = 4.3
C = 0.6X/6 = (0.618)/6 = 1.8
Z = Y/2 + V + A + B = 8/2 + 7 + 0.2 + 4.3 = 15.5 ft
(X)(Y)(Z) = (18)(8)(15.5) = 2232 ft^3
Since 2232 ft^3 < 3502 ft^3 from Table 1, select a post type L.

H2 = Y/2 + Z + D = 8/2 + 15.5 + 9 = 28.5 ft

H1 = H2-C = 28.5 – 1.8 = 26.7 ft

Laminated Wood Box Posts
Figure 820-4

Chapter 840 Illumination

840.01 General

Illumination is provided along highways, in parking lots, and at other facilities to enhance the visual perception of conditions or features that require additional motorist, cyclist, or pedestrian alertness during the hours of darkness.

WSDOT is responsible for illumination on state highways and crossroads (per WAC 468-18-050 and WAC 468-18-040) with partial limited access control, modified limited access control, or full limited access control, regardless of the location. WSDOT is responsible for illumination on state highways and crossroads (per WAC 468-18-050) with managed access control that are located outside the corporate limits of cities. Cities are responsible for illumination on managed access state highways within their corporate limits.

For the definitions of limited access control and managed access control, see Chapter 1420. For a listing (by milepost) of the limited access or managed access status of all state highways, see the "Access Control Tracking System, Limited Access and Managed Access Master Plan," under the RELATED SITES heading: www.wsdot.wa.gov/eesc/design/access/. Refer to the WSDOT/Association of Washington Cities agreement "City Streets as Part of State Highways" (www.wsdot.wa.gov/TA/Operations/LAG/CityStreets.html) for further information.

840.02 References

(1) Federal/State Laws and Codes

National Electrical Code, NFPA, Quincy, MA

RCW 47.24.020, Jurisdiction, control

WAC 296-24-960, Working on or near exposed energized parts

WAC 468-18-040, Design standards for rearranged county roads, frontage roads, access roads, intersections, ramps and crossings

WAC 468-18-050, Policy on the construction, improvement and maintenance of intersections of state highways and city streets

(2) Design Guidance

American National Standard Practice for Roadway Lighting, IES RP-8-00, New York, NY 2000

Directive D 22-21, "Truck Weigh Stations and Vehicle Inspection Facilities on State Highways"

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

NFPA 502: Standard for Road Tunnels, Bridges, and Other Limited Access Highways, NFPA, Quincy, MA 2008

Roadway Lighting Design Guide, AASHTO, October 2005

Roadway Lighting Handbook, Addendum to Chapter Six: Designing the Lighting System Using Pavement Luminance, Federal Highway Administration, Addendum to Implementation Package 78-15, Washington, DC 1983

Roadway Lighting Handbook, Federal Highway Administration, Implementation Package 78-15, Washington, DC 1978 (Reprinted April 1984)

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

(3) Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

An Informational Guide for Roadway Lighting, AASHTO, Washington, DC 1984

City Streets as a Part of State Highways, Final Report, WSDOT, 1997

Light Trespass: Research Results and Recommendations, IES TM-11-00, New York, NY 2000

Recommended Practice for Tunnel Lighting, IESNA RP-22-05, New York, NY 2005

840.03 Definitions

average light level The average of all light intensities within the design area.

complex ramp alignment and grade The exit advisory speed is mph or lower than the posted main line speed, or there is a 6% or greater change in grade from existing main line grade to the ramp grade.

continuous load The electrical load on a circuit that lasts for a duration of three or more hours on any day.

footcandle (fc) The illumination of a surface one square foot in area on which a flux of one lumen is uniformly distributed. One footcandle equals one lumen per square foot.

lamp lumens The total light output from a lamp, measured in lumens.

lumen The unit used to measure luminous flux.

luminaire A complete lighting unit comprised of a light bulb, wiring, and a housing unit.

luminance The quotient of the luminous flux at an element of the surface surrounding the point and propagated in directions defined by an elementary cone containing the given direction, by the product of the solid angle of the cone and area of the orthogonal projection of the element of the surface on a plane perpendicular to the given direction. The luminous flux may be leaving, passing through, and/or arriving at the surface.

luminous flux The time rate of the flow of light.

maximum uniformity ratio The average light level within the design area divided by the minimum light level within the design area (see Figure 840-25).

maximum veiling luminance ratio This ratio is the maximum veiling luminance divided by the average luminance over a given design area for an observer traveling parallel to the roadway centerline (see Figure 840-25).

minimum average light level The average of all light intensities within the design area, measured just prior to relamping the system (see Figure 840-25, Note 1).

minimum light level The minimum light intensity of illumination at any single point within the design area measured just prior to relamping the system (see Figure 840-25, Note 1).

mounting height – luminaire The vertical distance between the surface of the design area and the center of the light source of the luminaire. Note: This is not to be confused with pole height (H1), but is the actual distance that the luminaire is located above the roadway edge line.

multimodal connection The point where multiple types of transportation activities occur; for example, where transit buses and van pools drop off or pick up passengers (including passengers with bicycles).

nighttime The period of time from one-half hour after sunset to one-half hour before sunrise and any other time when persons or objects may not be clearly discernable at a distance of 500 feet (RCW 46.04.200).

pedestrian crossing For the purpose of lighting design, the number of pedestrian movements that cross through the design area.

pole height (H1) The vertical distance from the light source to the pole base. This distance is specified in contracts and used by the pole manufacturers to fabricate the light standard.

roadway luminance The light projected from a luminaire that travels toward a given area, represented by a point on the pavement surface, and then back toward the observer, opposite to the direction of travel. The units of roadway luminance are footcandles.

security lighting A minimal amount of lighting used to illuminate areas for public safety or theft reduction. Security lighting for walkways is the lighting of areas where shadows and horizontal and vertical geometry obstruct a pedestrian's view.

SIgnal Maintenance Management System (SIMMS) A database system to help the Signal Maintenance department manage work and inventory data. SIMMS is used to enter work reports for maintenance jobs, print timesheets, and maintain location records for Signals inventory.

slip base A mechanical base designed to allow the light standard to break away from the fixed foundation when hit by a vehicle traveling at the design speed.

spacing The distance in feet measured on centerline between adjacent luminaires.

transit flyer stop A multimodal connection located within the boundaries of a limited access facility.

transit stop A connection on the highway where the transit bus stops to pick up or drop off passengers.

uniformity ratio The ratio of the minimum average light level on the design area to the minimum light level of the same area (see Figure 840-25).

veiling luminance The stray light produced within the eye by light sources produces a veiling luminance that is superimposed on the retinal image of the objects being observed. This stray light alters the apparent brightness of an object within the visual field and the background against which it is viewed, thereby impairing the ability of the driver to perform visual tasks. Conceptually, veiling luminance is the light that travels directly from the luminaire to the observer's eye.

840.04 Design Considerations

An illumination system is built from many separate components. The simplest illumination system contains the following:

- A power feed from the local utility company
- An electrical service cabinet containing a photocell and circuit breaker for each illumination circuit
- Runs of conduit with associated junction boxes leading to each luminaire
- Conductors routed from the service cabinet breaker to each luminaire
- A concrete light standard foundation
- A light standard with a slip base or a fixed base
- A luminaire (light) over or near the roadway edge line

There are design considerations that need to be addressed when performing even the most minimal work on an existing illumination system. An existing electrical system is acceptable for use under the design requirements and National Electric Code (NEC) rules that were in effect at the time of installation. When modifying an existing electrical system, the designer is responsible for bringing the whole system up to current NEC design standards. Retrofitting an existing fixed base light standard with a slip base feature requires the installation of quick disconnect fittings and fuses in the circuit, at the luminaire. The existing conductor configuration for a fixed base luminaire is not acceptable for use on a breakaway (slip base) installation. Existing conductors and components that no longer meet current NEC requirements are to be replaced and the whole circuit is to be designed to current standards. This may mean replacing the whole circuit back to the nearest overcurrent protection device (circuit breaker). Design considerations to be addressed when modifying an existing illumination system include the following:

- Whether the existing circuit is in compliance with current NEC standards (deficient electrical component)
- Whether existing luminaire system components, such as conductors, conduit, junction boxes, foundation, and pole comply with current standards
- Whether conductors meet NEC requirements for temperature rating (deficient electrical component)
- Conductor material: aluminum conductors or copper conductors (deficient electrical component)
- The condition and adequacy of the existing conduit running between the luminaire and the nearest junction box (deficient electrical component)
- The condition of the junction box next to the luminaire (deficient electrical component)
- The suitability of the existing foundation to meet current design requirements
- The suitability of the location to meet current design standards for illumination
- The location and bolt pattern of the existing foundation to meet current design standards
- The design life remaining for the existing light standard (deficient electrical component)
- The condition of the existing light standard (deficient electrical component)
- Maintenance personnel assessment of the electrical safety of the installation

Involve appropriate Headquarters (HQ) and Region Traffic Office design personnel early in the process. Ensure that potential system deficiencies are reflected in the estimate of work.

Another consideration is the need to maintain illumination during construction. Site preparation, widening, drainage, guardrail installation, or other work can easily impact existing conduit runs or luminaire locations. Also, changed conditions such as merging, weaving, or unusual alignment due to traffic control often require additional temporary illumination. Note: The same lighting requirements apply whether a condition is temporary or permanent.

840.05 Required Illumination

The design matrices identify the design levels for illumination on all Preservation and Improvement projects (see Chapter 325).

- **Basic Design Level**. At the basic design level for minor safety or preservation work, providing slip base features on existing light standards (when in the Design Clear Zone or recovery area) and bringing electrical components to current standards is required. Consider other minor safety work as necessary. Providing additional lighting or relocating light standards on Preservation projects may be considered spot safety enhancements. When the Illumination column has an EU (evaluate upgrade to full design level), consider providing illumination if it would be beneficial to the specific project, and document accordingly.

  For Minor Operational Enhancement projects using the design matrices in Chapter 340, illumination is not required.

- **Evaluate Upgrade**. Review the age of the equipment as listed in SIMMS and consider replacing components that have reached their design life. Where items will not be upgraded, document why it will not be done. Components should be located so that they can be safely accessed from the right of way. Poles, foundations, heads, etc., that have reached their design life should be replaced. Slip base features should be per current design standards. Uniformity should be evaluated in the design areas (see 840.07(2)). Locations that are illuminated per this section should be brought to full standards or documented regarding why they are not (deferred to another project, etc.). Consider additional illumination per 840.06, if warranted, or design additional illumination if it is called for in the Project Definition.

  When it is necessary to relocate existing light standard foundations, evaluate the entire conduit run serving those light standards and replace deficient components to current (NEC) standards.
- **Full Standards**. For full design level, the illumination specified in this chapter is required when constructing a new system and/or bringing the entire existing system to full standards (such as slip base features, grounding, conduit, light levels, and uniformity). On existing systems, this includes all components not otherwise affected by the project. Review all conduit runs, not just the one affected by relocating light standards on that run.

Figures 840-1 through 840-24 show examples of illumination for roadway, transit flyer stops, parking lots, truck weigh stations, tunnels, bridges, work zones, and detour applications. Illumination is required in these examples, which are further discussed in the remainder of this section.

A minimum of two light standards of standard pole height are required at all design areas, with the exception of ramp terminals and entrance/exit points at minor parking lots.

(1) Freeway Off-Ramps and On-Ramps

Provide the necessary illumination for the design area of all freeway off-ramp gore areas and on-ramp acceleration tapers (see 840.07(2) and Figures 840-1a, 1b, and 1c).

(2) Freeway Ramp Terminals

Provide the necessary illumination for the design area (see Figure 840-2). Additional illumination is required if the intersection has left-turn channelization or a traffic signal.

(3) Freeway On-Ramps With Ramp Meter Signals

Provide the necessary number of light standards to illuminate freeway on-ramps with ramp meters, from the beginning of the on-ramp to the ramp meter stop bar. When there is an HOV bypass lane or a two-lane merge beyond the ramp meter, then provide illumination for the entire ramp from the beginning of the on-ramp to the ramp merge point with the main line (see Figure 840-3).

(4) Freeway-to-Freeway Ramp Connections

Provide the necessary number of light standards to illuminate freeway-to-freeway ramps that connect full limited access freeway systems from the exit ramp gore area to the main line merge area (see Figure 840-4).

(5) HOT (High Occupancy Toll) Lane Enter/Exit Zones

Provide the necessary number of luminaires to illuminate the design area of the enter/exit zones of the HOT Lane (see Figure 840-5).

(6) Lane Reduction

Provide the necessary number of light standards to illuminate the design area of all highway lane reduction areas within the urban boundary (see Figure 840-6). This requirement does not apply to:

- The end of slow-moving vehicle turnouts.
- The end of the area where driving on shoulders is allowed.

(7) Add Lane Channelization

Provide the necessary number of light standards to illuminate the design area of highway add lanes on high-volume roadways within the urban boundary (see Figure 840-7). This requirement does not apply to the following:

- The beginning of an add lane on a low-volume roadway in a rural area beyond the urban boundary
- The beginning of a slow-moving vehicle turnout
- The beginning of an area where driving on shoulders is allowed

(8) Intersections With Left-Turn Lane Channelization

Illumination of the intersection area and the left-turn storage area is required for intersections with painted or other low-profile pavement markings such as raised pavement markings. When the channelization is delineated with curbs, raised medians, or islands, illuminate the raised channelization from the beginning of the left-turn approach taper (see Figures 840-8a and 8b). Illumination of the secondary road intersecting the state highway can be beneficial to the motoring public. Funding and design, however, are the local agency's responsibility. Contact that agency to see whether it is interested in participating.

(9) Intersection With Drop Lane/Right-Turn Lane Channelization

Illumination of the intersection area and the right-turn storage area is required for intersections with painted or other low-profile pavement markings such as raised pavement markings. Raised channelization such as curbs, raised medians, and islands are to be illuminated from the beginning of the right-turn taper. For concurrent left-turn and right-turn channelization, where the left-turn lane and the left-turn taper are longer than the right-turn lane and taper, illuminate the roadway as described in 840.05(8), and include the right-turn lane area in the design area (see Figure 840-9). Illumination of the secondary road intersecting the state highway can be beneficial to the motoring public. Funding and design, however, are the local agency's responsibility. Contact that agency to see whether it is interested in participating

(10) Intersections With Traffic Signals

Illuminate all intersections with traffic signals on state highways (see Figure 840-10). Illumination of the crossroad is beneficial and the participation of the local agency is desirable. In cities with a population under 22,500, the state may assume responsibility for illumination installed on signal standards.

(11) Roundabouts

Provide the necessary number of light standards to illuminate the design area of roundabouts (see Chapter 915 and Figure 840-12).

(12) Railroad Crossings With Gates or Signals

Railroad crossings with automated gates or signals on state highways are illuminated if there is nighttime train traffic. Within the corporate limits of a city, and outside limited access control, illumination is the responsibility of the city. Install luminaires beyond the railroad crossing, on the side of the roadway opposite the approaching traffic, to back light the train (see Figure 840-13).

(13) Midblock Pedestrian Crossings

Illuminate the entire midblock pedestrian crossing, including the crosswalks, the refuge area in the roadway, and the sidewalks or shoulders adjacent to the crosswalk. When a raised median pedestrian refuge design is used, illuminate the raised channelization (see Figure 840-14).

(14) Transit Flyer Stops

Illuminate the pedestrian-loading areas of transit flyer stops located within the limited access boundaries (see Figure 840-15).

(15) Major Parking Lots

All parking lots with usage exceeding 50 vehicles during the nighttime peak hour are considered major parking lots. Provide an illumination design that will produce the light levels shown in Figure 840-25. (See Figure 840-16 for the parking design area and bus loading zone design area.) During periods of low usage at night, security lighting is required only in the parking area and bus loading zone. Provide an electrical circuitry design that allows the illumination system to be reduced to approximately 25% of the required light level.

(16) Minor Parking Lots

Minor parking lots have a nighttime peak hour usage of 50 or fewer vehicles. Provide security-level lighting for those lots owned and maintained by the state. Security lighting for a minor parking lot consists of lighting the entrance and exit to the lot (see Figure 840-17).

(17) Truck Weigh Sites

Provide illumination of the roadway diverge and merge sections, scale platforms, parking areas, and inspection areas of weigh sites (see Figure 840-18).

(18) Safety Rest Areas

Provide illumination within rest areas at the roadway diverge and merge sections, the walkways between parking areas and rest room buildings, and the parking areas as for a major parking lot (see Figure 840-19).

(19) Chain-Up/Chain-Off Parking Areas

Provide the necessary number of luminaires to illuminate the design area of the chain-up/chain-off parking area (see Figure 840-20).

(20) Tunnels

Long tunnels have a portal-to-portal length greater than the stopping sight distance. Provide both nighttime and daytime illumination for long tunnels. Consider illumination for short tunnels if the horizontal-to-vertical ratio is ≥ 10:1 (see Chapter 650 and Figure 840-21). Provide daytime security lighting in pedestrian tunnels.

(21) Bridge Inspection Lighting

Provide the necessary number of light fixtures to illuminate the interior inspection areas of floating bridges and steel box girder bridges (see Figure 840-22). Coordinate bridge illumination requirements with the HQ Bridge and Structures Office.

(22) Same Direction Traffic Split Around an Obstruction

Provide the necessary number of light standards to illuminate the design area where traffic is split around an obstruction. This requirement applies to permanent and temporary same-direction split channelization. For temporary work zones, illuminate the obstruction for the duration of the traffic split (see Figure 840-23).

(23) Overhead Sign Illumination

Provide sign lighting on overhead signs as discussed in Chapter 820. Sign illumination is provided with sign lighting fixtures mounted directly below the sign. The light source of the fixture is a 175 watt mercury vapor lamp or an 85 watt induction lamp. Provide one sign with a width of 16 feet or less. For wider signs, provide two or more sign lights with a spacing not exceeding 16 feet. If two or more closely spaced signs are in the same vertical plane on the structure, consider the signs as one unit and use a uniform light fixture spacing for the entire width. Voltage drops can be significant when the electrical service is not nearby. In areas where an electrical power source is more than ½ mile away, utility company installation costs can be prohibitive. With justification, overhead sign illumination is not required where the power source is more than ½ mile away.

840.06 Additional Illumination

At certain locations, additional illumination is desirable to provide better definition of nighttime driving conditions or to provide consistency with local agency goals and enhancement projects. For improvement projects on state highways, additional illumination is considered under certain circumstances, which are listed in this section. Justify the additional illumination in the Design Documentation Package (DDP).

Some conditions used in making the decision to provide additional illumination are:

- **Diminished Level of Service**. A mobility condition where the nighttime peak hour level of service is D or lower. To determine the level of service, use traffic volume counts taken during the evening peak hour. Peaking characteristics in urban areas are related to the time of day. Traffic counts taken in the summer between 4:30 p.m. and 7:30 a.m. may be used as nighttime volumes if adjustment factors for differences in seasonal traffic volumes are applied for November, December, and January.
- **Nighttime Collision Frequency**. When the number of nighttime collisions equals or exceeds the number of daytime collisions. An engineering study indicating that illumination will result in a reduction in nighttime collisions is required as justification. Consider the seasonal variations in lighting conditions when reviewing reported collisions. Collision reporting forms, using a specific time period to distinguish between "day" and "night," might not indicate the actual lighting conditions at the time of a collision. Consider the time of year when determining whether a collision occurred at nighttime. A collision occurring at 5:00 p.m. in July would be a daytime collision, but a collision occurring at the same time in December would be during the hours of darkness.
- **Nighttime Pedestrian Accident Locations (PALs)**. The mitigation of nighttime PALS requires different lighting strategies than vehicular accident locations. Provide light levels to emphasize crosswalks and adjacent sidewalks. Multilane highways with two-way left-turn lanes, in areas transitioning from rural land use to urban land use or areas experiencing commercial growth or commercial redevelopment, are typically high-speed facilities with numerous road approaches and driveways. These approaches allow numerous vehicle entry and exit points and provide few crossing opportunities for pedestrians; consider additional illumination.

(1) Highways

Proposals to provide full (continuous) illumination require the approval of the State Traffic Engineer. Regions may choose to develop (regional or corridor-specific) system plans for providing full (continuous) illumination. The State Traffic Engineer's approval of a system plan will eliminate the need for a project-specific approval from the State Traffic Engineer.

The decision whether to provide full (continuous) illumination is to be made during the scoping stage and communicated to the designers as soon as possible.

(a) On the main line of full limited access highways, consider full (continuous) illumination if a diminished level of service exists and any two of the following conditions are satisfied:

- There are three or more successive interchanges with an average spacing of 1½ miles or less, measured from the center of each interchange or a common point such as a major crossroad
- The segment is in an urban area
- A nighttime collision frequency condition exists
- A benefit/cost analysis between the required and full (continuous) illumination indicates a value added condition with the addition of continuous illumination

(b) On the main line of highways without full limited access control, consider full (continuous) illumination if the segment of highway is in a commercial area and either a diminished level of service exists or a nighttime collision frequency exists and an engineering study indicates that nighttime driving conditions will be improved.

(2) Ramps

At ramps, consider additional illumination when a diminished level of service exists for the ramps and any of the following conditions are present:

- The ramp alignment and grade are complex
- There are routine queues of five or more vehicles per lane at the ramp terminal during the nighttime peak hour due to traffic control features
- A nighttime collision frequency condition exists
- The criteria for continuous main line illumination have been satisfied

(3) Highway-to-Highway Ramp Connections

Provide the necessary number of light standards to illuminate highway-to-highway ramps that connect partial or modified limited access freeway systems or managed access highway systems, from the exit ramp gore area to the main line merge area. For an example of the ramp connection, see Figure 840-4.

(4) Crossroads

At crossroads, consider additional illumination when a diminished level of service exists and a nighttime collision frequency exists. Also, consider additional illumination if the crossroad is in a short tunnel, an underpass, or a lid.

(5) Intersections Without Turn-Lane Channelization

Consider illumination of intersections without turn-lane channelization if a nighttime collision frequency requirement is satisfied or the intersection meets warrants for left-turn channelization (see Figure 840-11).

(6) Short Tunnels, Underpasses, or Lids

Consider illumination of short tunnels, underpasses, or lids if portal conditions result in brightness that is less than the measured daytime brightness of the approach roadway divided by 15 and the length to vertical clearance ratio is 10:1 or greater.

(7) Work Zones and Detours

Consider temporary illumination of the highway through work zones and detours when changes to the highway alignment or grade remain in place during nighttime hours, and when the following conditions may be present (see Figure 840-24):

- Nonstandard roadway features such as narrow lanes, narrow shoulders, or substandard shy distance to barriers or structures
- The temporary alignment includes abrupt changes in highway direction or lane shifts with substandard lane shift tapers
- Other unusual highway features such as abrupt lane edge drop-offs, sudden changes in pavement conditions, or temporary excavation or trenching covers
- There is an anticipation of heavy construction truck traffic, possibly requiring flaggers, entering and exiting the highway during nighttime hours

For further information, see Chapter 810.

(8) Transit Stops

The responsibility for lighting at transit stops is shared with the transit agency. Consider illuminating transit stops with shelters, as they usually indicate greater passenger usage. Negotiation with the transit agencies is required for the funding and maintenance of this illumination. Negotiating a memorandum of understanding (MOU) with each transit agency is preferred over spot negotiations. If the transit agency is unable or unwilling to participate in the funding and maintenance of the illumination, consider a single light standard positioned to illuminate both the transit pullout area and the loading area.

(9) Bridges

Justification for illuminating the roadway/sidewalk portion of bridges is the same as that for highways on either end of the bridge with or without full limited access control, as applicable. Justification for illuminating the architectural features of a bridge structure requires the approval of the State Traffic Engineer. For justification for illuminating pedestrian walkways or bicycle trails under a bridge, see 840.06(11).

(10) Railroad Crossing Without Gates or Signals

Consider the illumination of railroad crossings without gates or signals when:

- The collision history indicates that motorists experience difficulty in seeing trains or control devices.
- There are a substantial number of rail operations conducted during nighttime hours.
- The crossing is blocked for long periods due to low train speeds.
- The crossing is blocked for long periods during the nighttime.

For further information, see the MUTCD.

(11) Walkways and Bicycle Trails

Consider illumination of a pedestrian walkway if the walkway is a connection between two highway facilities. This could be between parking areas and rest room buildings at rest areas; between drop-off/pick-up points and bus loading areas at flyer stops; or between parking areas and bus loading areas or ferry loading zones. Consider illuminating existing walkways and bicycle trails if security problems have been reported. Also, consider illumination if security problems are anticipated. Under these conditions, the walkways and bicycle trails are illuminated to the level shown in Figure 840-25.

840.07 Design Criteria

(1) Light Levels

Light levels vary with the functional classification of the highway, the development of the adjacent area, and the level of nighttime activity. Light level requirements for highways and other facilities are shown in Figure 840-25. These levels are the minimum average light levels required for a design area at the end of rated lamp life for applications requiring a spacing calculation. Light level requirements *are not applicable* for single light standards or security lighting installations where:

- The light level is reduced to approximately 25% of the required light level in parking lots and parking lot loading areas during periods of low usage at night.
- Walkway or path illumination is installed only at areas where shadows and horizontal and vertical geometry obstruct a pedestrian's view.

Light level requirements *are applicable* when:

- The complete walkway or path is to be illuminated for public safety.

For design-level classifications of highways, see Chapters 325, 410, 430, and 440.

(a) **Activity Areas**. The types of activity areas (shown below) are related to the number of pedestrian crossings through the design area. These crossings need not occur within a single crosswalk and can be at several locations along the roadway in an area with pedestrian generators. Land use and activity classifications are as follows:

  - **High Activity**. Areas with over 100 pedestrian crossings during nighttime peak hour pedestrian usage. Examples include downtown retail areas; near outdoor stage theaters, concert halls, stadiums, and transit terminals; and parking areas adjacent to these facilities.
  - **Medium Activity**. Areas with pedestrian crossings that number between 11 and 100 during nighttime peak hour pedestrian usage. Examples include downtown office areas; blocks with libraries, movie theaters, apartments, neighborhood shopping, industrial buildings, and older city areas; and streets with transit lines.
  - **Low Activity**. Areas with pedestrian crossings that number less than 11 during the nighttime peak hour pedestrian usage. Examples include suburban single-family areas, low-density residential developments, and rural or semirural areas.

(2) Design Areas

The design area is that portion of the roadway, parking lot, or other facility subject to the minimum light level, minimum average light level, uniformity ratio, and maximum veiling luminance ratio design requirements. This encompasses the area between the edges of the traveled way along the roadway; the outer edges of the stopping points at intersections; and, when present, a bike lane adjacent to the traveled way. When the roadway has adjacent sidewalks, the design area includes these features, except that sidewalks adjacent to the traveled way are exempt from maximum veiling luminance ratio requirements. The access areas used for interior inspection of a floating bridge or steel box girder bridge are exempt from lighting level and lighting ratio design requirements.

Design area requirements for various applications are shown in Figures 840-1 through 840-24 and the following:

- **Single-Lane Off-Ramp**. Two main line through lanes and the ramp lane, including gore area, from the gore point (beginning of wide line) to a point 200 feet (minimum) downstream of the gore point. A 100-foot longitudinal tolerance either way from the gore point is allowed.
- **Two-Lane Off-Ramp**. Two main line through lanes and both ramp lanes, including gore area, from a point 200 feet upstream of the gore point (beginning of wide line) to a point 200 feet downstream of the gore point. A 100-foot longitudinal tolerance either way from the gore point is allowed.
- **Single-Lane On-Ramp**. Two main line through lanes and the ramp lane, from a point where the ramp lane is 10 feet wide to a point 200 feet downstream. A 100-foot longitudinal tolerance either way is allowed (this includes auxiliary lane on-connections and lane reductions).
- **Two-Lane On-Ramp**. Two main line through lanes and the ramp lanes from a point where the ramp width is 22 feet wide to a point 200 feet upstream and 200 feet downstream. A 100-foot longitudinal tolerance either way is allowed.
- **Intersections Channelized With Pavement Markings**. The design area has two components: the intersection area and the approach areas. The intersection area is the area between the stopping points on both the main road and the minor road, including marked or unmarked crosswalks. The approach areas are the areas on the main roadway between the stopping point and where the left-turn lane is full width.
- **Intersections With Raised Channelization**. The design area has two components: the intersection area and the approach areas. The intersection area is the area between the stopping points on both the main road and the minor road, including marked or unmarked crosswalks. The approach areas are the areas on the main roadway between the stopping point and where the left-turn taper begins.
- **Unchannelized Intersection**. The area between the stopping points on both the main road and the minor road, including marked or unmarked crosswalks.
- **Railroad Crossing**. The roadway width from a point 50 feet on either side of the track (the approach side only for one-way roadways).
- **Transit Loading Area**. The lane width and length designated for loading.
- **Major Parking Lot**. The entire area designated for parking, including internal access lanes.

- **Scale Platform at Weigh Site**. The approach width from the beginning of the scale platform to the end of the platform.
- **Inspection Area at Weigh Site**. The area dedicated to inspection as agreed upon with the Washington State Patrol.
- **Bridge Inspection Lighting System**. Fixtures are to be ceiling mounted with a maximum spacing of 25 feet. Illumination is to consists of a 100 watt incandescent (or fluorescent equivalent) fixture. Each fixture is to be designed with a 20 amp rated ground fault circuit interrupt (GFCI) receptacle. A light switch is needed at each entrance to any common inspection area. For inspection areas with two or more entrances, three-way or four-way switches are required.

(3) Daytime Light Levels for Tunnels and Underpasses

It is important to provide sufficient illumination inside a tunnel. When driving into and through a tunnel during the day, a driver's eyes have to adjust from a high light level (daylight) to a lower lighting level inside the tunnel. Motorists require sufficient time for their eyes to adapt to the lower light level of the tunnel itself. When sufficient lighting is not provided in the threshold, transition, or interior zones of a tunnel, a motorist's eyes may not have enough time to adapt and may experience a "black hole" or "blackout" effect. This "black hole" effect may cause a motorist to slow down, reducing the efficiency of the roadway. When leaving the tunnel, the driver's eyes have to adjust from a low lighting level back to daytime conditions. The full design considerations for tunnel lighting are covered in 840.02 in the Supporting Information section. All designs for illuminating tunnels are to be reviewed and approved by the State Traffic Engineer.

- Long tunnels are divided into zones for the determination of daytime light levels. Each zone is equal in length to the pavement stopping sight distance. The entrance zone beginning point is a point outside the portal where the motorist's view is confined to the predominance of the darkened tunnel structure.
- The daytime entrance zone light level is dependent upon the brightness of the features within the motorists' view on the portal approach. The brightness level is defined as the average brightness measured over a 20° cone at a point 500 feet in advance of the portal. The entrance zone light level produced within the tunnel must be sufficient to provide a brightness level of approximately 5% of the measured portal brightness, after adjustment for the reflectivity of the roadway, walls, and ceiling. Design successive zones for a daytime light level of 5% of the previous zone light level to a minimum value of five footcandles. Requirements for nighttime light levels for long tunnels on continuously illuminated roadways are the same as the light level required on a roadway outside the tunnel. Provide illumination of fire protection equipment, alarm pull boxes, phones, and emergency exits in long tunnels. (See NFPA 502 for additional information.)
- A short tunnel or underpass has a length-to-vertical clearance ratio of 10:1 or less. Short tunnels and underpasses in rural areas or with low pedestrian usage normally do not have daytime illumination. Short tunnels and underpasses in urban areas with high pedestrian usage may require daytime and nighttime illumination. Consultation with the affected local agency is recommended. Short tunnels and underpasses with length-to-vertical clearance ratios greater than 10:1 are treated the same as an entrance zone on a long tunnel to establish daytime light levels. Short tunnels and underpasses where the exit portal is not visible from the entrance portal due to curvature of the roadway are to be considered

long tunnels. Nighttime light level requirements for short tunnels on continuously illuminated roadways are the same as the light level required on the roadway outside the tunnel.

(4) Light Standards

(a) **Light Standards**. Light standards are the most common supports used to provide illumination for highway facilities. The 40-foot and 50-foot-high light standards with slip bases and Type 1 mast arms are predominantly used on state highways. The angular Type 2 mast arms are allowed only to match existing systems. Use Type 1 mast arms on all new systems. Cities and counties may elect to use different mounting heights to address factors unique to their environments. On state highways, alternative light standards may be considered if requested by the city or county, provided they agree to pay any additional costs associated with this change.

The typical location for a light standard is on the right shoulder. When considering designs for light standards mounted on concrete barrier in the median, consider the total life cycle cost of the system, including the user costs resulting from lane closures required for relamping and repair operations. Light standards located in the vicinity of overhead power lines require a minimum 10-foot circumferential clearance from the power line (including the neutral conductor) to any portion of the light standard or luminaire. Depending on the line voltage, a distance greater than 10 feet may be required (WAC 296-24-960). Consult the HQ Bridge and Structures Office when mounting light standards on structures such as retaining walls and bridge railings.

It is preferable to locate a light standard as far from the traveled way as possible to reduce the potential for impacts from errant vehicles. The preferred position for the luminaire is directly over the edge line. However, some flexibility is acceptable with the luminaire position to allow for placement of the light standard. On Type III signal standards, luminaires may be placed more than 4 feet from the edge line. Standard mast arm lengths are available in 2-foot increments between 6 and 16 feet. The preferred design for a single-arm light standard is a 16-foot mast arm installed on a 40-foot or 50-foot standard. The maximum allowable mast arm length for a single-arm light standard is 16 feet. The preferred design for a double mast arm light standard has mast arms between 6 feet and 12 feet in length, installed on a 40-foot or 50-foot standard. The maximum allowable mast arm length for a double luminaire light standard is 12 feet.

When light standards are located within the Design Clear Zone, breakaway and slip base features are used to reduce the severity of an impact. (See Chapter 700 for additional guidance on clear zone issues.)

In curb and sidewalk sections, locate the light standard behind the sidewalk. Slip bases on light standards are a safety requirement for roadways where the posted speed is 35 mph or higher. They are not always desirable at other locations. Fixed bases are installed in the following locations:

- Parking lots
- Medians where the light standard is mounted on median barrier

- Behind traffic barrier, beyond the barrier's deflection design value (see Chapter 710)
- Along pedestrian walkways, bike paths, and shared-use paths

(b) **Light Standard Heights**. Standard pole heights (20-foot, 30-foot, 40-foot, or 50-foot) are readily available from local distributors and manufacturers. Light standards can also be supplied with other lengths. However, WSDOT maintenance offices cannot stock poles with nonstandard lengths for use as replacements in the event of a knockdown. Nonstandard lengths in 5-foot increments (25-foot, 35-foot, or 45-foot) will require a longer delivery time. Other nonstandard lengths (for example, 27-foot, 33-foot, 43-foot, or 47-foot) will not only require a longer delivery time, they will also be more expensive.

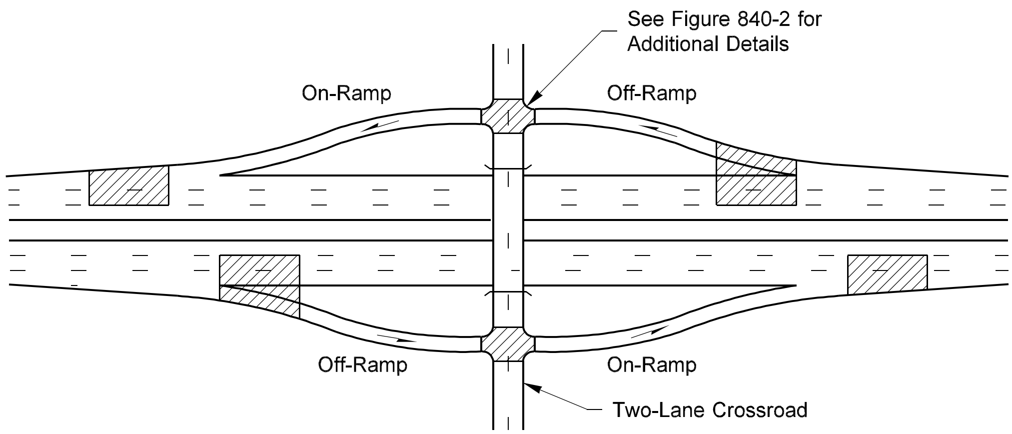
In almost all cases, use standard pole heights of 40 feet and 50 feet for roadway illumination. Structure-mounted light standards may need to be shorter than the standard 40-foot or 50-foot grade-mounted pole. It is acceptable to use 20-foot or 30-foot light standards on bridges, retaining walls, or other structures to compensate for top-of-structure elevation above the roadway surface. Use of these standard pole heights will result in variable mounting heights for the luminaires. Luminaire mounting height is defined as the actual distance from the roadway surface directly under the luminaire to the luminaire itself. Use the actual mounting height at each location when calculating light standard spacing. High mast light supports may be considered for complex interchanges where continuous lighting is justified. High mast lighting may be considered for temporary illumination areas during construction. Initial construction costs, long-term maintenance, clear zone mitigation, spillover light onto adjacent properties, and negative visual impacts are important factors when considering high mast illumination. Shorter light standards of 30 feet or less may be used for minor parking lots, trails, pedestrian walkways, and locations with restricted vertical clearance.

(c) **Standard Luminaire**. The cobra head-style, high-pressure sodium vapor luminaire with Type III, medium cut-off light distribution is the normal light source used for state highway lighting. A Type III distribution projects an oval pattern of light on the roadway, and a Type V distribution projects a circular pattern of light on the roadway. Post top-mounted luminaires and other decorative light fixtures with Type V patterns are more effective for area lighting in parking lots and other locations where more symmetrical light distribution patterns are used.

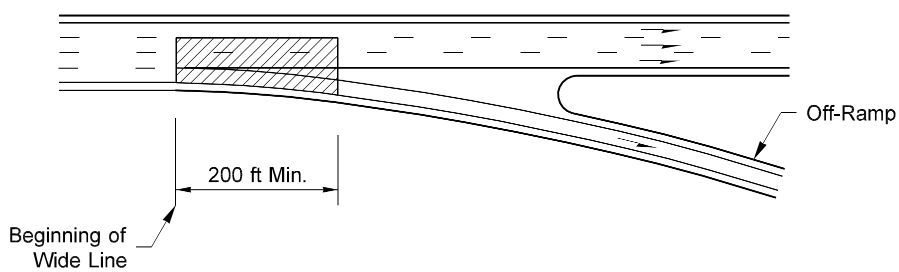
(d) **Electrical Design**. For an example of circuit layout, conductor sizing, conduit sizing, overcurrent protection device sizing, and other electrical design calculations, see the *Traffic Manual*, Chapter 4.

840.08 Documentation

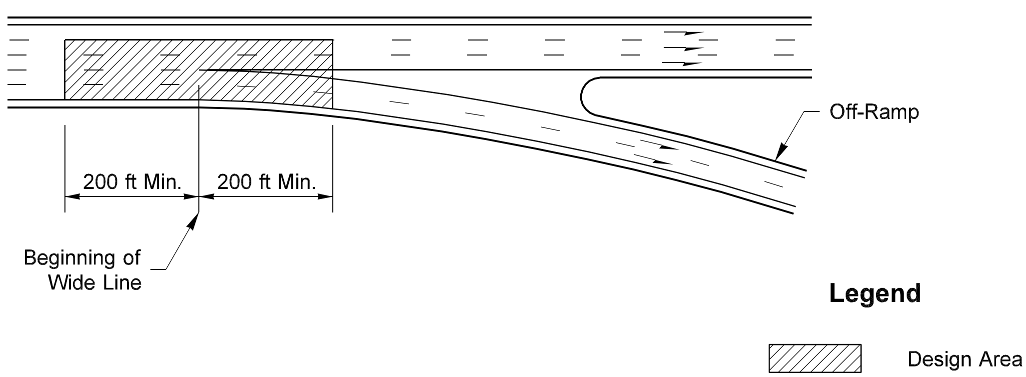
For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/



Required Illumination for a Typical Diamond Interchange
(Shown for single-lane ramp connection and a two-lane crossroad without channelization.)

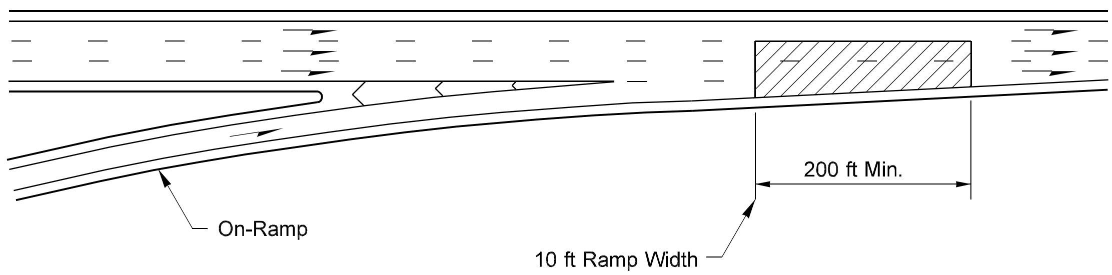


Single-Lane Off-Connection
(The design area may be shifted up to 100 ft from the beginning of the wide line;
a minimum of two light standards of standard pole height required for design area.)

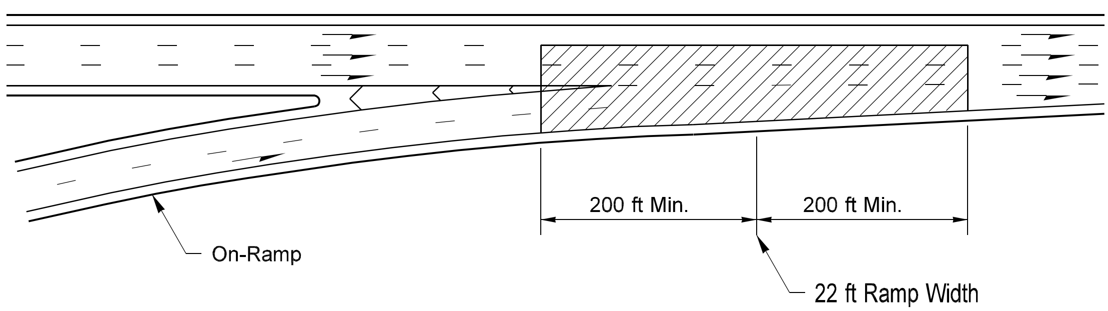


Two-Lane Off-Connection
(The design area may be shifted up to 100 ft from the beginning of the wide line;
a minimum of three light standards of standard pole height required for design area.)

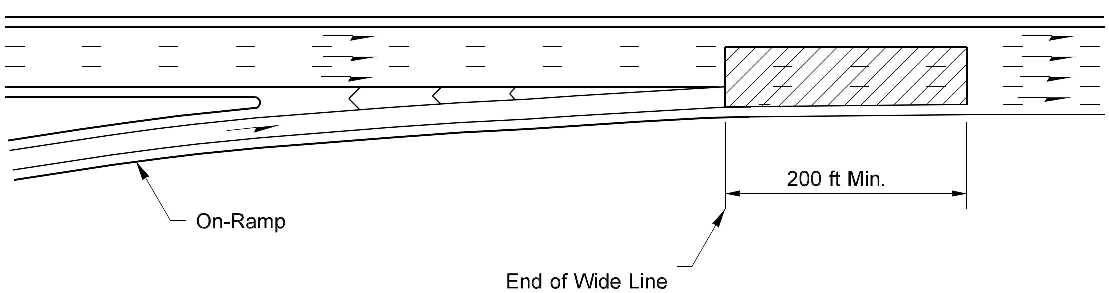
Freeway Lighting Applications
Figure 840-1a



Single-Lane On-Connection
(The design area may be shifted up to 100 ft from the 10-ft-wide ramp point;
a minimum of two light standards of standard pole height required for design area.)



Two-Lane On-Connection
(The design area may be shifted up to 100 ft from the 22-ft-wide ramp point;
a minimum of three light standards of standard pole height required for design area.)

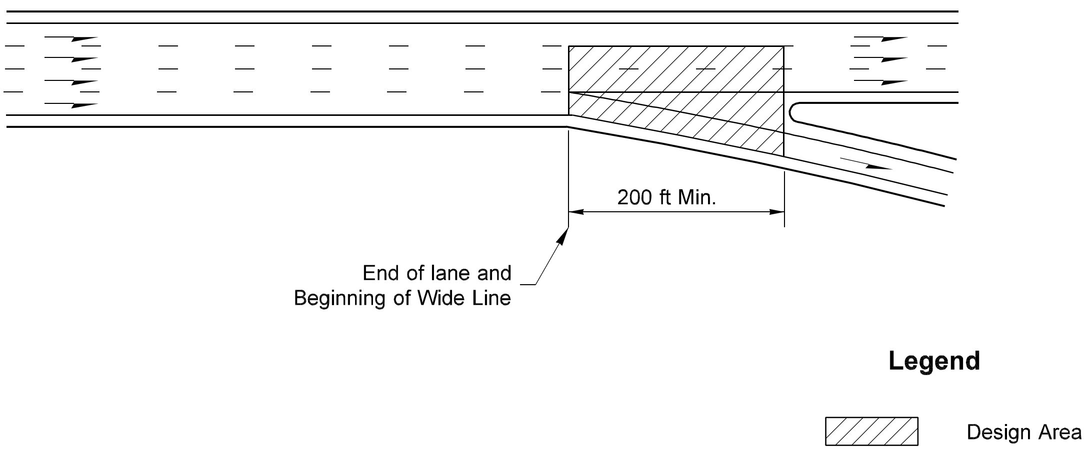


Legend

Design Area

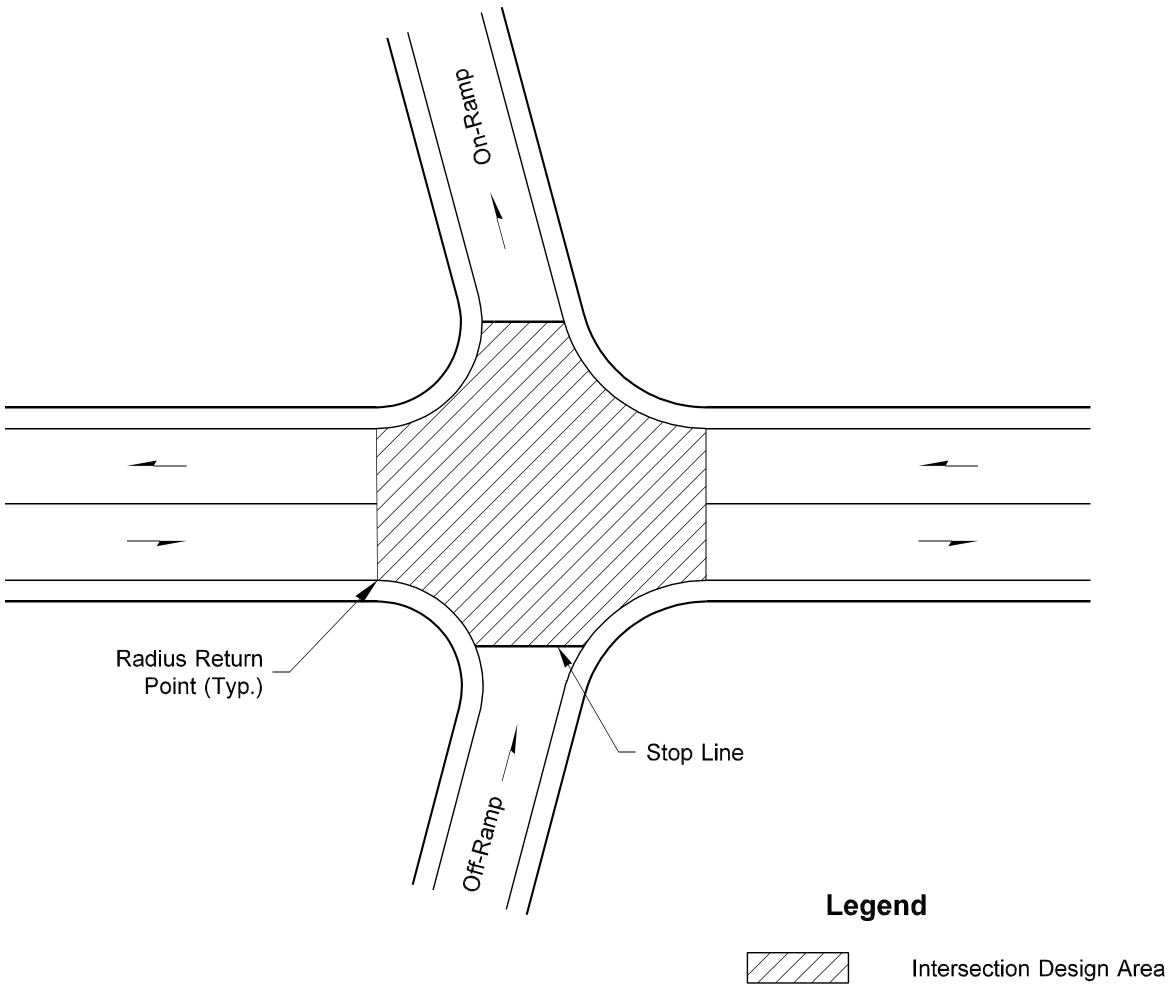
Auxiliary-Lane at On-Connection
(The design area may be shifted up to 100 ft from the 10-ft-wide ramp point;
a minimum of two light standards of standard pole height required for design area.)

Freeway Lighting Applications
Figure 840-1b

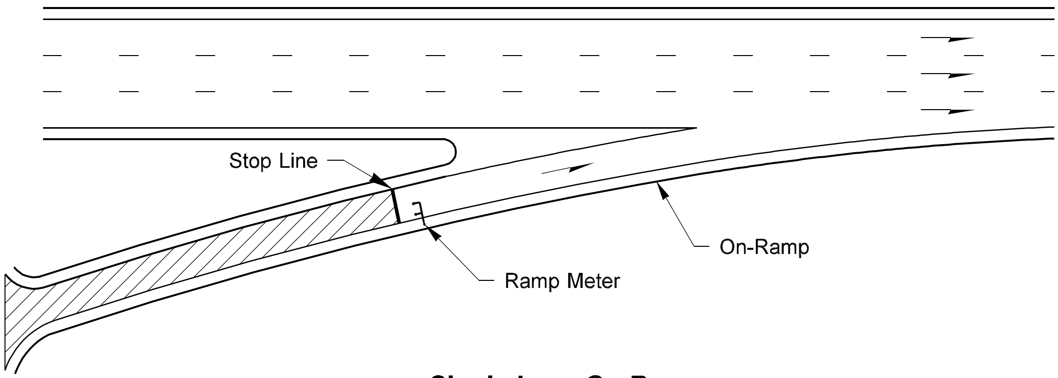


Exit-Only Lane
(The design area may be shifted up to 100 ft from the end of lane and the beginning of wide line; a minimum of two light standards of standard pole height required for design area.)

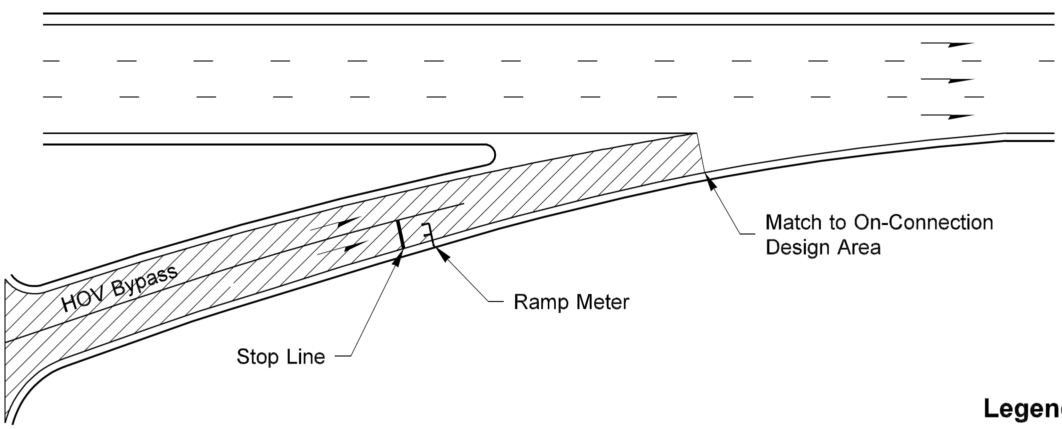
Freeway Lighting Applications
Figure 840-1c



Freeway Ramp Terminals
Figure 840-2

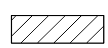


Single-Lane On-Ramp

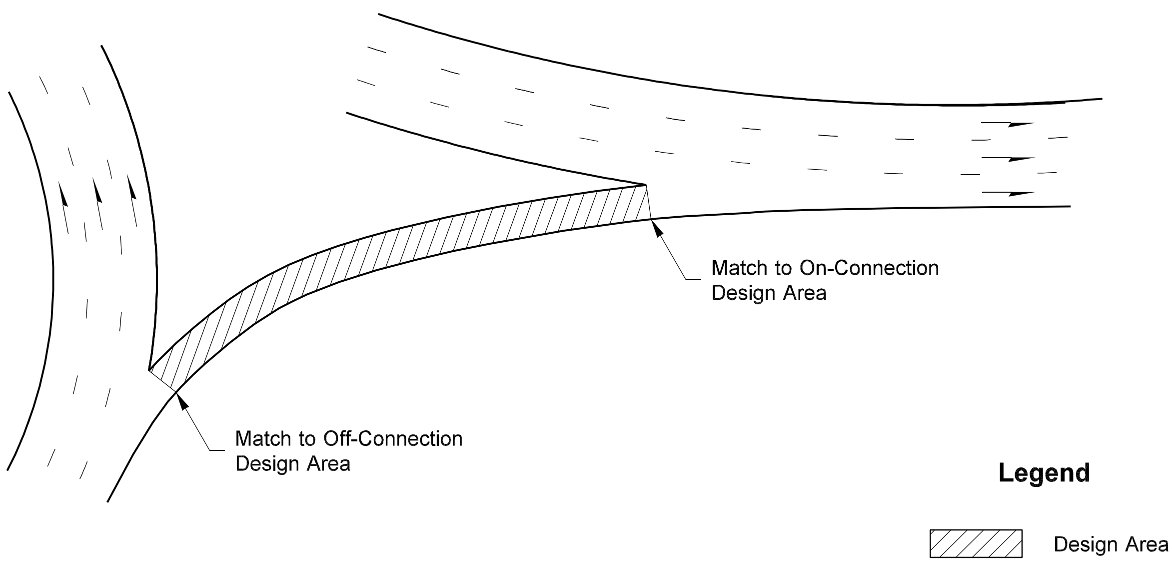


Two or More Lanes

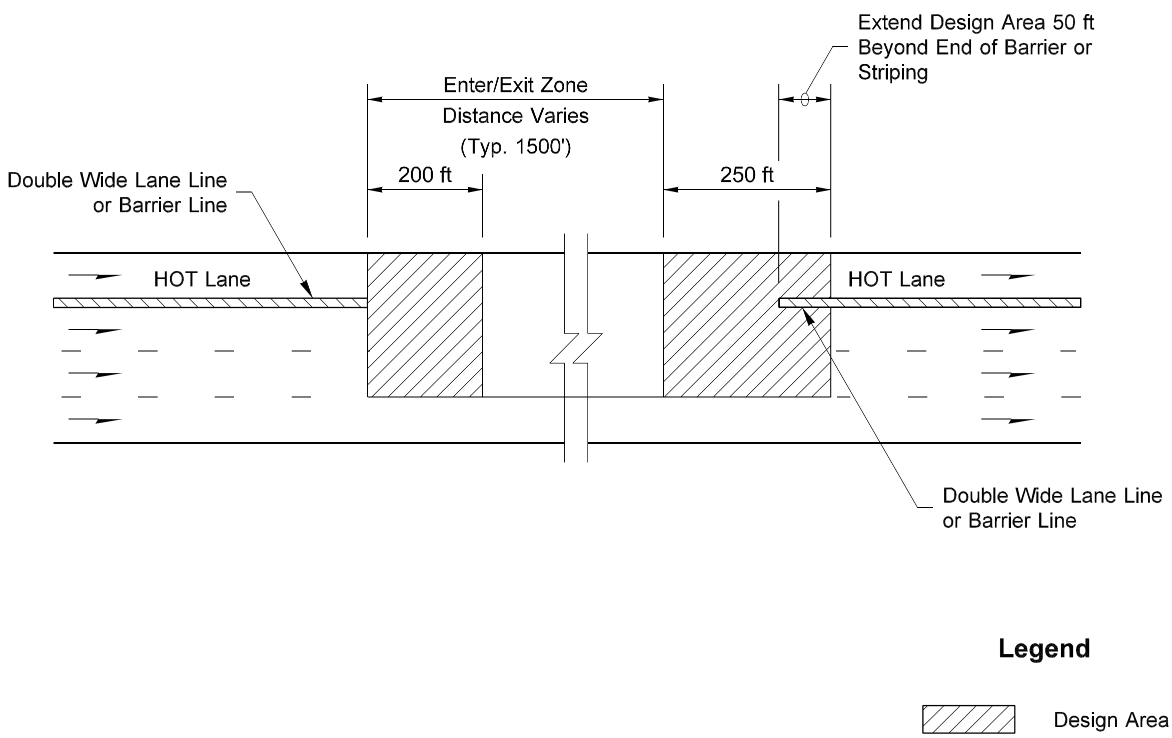
Legend


Design Area

Ramp With Meter
Figure 840-3

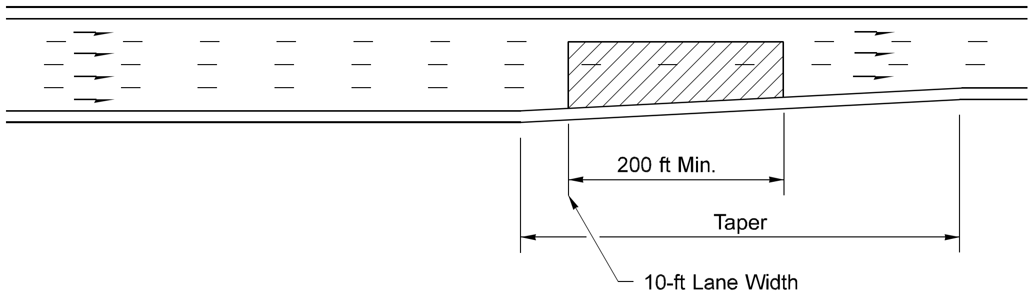


Freeway-to-Freeway Connection
Figure 840-4



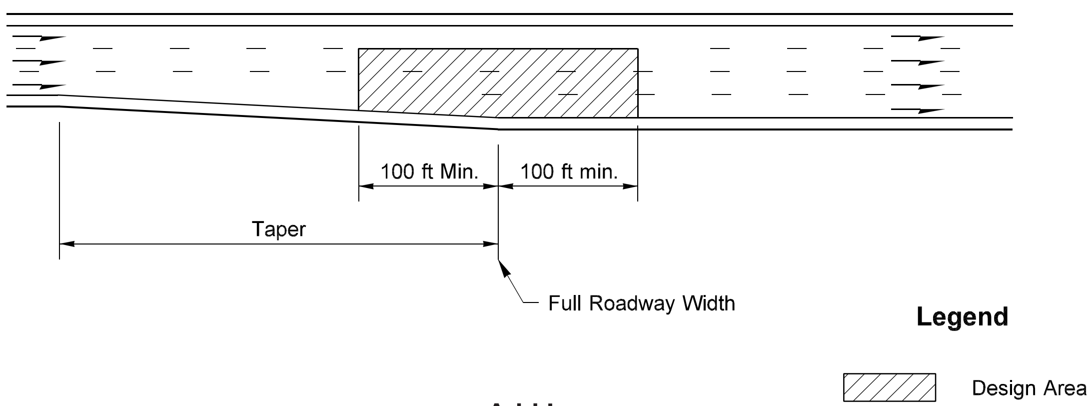
A minimum of two light standards of standard pole height required for each design area.

HOT (High Occupancy Toll) Lane Enter/Exit Zone
Figure 840-5



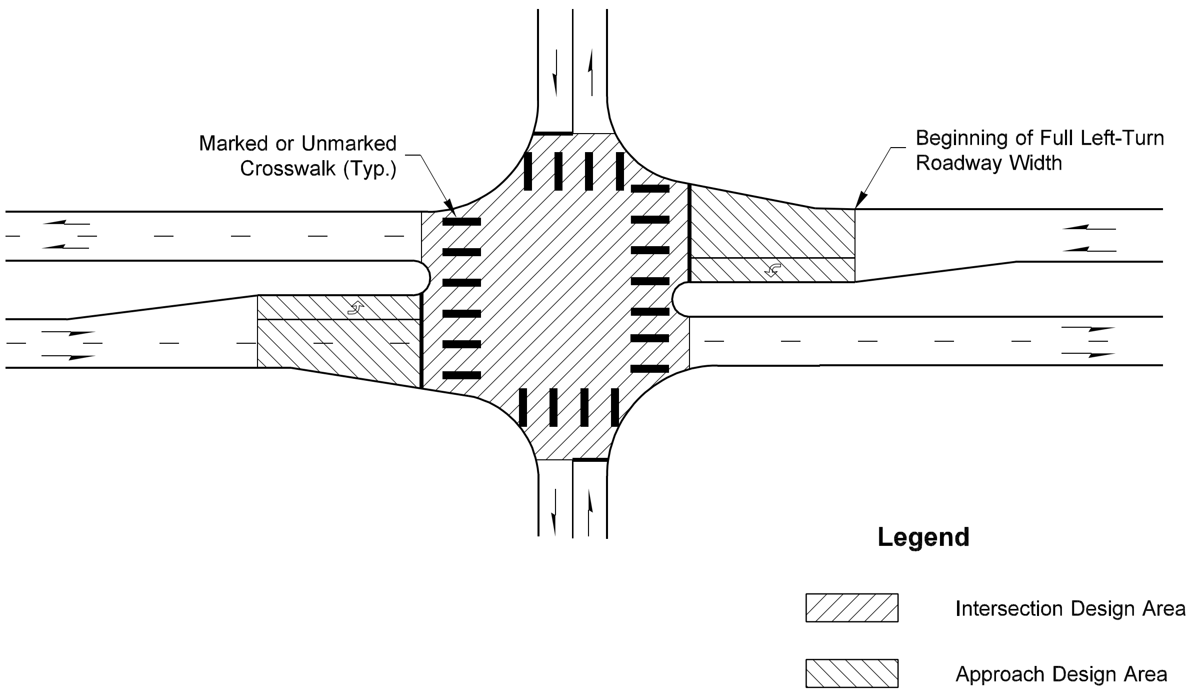
Lane Reduction
(A minimum of two light standards of standard pole height required for design area; design area may be shifted 100 ft.)

Lane Reduction
Figure 840-6

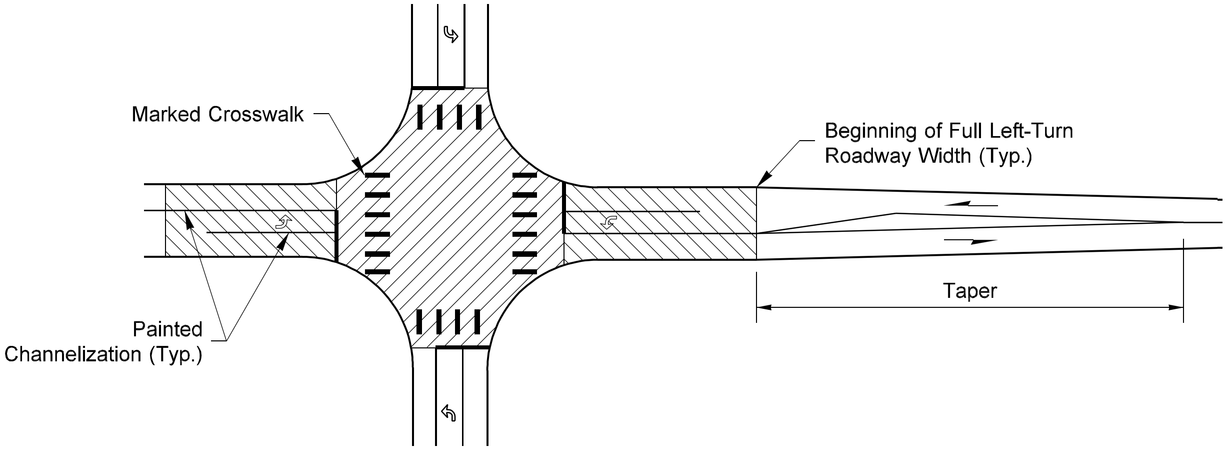


Add Lane
(A minimum of two light standards of standard pole height required for design area.)

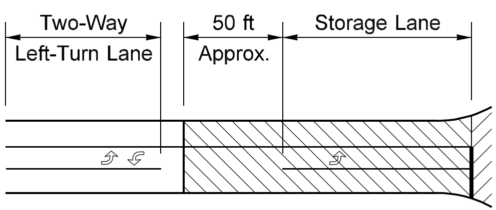
Add Lane
Figure 840-7



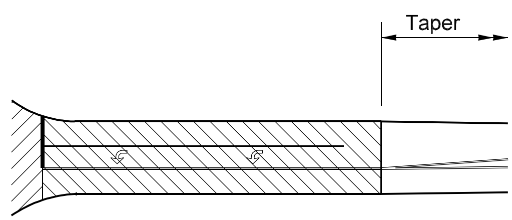
Intersections With Left-Turn Channelization
Figure 840-8a



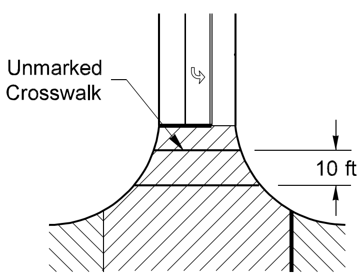
Intersection With Left-Turn Lane Channelization



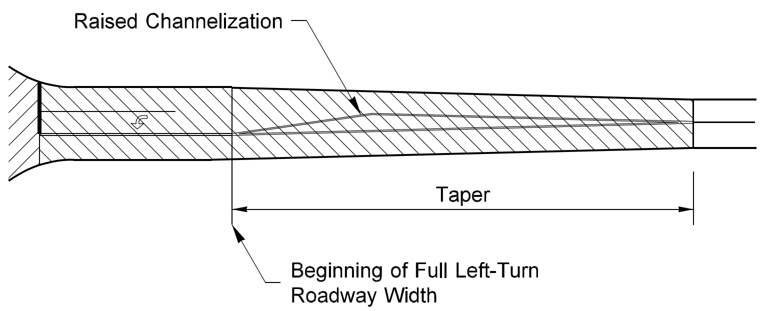
Alternate for Transitions to Two-Way Left-Turn Lanes



Alternate for Long Storage Lanes

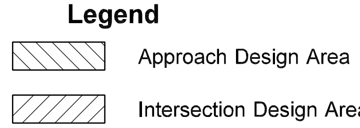


Unmarked Crosswalk Detail



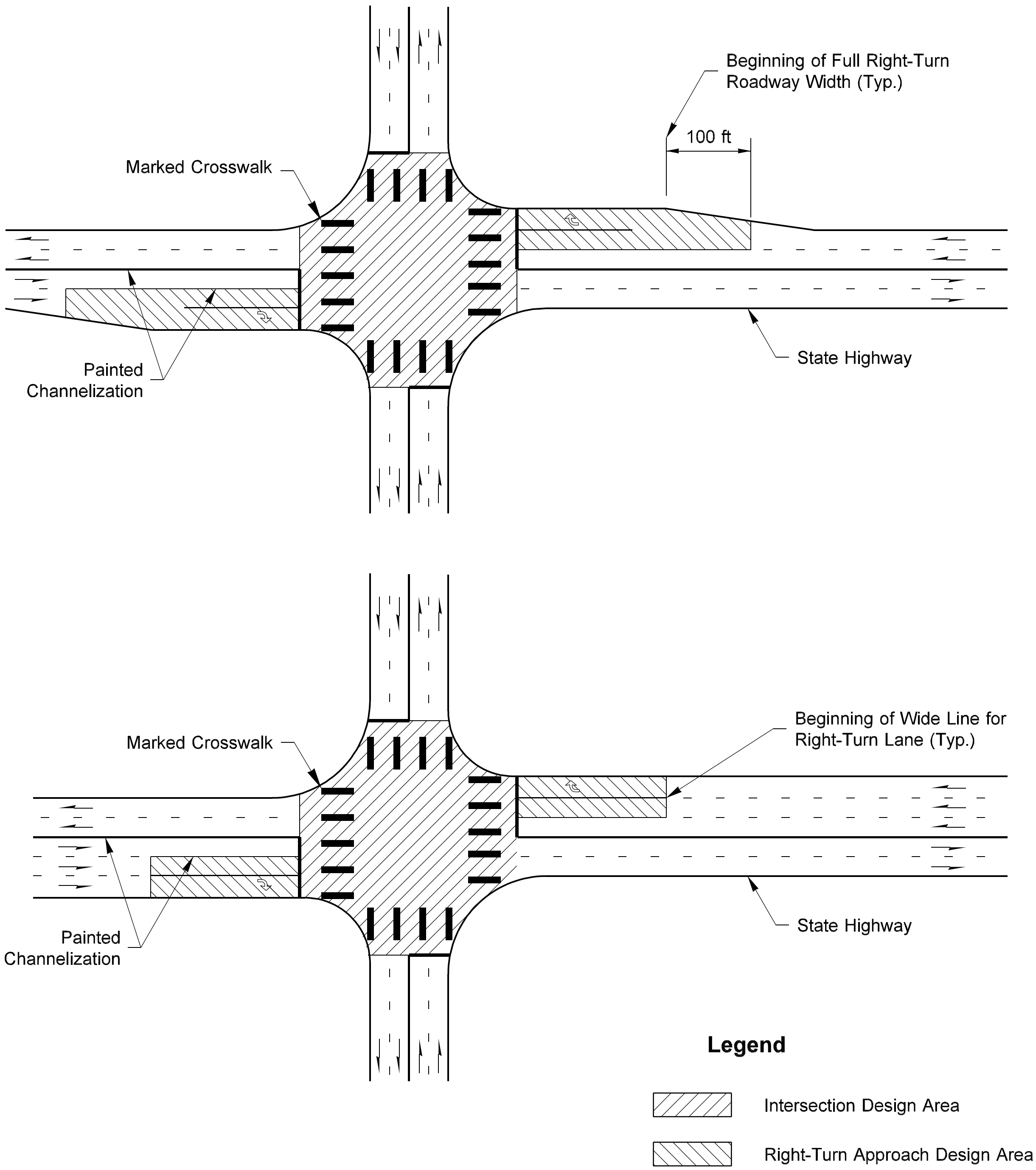
Alternate for Raised Channelization

Legend

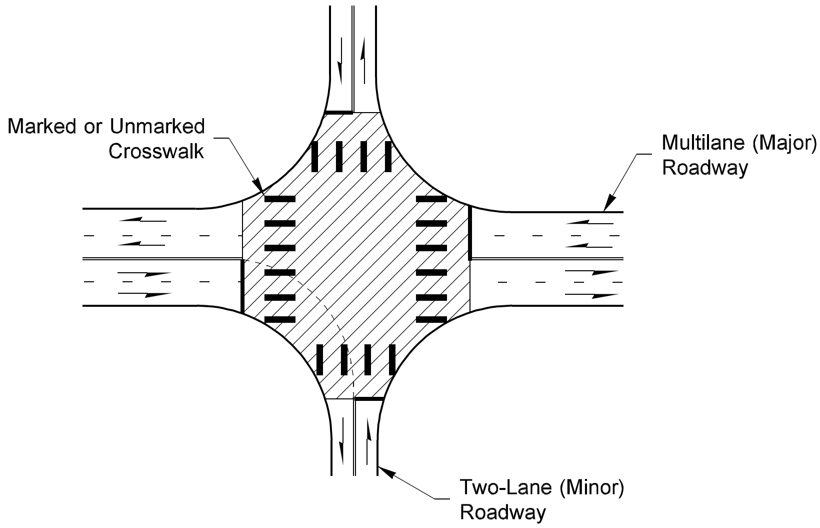


Intersections With Left-Turn Channelization

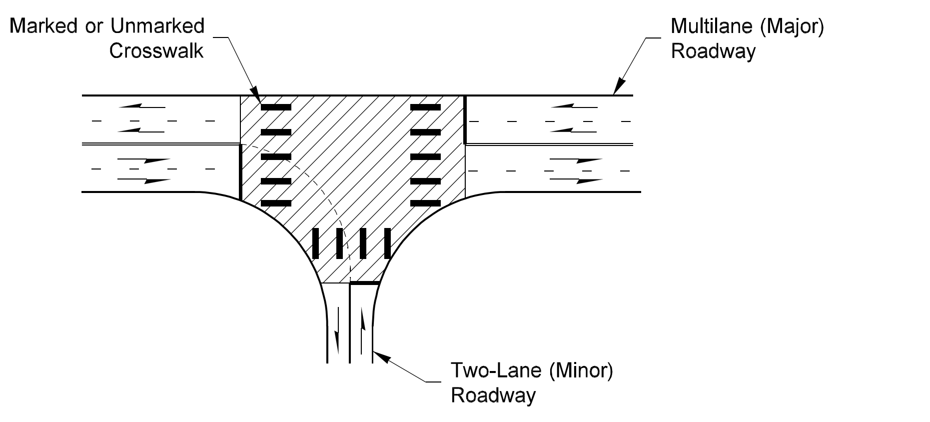
Figure 840-8b



Intersection With Drop Lane/Right-Turn Lane Channelization
Figure 840-9

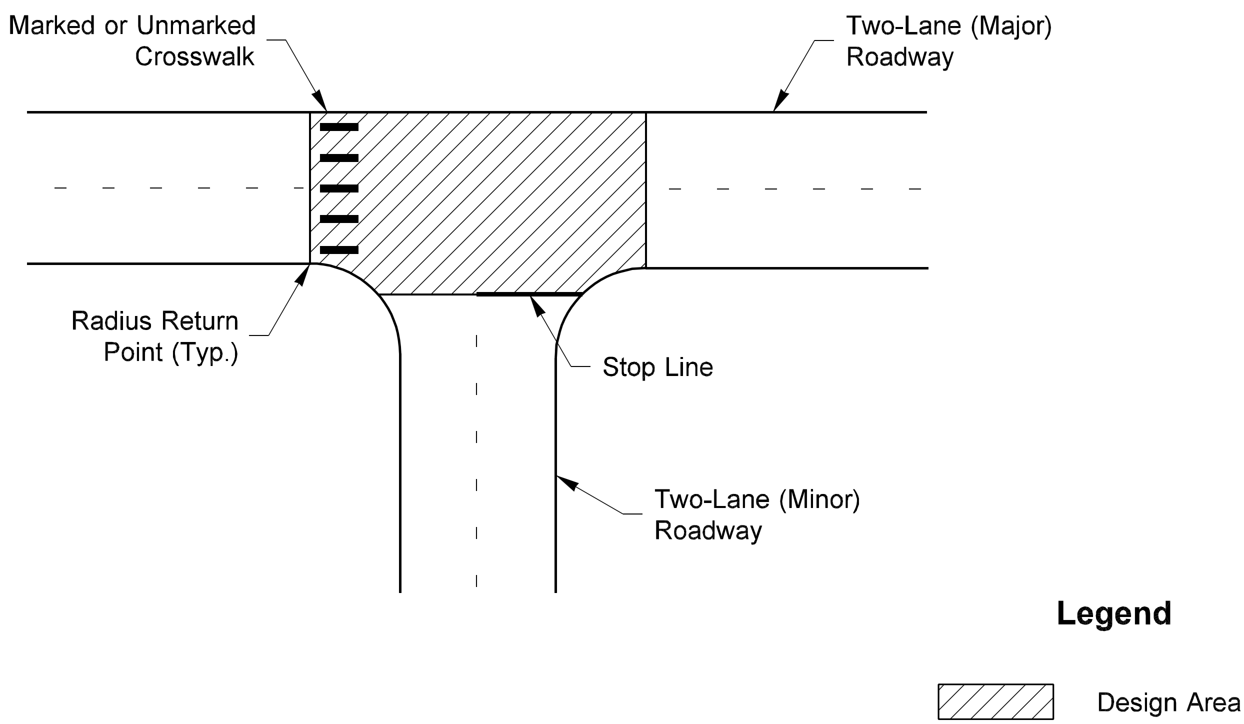


Four-Way Intersection
(Without left-turn channelization; a minimum of two light standards of standard pole height required for design area.)



Major Tee Intersection
(Without left-turn channelization; a minimum of two light standards of standard pole height required for design area.)

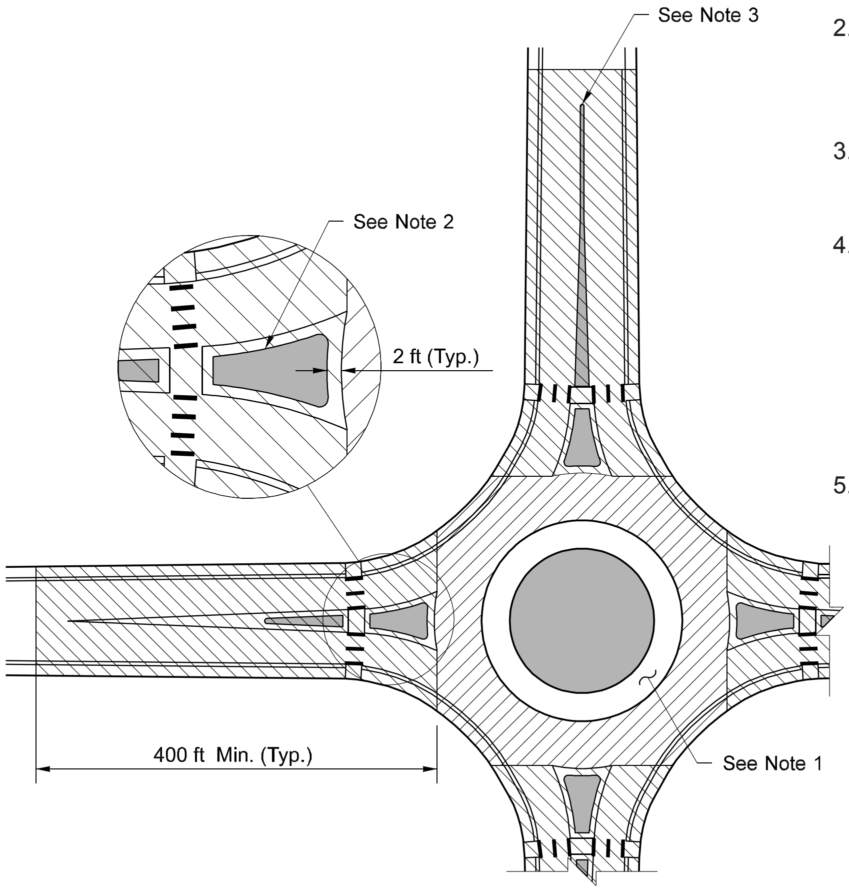
Intersections With Traffic Signals
Figure 840-10

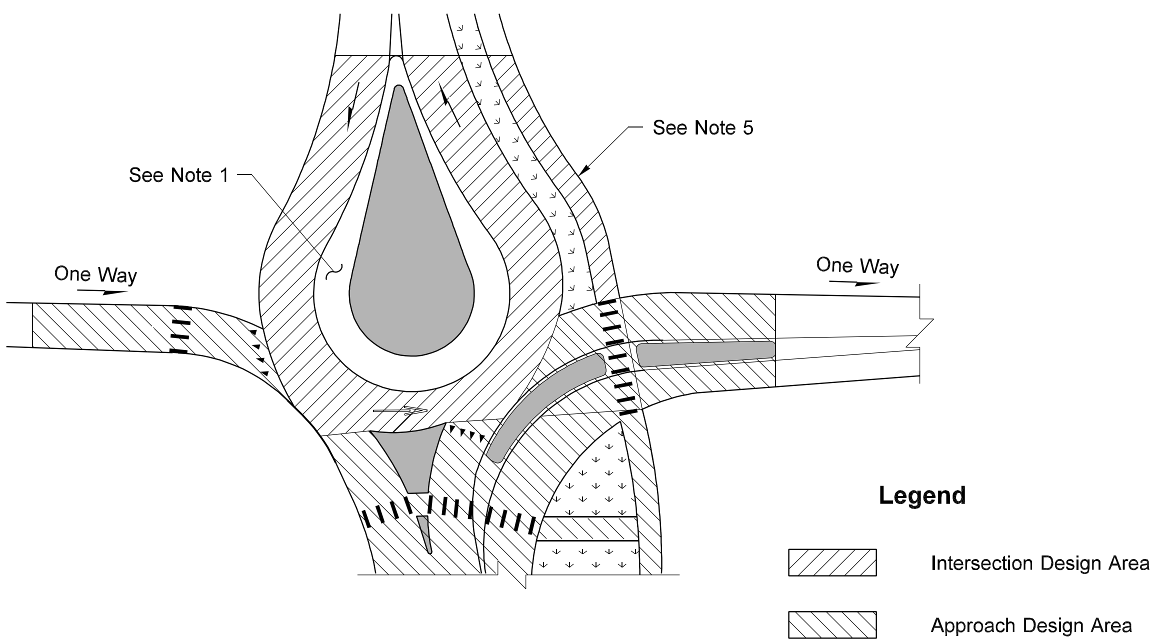


Intersection Without Channelization
Figure 840-11

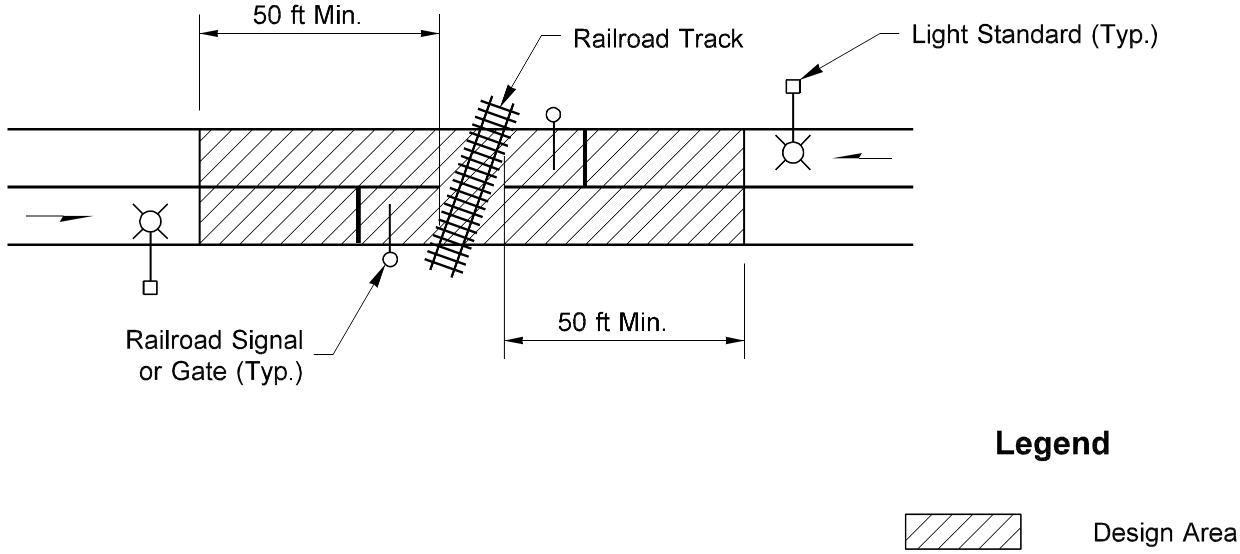
Notes:

1. Exclude Truck Apron from lighting calculation.
2. Exclude the portion inside the 2-ft offset areas of the raised channelization islands from lighting calculation.
3. All channelization 2 ft wide or less is included in Approach Design Area calculation.
4. When a leg of the roundabout is a one-way roadway, the Approach Design Area starts at the beginning of the raised channelization, or 50 ft from the outside edge of the circulating roadway or 50 ft beyond a sidewalk, whichever is farther.
5. A sidewalk is included in the Intersection Design Area calculation when a planting strip is less than 15 ft wide.

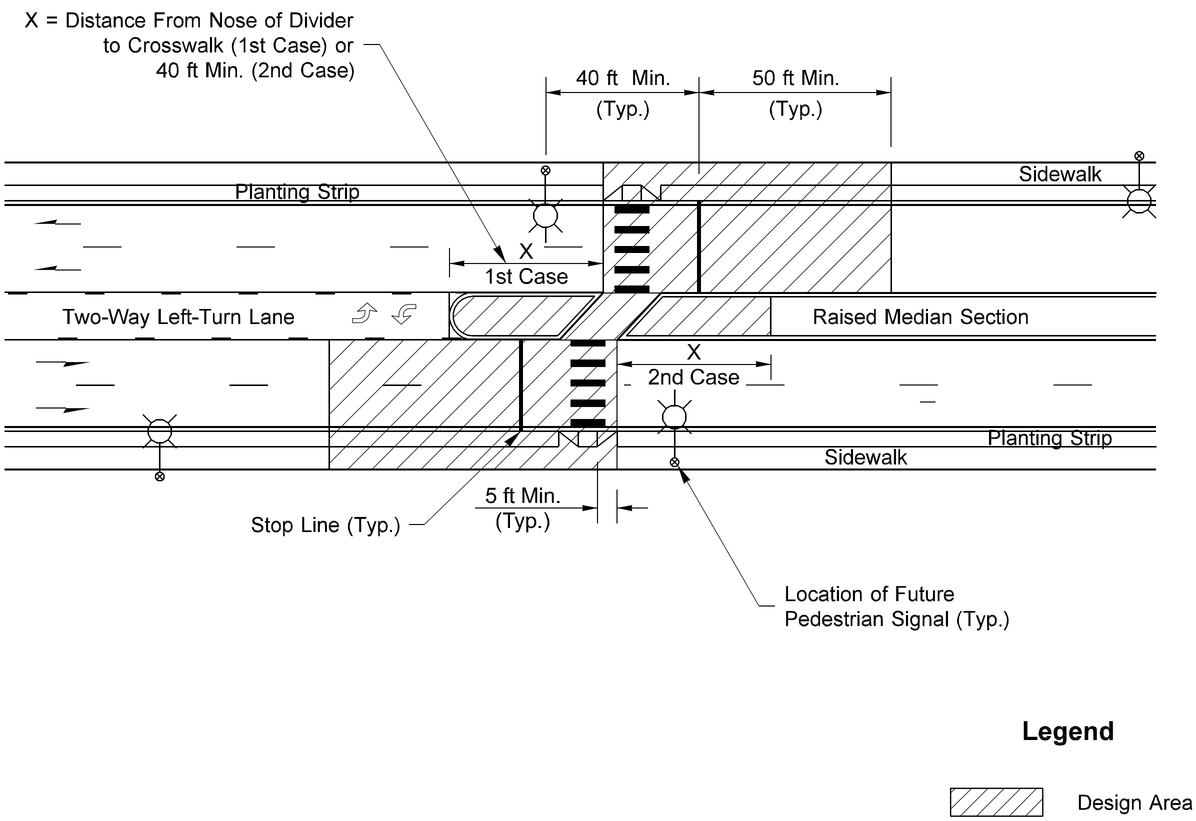




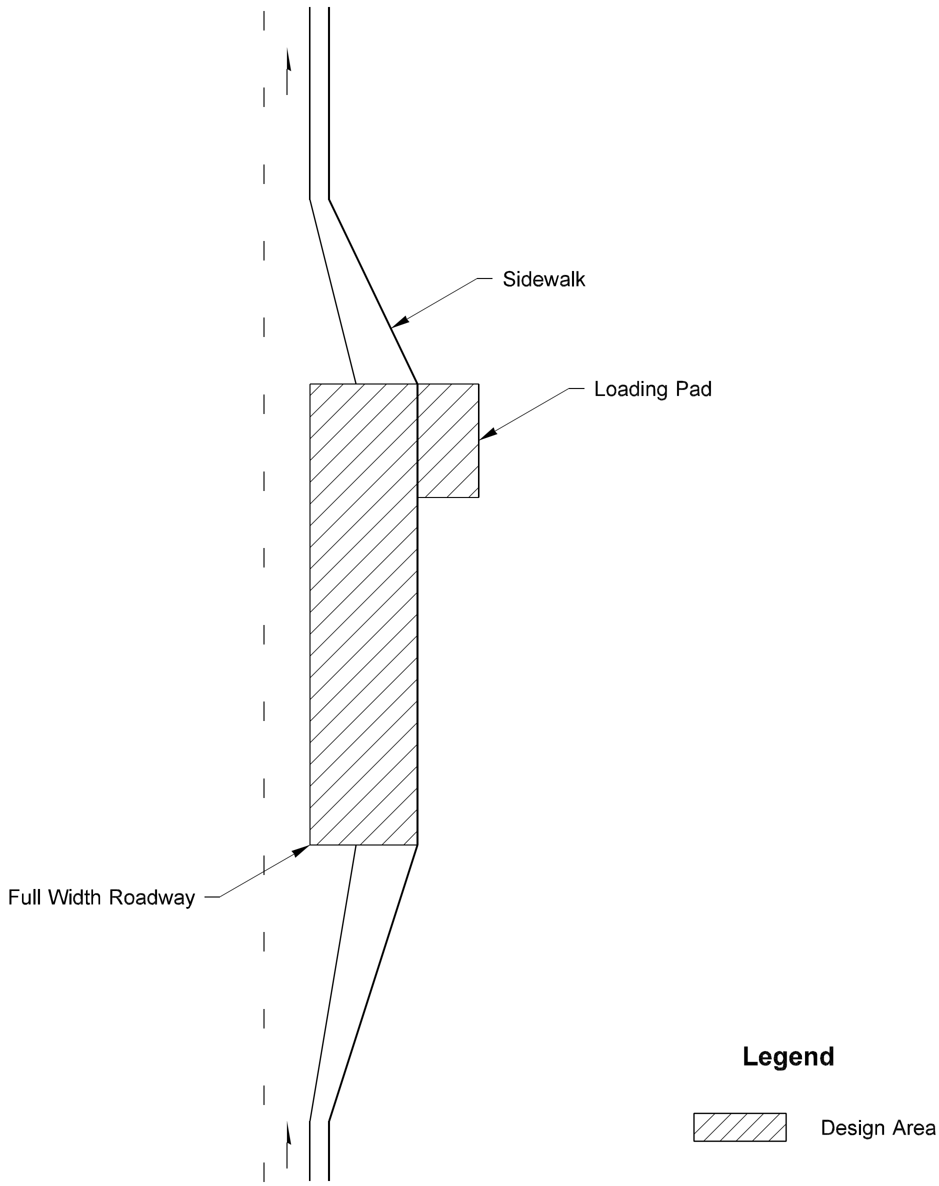
Roundabout
Figure 840-12



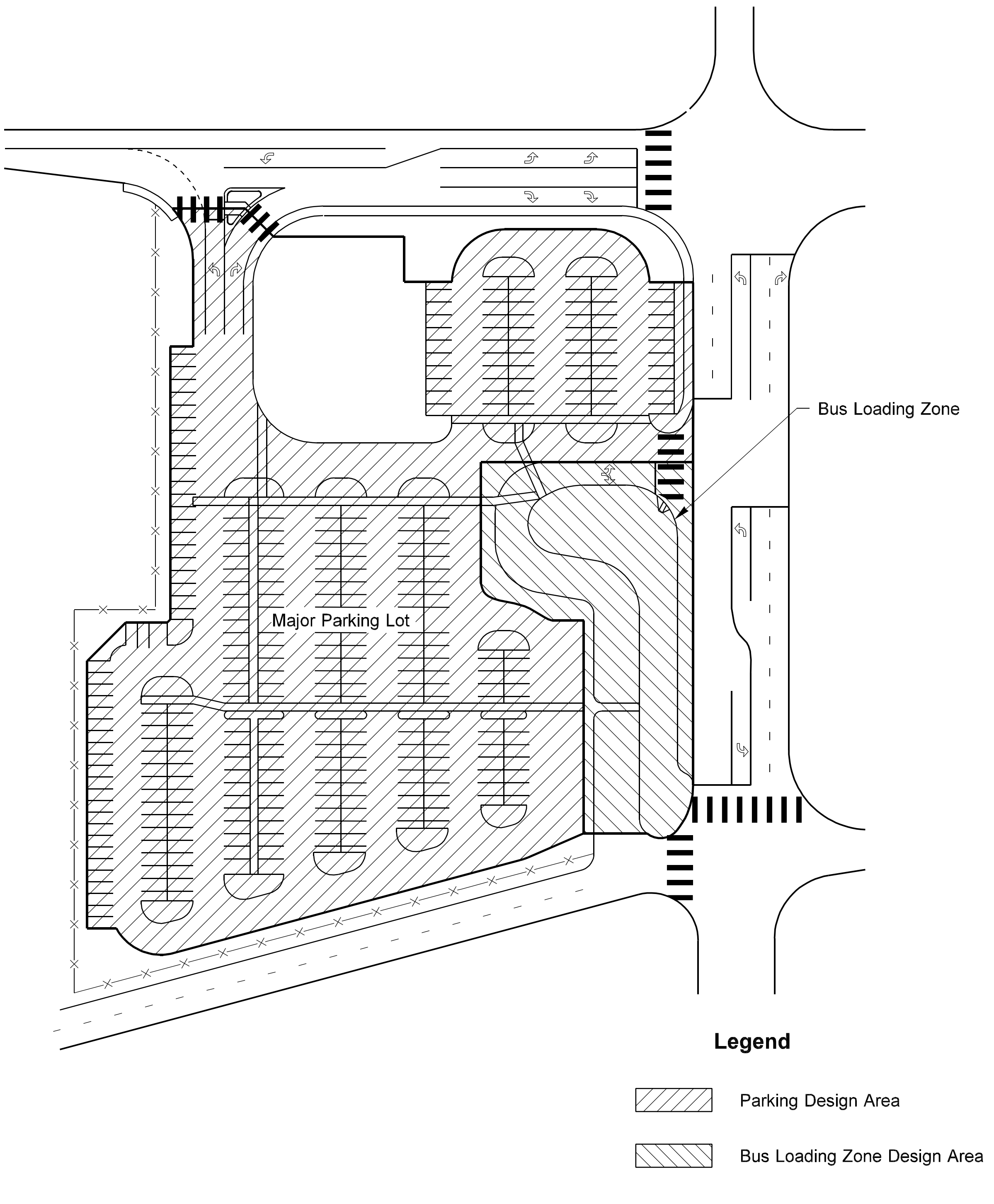
Railroad Crossing With Gates or Signals
Figure 840-13



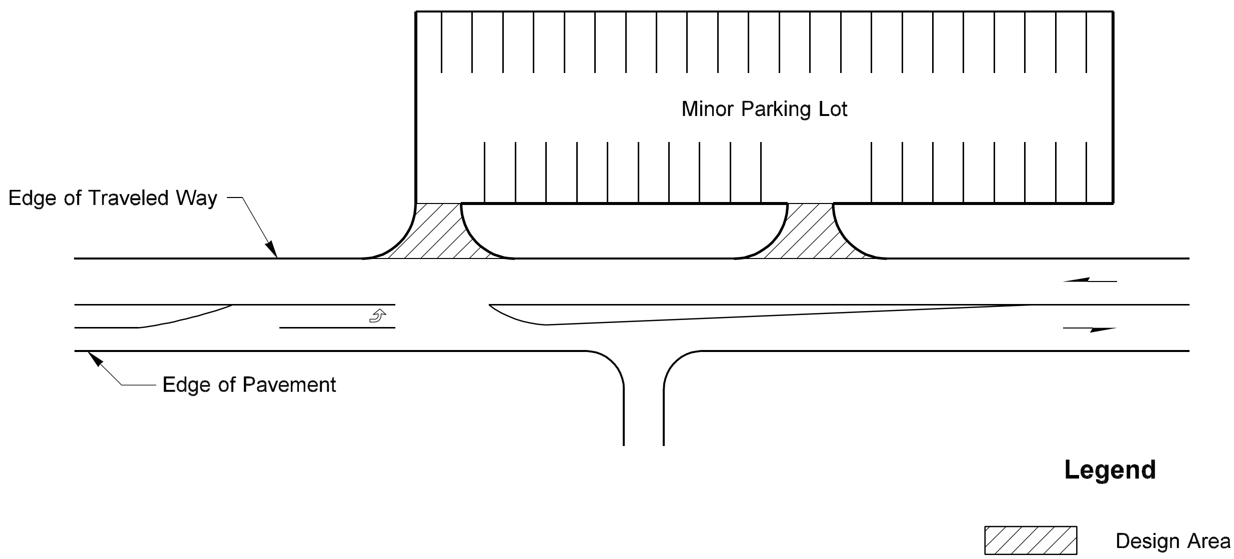
Midblock Pedestrian Crossing
Figure 840-14



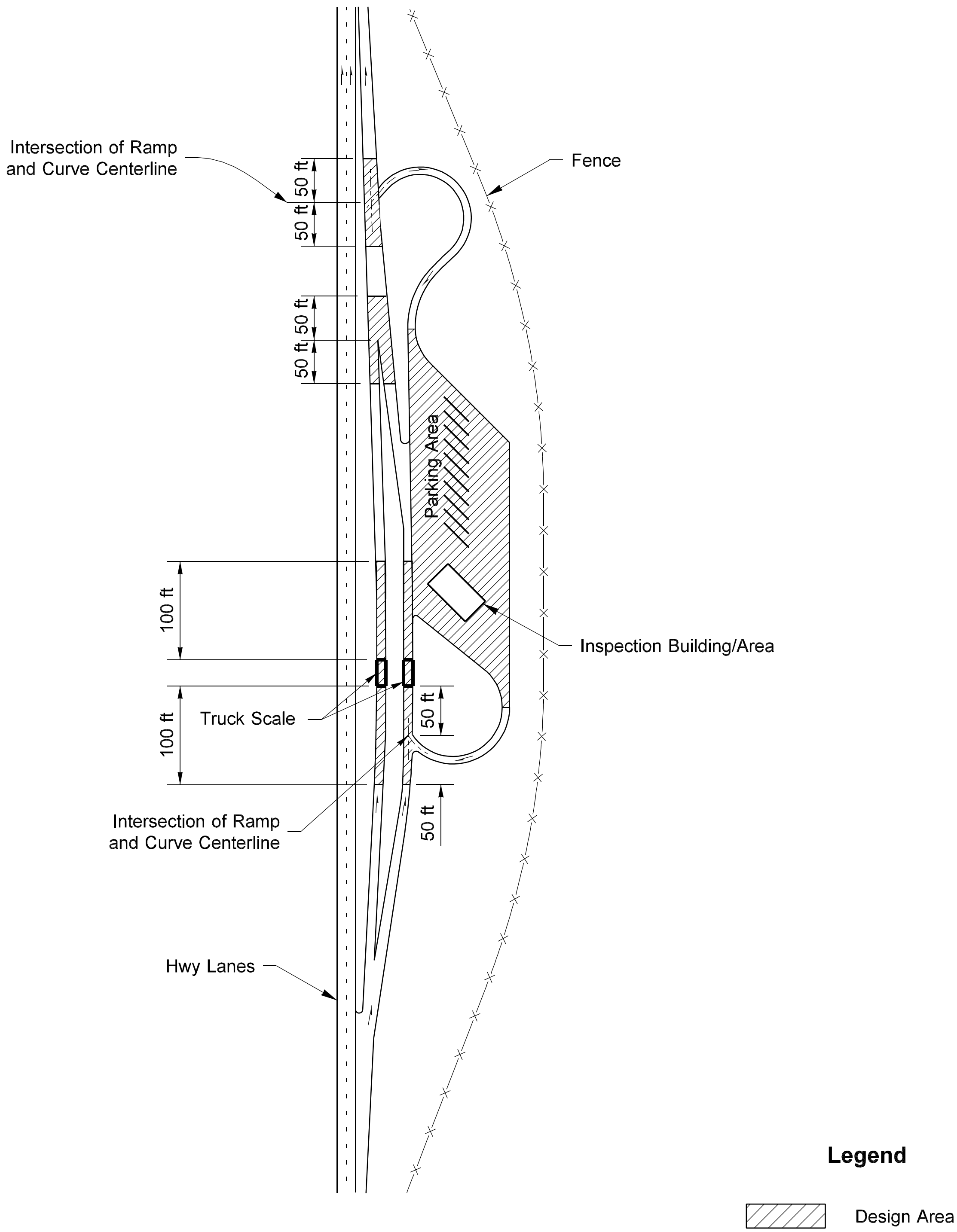
Transit Flyer Stop
Figure 840-15



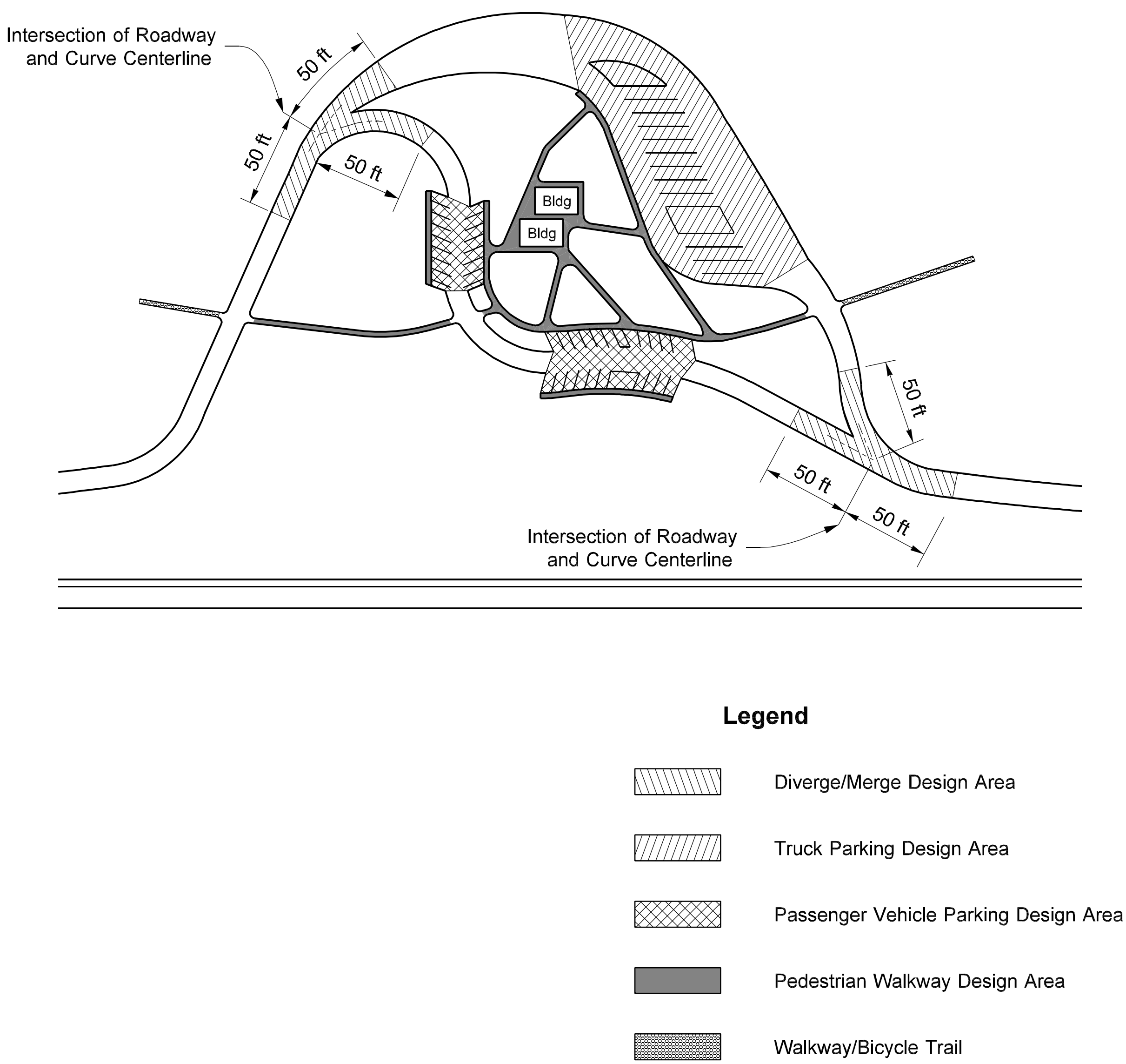
Major Parking Lot
Figure 840-16



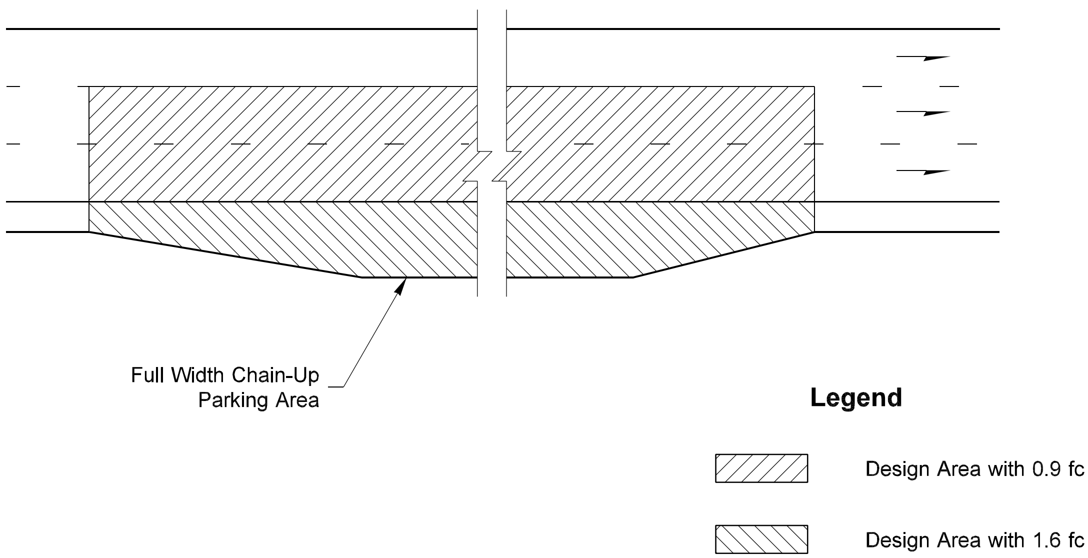
Minor Parking Lot
Figure 840-17



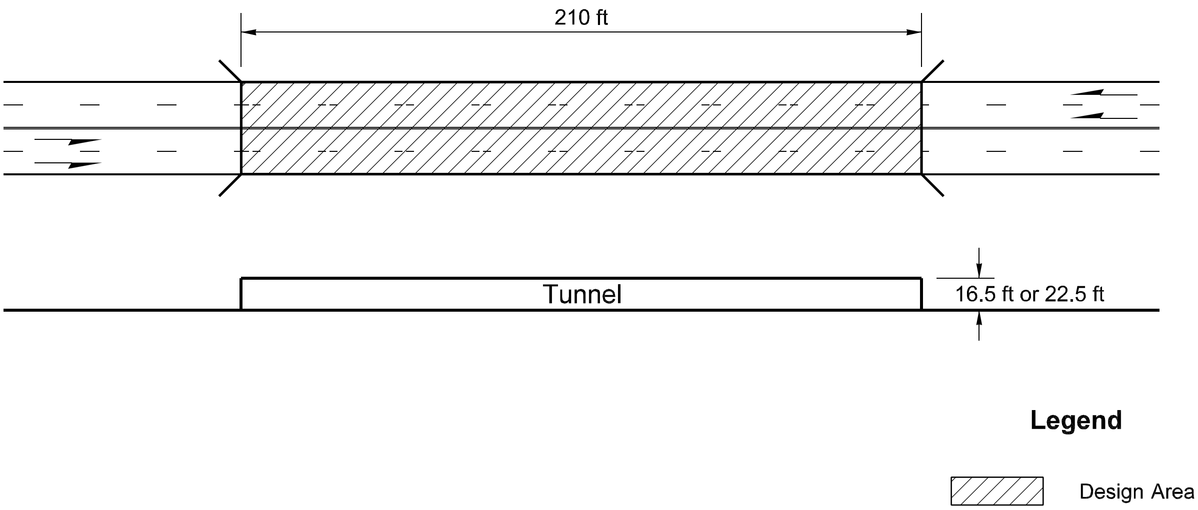
Truck Weigh Site
Figure 840-18



Safety Rest Area
Figure 840-19



Chain-Up/Chain-Off Parking Area
Figure 840-20



If tunnel length exceeds stopping sight distance, then it is classified as a long tunnel:

Example #1
- The stopping sight distance for a 30 mph roadway is 196.7’
- The tunnel length is 210’

196.7’ < 210’ – This would be a long tunnel.

Example #2
- The stopping sight distance for a 40 mph roadway is 300.6’
- The tunnel length is 210’

300.6’ > 210’ – This would be a short tunnel.

Determining whether a short tunnel needs illumination:

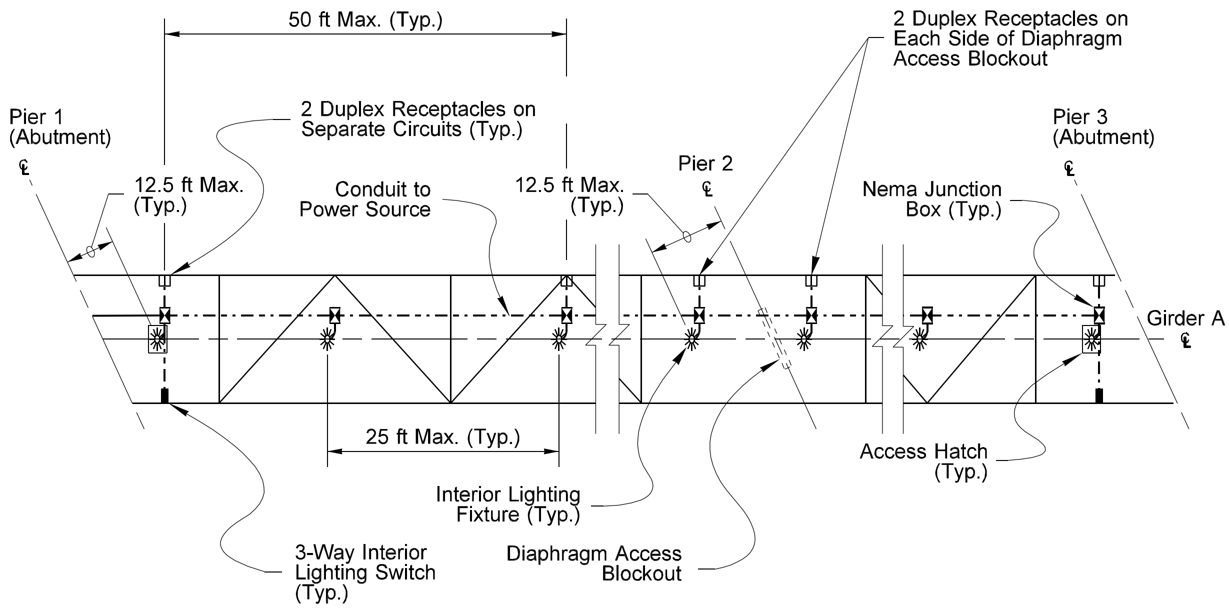
Example #1
- Vertical clearance is 16.5’
- Tunnel length is 210’

If horizontal-to-vertical ratio is 10:1 or greater, then illuminate.
210’ divided by 16.5’ = 12.7:1 ratio – This ratio exceeds the short tunnel horizontal-to-vertical ratio of 10:1, so this tunnel would need illumination—OR—How long can the tunnel be at a given height before it needs to be illuminated?
Tunnel height x maximum ratio factor of short tunnel (10:1 or less).
16.5’ x 10 = 165’
165’ < 210’ – This tunnel would need illumination.

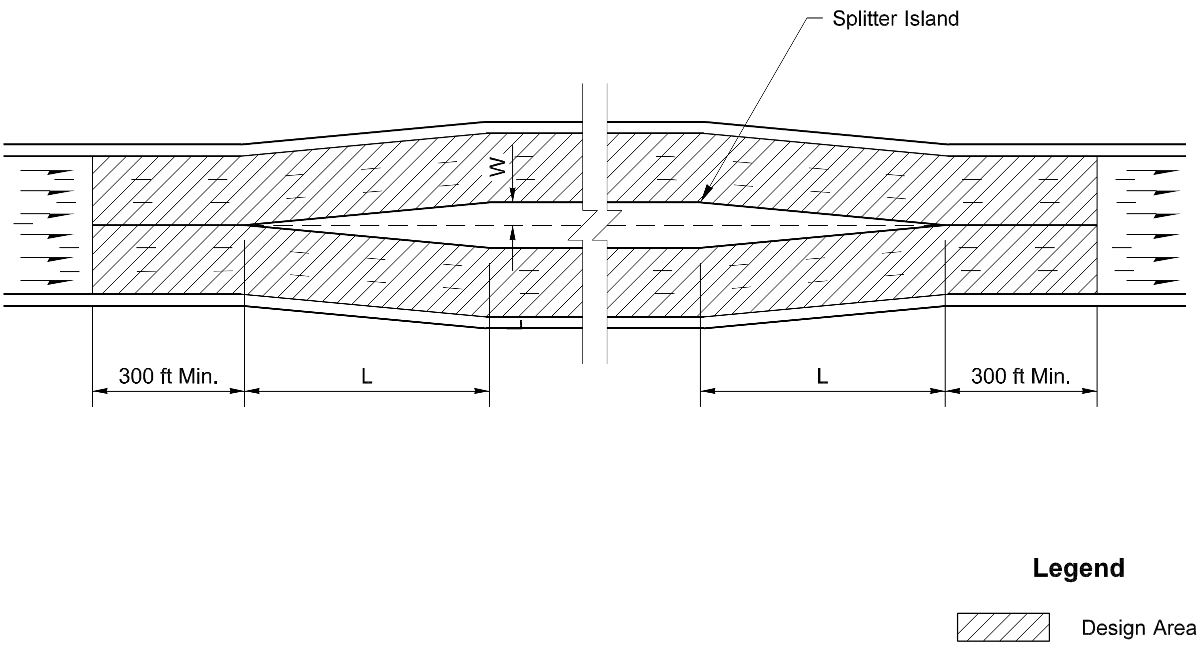
Example #2
- Vertical clearance is 22.5’
- Tunnel length is 210’

If horizontal-to-vertical ratio is 10:1 or greater, then illuminate.
210’ divided by 22.5’ = 9.3:1 ratio – This ratio is less than the short tunnel horizontal-to-vertical ratio of 10:1, so this tunnel would not need illumination—OR—How long can the tunnel be at a given height before it needs to be illuminated?
Tunnel height x maximum ratio factor of short tunnel (10:1 or less).
22.5’ x 10 = 225’
225’ > 210’ – This tunnel would not need illumination.

Tunnel
Figure 840-21



Bridge Inspection Lighting System
Figure 840-22



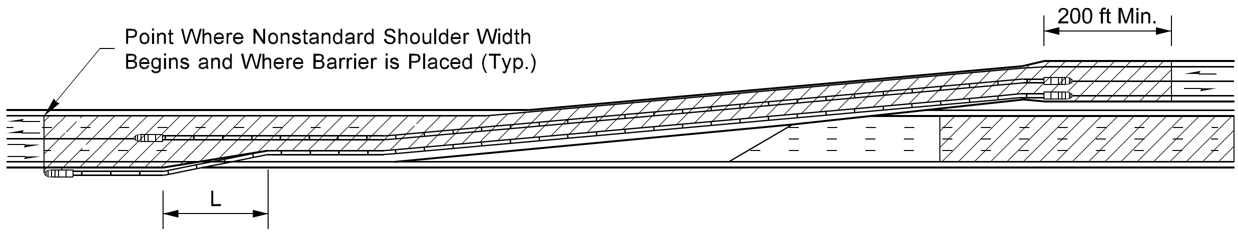
For speeds 45 mph or more: L = WS
For speeds less than 45 mph: L = WS/60

L = Taper in feet
W = Width of offset in feet
S = Posted speed

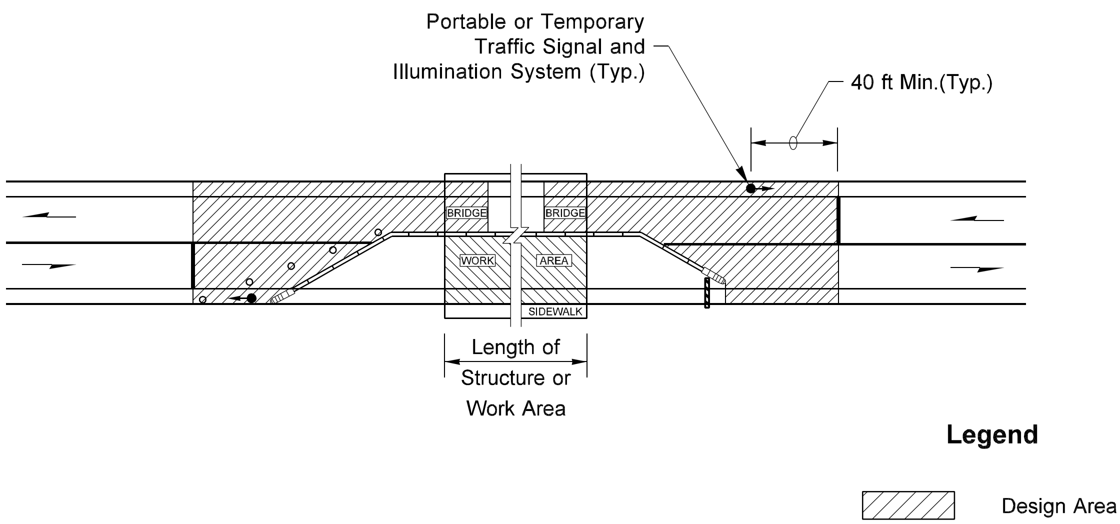
Note:

For temporary Work Zone Plan applications, a site-specific Traffic Control Plan is required. Refer to Chapters 710 and 720 for traffic barrier and attenuator information, Chapter 810 for Work Zone information, and Chapter 820 for signing information.

Traffic Split Around an Obstruction
Figure 840-23



Detour Traffic



Lane Closure With Barrier & Signals Without Flaggers or Spotters
(One direction closure shown/other direction closure typical.)

Note:
For temporary Work Zone Plan applications, a site-specific Traffic Control Plan is required. Refer to Chapters 710 and 720 for traffic barrier and attenuator information, Chapter 810 for Work Zone information, and Chapter 820 for signing information. Refer to the MUTCD Typical Application 12 for additional details.

Construction Work Zone and Detour
Figure 840-24

Light Level and Uniformity Ratio Chart					
Highway Design Class	Minimum Average Maintained Horizontal Light Level[2] Pedestrian/Area Classification			Maximum Uniformity Ratio[6]	Maximum Veiling Luminance[7]
	High (footcandles)	Medium (footcandles)	Low (footcandles)		
Highways With Full Access Control[1]					
Main Line	0.6	0.6	0.6	4:1	0.3:1
Ramps	0.6	0.6	0.6	4:1	0.3:1
Crossroads	0.6	0.6	0.6	3:1	0.3:1
Ramp Intersections	0.9	0.9	0.9	3:1	0.3:1
Principal Arterials[3]					
Main Line	1.6	1.2	0.6	3:1	0.3:1
Intersections	1.6	1.2	0.9	3:1	0.3:1
Minor Arterials					
Main Line	1.2	0.9	0.6	4:1	0.3:1
Intersections	1.2	0.9	0.9	4:1	0.3:1
Collectors					
Main Line	1.1	0.8	0.6	4:1	0.3:1
Intersections	1.1	1.0	0.9	4:1	0.3:1
Construction Lanes and Detours	1.0	1.0	1.0	3:1	0.3:1
Major Parking Lots/Rest Areas[5]	0.8	0.8	0.8	3:1	0.3:1
Vehicle Inspection Areas	2.0	2.0	2.0	3:1	0.3:1
Walkways & Bicycle Trails	0.8	0.8	0.8	3:1	0.3:1
Weigh Scales	0.8	0.8	0.8	3:1	0.3:1
Transit Stops[4]	2.0	2.0	2.0	NA[8]	0.3:1
Midblock Ped X-ing	2.0	2.0	2.0	3:1	0.3:1

Notes:

[1] The minimum light level is 0.2 footcandle (fc) for any application with a minimum average maintained horizontal light level of 0.6 fc. The minimum light levels for all other applications are controlled by the uniformity ratio.

[2] Light level and uniformity ratio apply only when installation of more than one light standard is justified.

[3] Light levels shown also apply to modified and partial limited access control.

[4] For single light standard installations, provide the light level at the location where the bus stops for riders (see 840.06(6)).

[5] Includes illumination at ramp on- and off-connections.

[6] Minimum Average Maintained Light Level/Minimum Light Level = Maximum Uniformity Ratio.

[7] Maximum Veiling Luminance/Average Luminance = Maximum Veiling Luminance Ratio.

[8] The Maximum Uniformity Ratio is 3:1 when more than one light standard is justified.

Light Levels and Uniformity Ratios

Figure 840-25

Chapter 910 Intersections At Grade

910.01 General

Intersections are a critical part of highway design because of increased conflict potential. Traffic and driver characteristics, bicycle and pedestrian needs, physical features, and economics are considered during the design stage to develop channelization and traffic control to enhance safe and efficient multimodal traffic flow through intersections.

This chapter provides guidance for designing intersections at grade, including at-grade ramp terminals. Refer to the following chapters for additional information:

Chapter	**Subject**
915	Roundabouts
920	Road approaches
940	Interchanges
1025	Pedestrian design considerations

If an intersection design situation is not covered in this chapter, contact the Headquarters (HQ) Design Office for assistance.

910.02 References

(1) Federal/State Laws and Codes

Americans with Disabilities Act of 1990 (ADA) (23 CFR Part 36, Appendix A)

RCW 35.68.075, Curb ramps for persons with disabilities – Required – Standards and requirements

WAC 468-18-040, Design standards for rearranged county roads, frontage roads, access roads, intersections, ramps and crossings

WAC 468-52, Highway access management – access control classification system and standards

(2) Design Guidance

Local Agency Guidelines (LAG), M 36-63, WSDOT

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

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

(3) Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

Guidelines and Recommendations to Accommodate Older Drivers and Pedestrians, FHWA-RD-01-051, USDOT, FHWA, May 2001

Highway Capacity Manual (HCM), Special Report 209, Transportation Research Board, National Research Council

Highway Research Record No. 211, *Aspects of Traffic Control Devices*, pp 1-18, "Volume Warrants for Left-Turn Storage Lanes at Unsignalized Grade Intersections." Harmelink, M.D.

NCHRP 279, *Intersection Channelization Design Guide*

Roundabouts: An Informational Guide, FHWA-RD-00-067, USDOT, FHWA

910.03 Definitions

For definitions of ***design speed***, ***divided multilane***, ***expressway***, ***highway***, ***roadway***, ***rural design area***, ***suburban area***, ***traveled way***, ***undivided multilane***, and ***urban design area***, see Chapter 440; for ***lane***, ***median***, and ***shoulder***, see Chapter 640; and for ***decision sight distance***, ***sight distance***, and ***stopping sight distance***, see Chapter 650.

conflict An event involving two or more road users, in which the action of one user causes the other user to make an evasive maneuver to avoid a collision.

conflict point A point where traffic paths cross, merge, or diverge.

crossroad The minor roadway at an intersection. At a stop-controlled intersection, the crossroad has the stop.

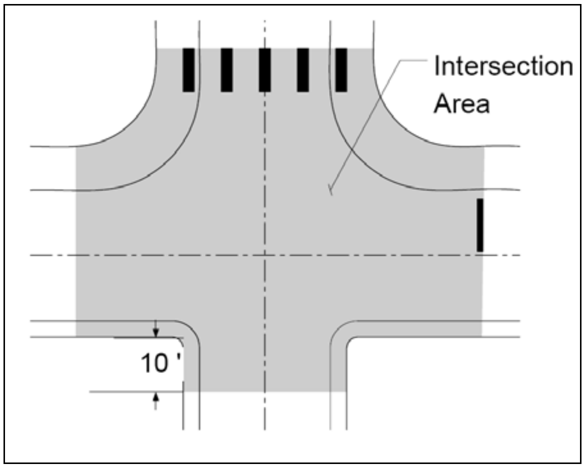
curb extensions A curb and sidewalk bulge or extension into the parking lane or shoulder to decrease the length of a pedestrian crossing (see Chapter 1025).

curb section A roadway cross section with curb and sidewalk.

design vehicle A vehicle, the dimensions and operating characteristics of which are used to establish the intersection geometry.

intersection angle The angle between any two intersecting legs at the point that the centerlines intersect.

intersection area The area of the intersecting roadways bounded by the edge of traveled ways and the area of the adjacent roadways for the farther distance (1) to the end of the corner radii, (2) through any marked crosswalks adjacent to the intersection, (3) to the stop bar, or (4) 10 feet from the edge of shoulder of the intersecting roadway (see Figure 910-1).



Intersection Area
Figure 910-1

intersection at grade The general area where a roadway or ramp terminal is met or crossed at a common grade or elevation by another roadway.

four-leg intersection An intersection formed by two crossing roadways.

split tee A four-leg intersection with the crossroad intersecting the through roadway at two tee intersections. The tee intersection must be offset at least the width of the roadway.

tee (T) intersection An intersection formed by two roadways where one roadway terminates at the point it meets a through roadway.

wye (Y) intersection An intersection formed by three legs in the general form of a "Y" and the angle between two legs is less than 60°.

intersection leg Any one of the roadways radiating from and forming part of an intersection.

entrance leg The lanes of an intersection leg for traffic entering the intersection.

exit leg The lanes of an intersection leg for traffic leaving the intersection.

Note: Whether an intersection leg is an entrance leg or an exit leg depends on which movement is being analyzed. For two-way roadways, each leg is an entrance leg for some movements and an exit leg for other movements.

intersection sight distance The required length of roadway visible to the driver for the safe operation of a vehicle entering an intersection.

island A defined area within an intersection, between traffic lanes, for the separation of vehicle movements or for pedestrian refuge.

channelization island An island that separates traffic movements into definite paths of travel and guides traffic into the intended route.

divisional island An island introduced at an intersection on an undivided roadway to warn drivers of the crossroad ahead and regulate traffic through the intersection.

refuge island An island at or near a crosswalk or bicycle path to aid and protect pedestrians and bicyclists crossing the roadway.

roundabout A circular intersection at grade (see Chapter 915).

rural intersection An intersection in a rural design area (see Chapter 440).

slip ramp A connection between legs of an intersection that allows right-turning vehicles to bypass the intersection or a connection between an expressway and a parallel frontage road.

two-way left-turn lane (TWLTL) A lane located between opposing lanes of traffic to be used by vehicles making left turns from either direction, from or onto the roadway.

urban intersection An intersection in an urban design area (see Chapter 440).

910.04 Intersection Configurations

At-grade intersection configurations in their simplest forms are three-leg, four-leg, and multileg. More complex designs are variations or combinations selected to accommodate the constraints and traffic presented by the location. The intersection configurations at any location are determined by the number of intersecting legs; the topography; the character of the intersecting roadways; the traffic volumes, patterns, and speeds; and the desired type of operation.

(1) Roundabouts

Modern roundabouts are circular intersections. They can be an effective intersection type.

When well designed, roundabouts are an efficient form of intersection control. They have fewer conflict points, lower speeds, easier decision making, and require less maintenance. When properly designed and located, they have been found to reduce injury accidents, traffic delays, fuel consumption, and air pollution. Roundabouts also permit U-turns.

Include roundabouts as an alternative at intersections where:

- Stop signs result in unacceptable delays for the crossroad traffic.
- There is a high left-turn percentage.
- There are more than four legs.
- A disproportionately high number of accidents involve crossing or turning traffic.
- The major traffic movement makes a turn.
- Traffic growth is expected to be high and future traffic patterns are uncertain.
- It is not desirable to give priority to either roadway.

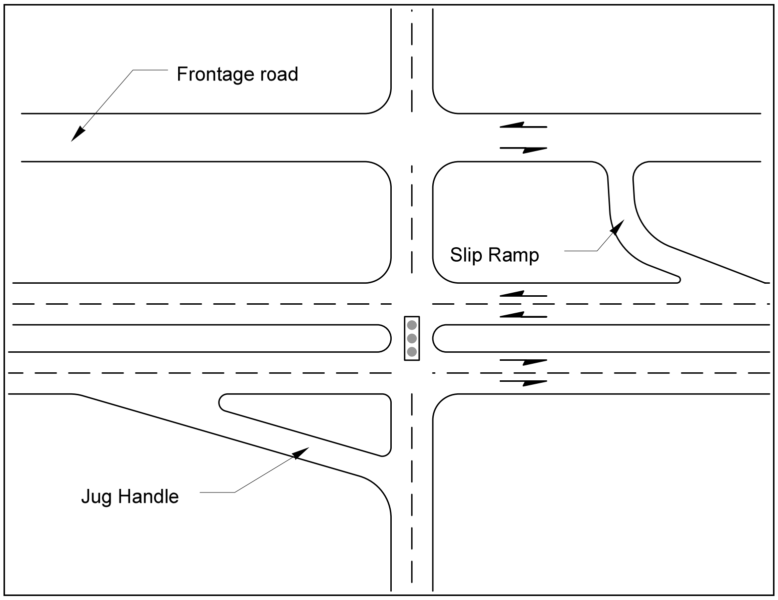
Other tradeoffs with roundabouts include:

- Roundabouts give equal priority to all legs.
- All traffic entering a roundabout is required to reduce speed.

Refer to Chapter 915 for information and requirements on the design and documentation of roundabouts.

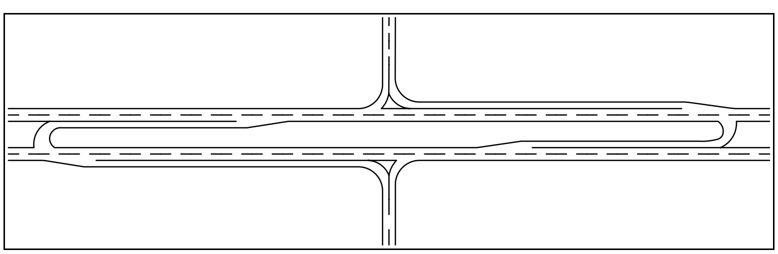
(2) Indirect Left Turns

At signalized intersections, indirect left-turn intersections reduce conflict points and delays to the major route by eliminating the left-turn phase (see Figure 910-2a for an example).



Indirect Left Turns (Signalized Intersections)
Figure 910-2a

At unsignalized intersections, indirect left-turn intersections help mitigate entering-at-angle collisions. Left-turning and through traffic on the crossroad must turn right and then make a U-turn at a median crossover or a nearby intersection (see Figure 910-2b for an example). Provide for weaving movements when selecting the distance between right turns and U-turns on major routes and the storage (if needed) for U-turning vehicles. This treatment eliminates conflict points while minimizing delays to the major route. (See 910.08 for guidance on the design of U-turn locations.)

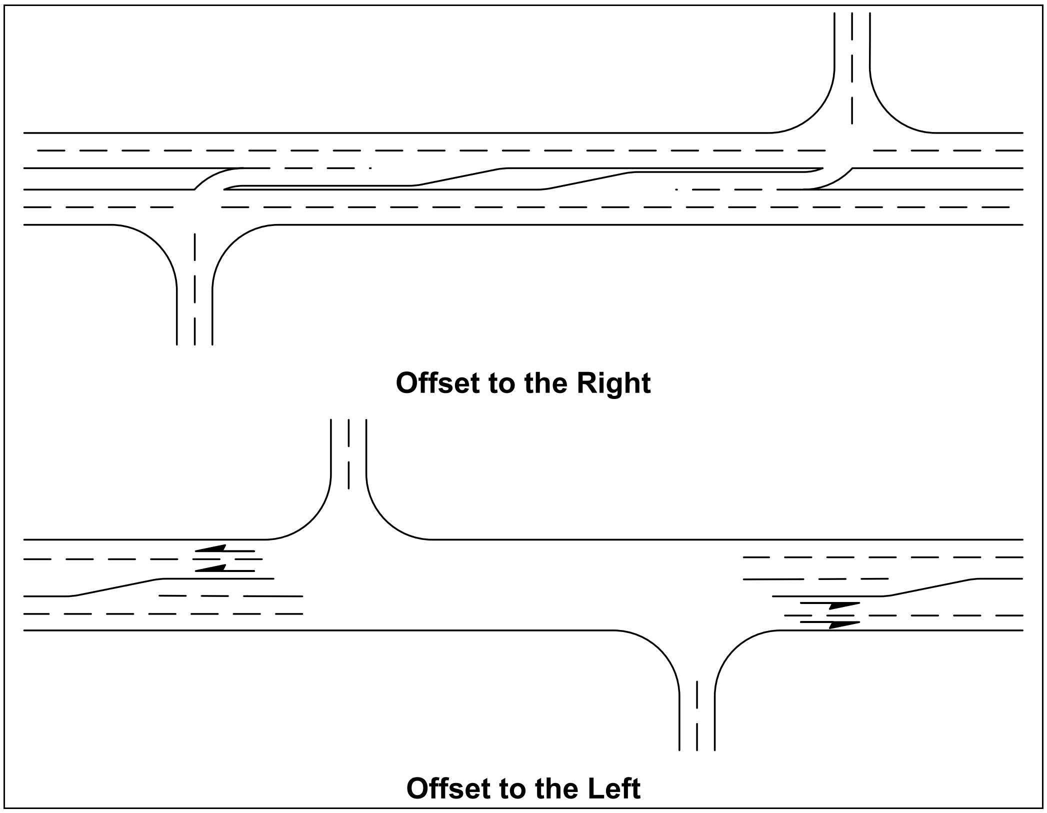


Indirect Left Turns (Unsignalized Intersections)
Figure 910-2b

(3) Split Tee

Avoid split tee intersections where there is less than the required intersection spacing (see 910.05(4)). Split tee intersections with an offset distance to the left greater than the width of the roadway, but less than the intersection spacing, may be designed, with justification. Evaluate the anticipated benefits against the increased difficulty for cross traffic in driving through the intersection and a more complicated traffic signal design.

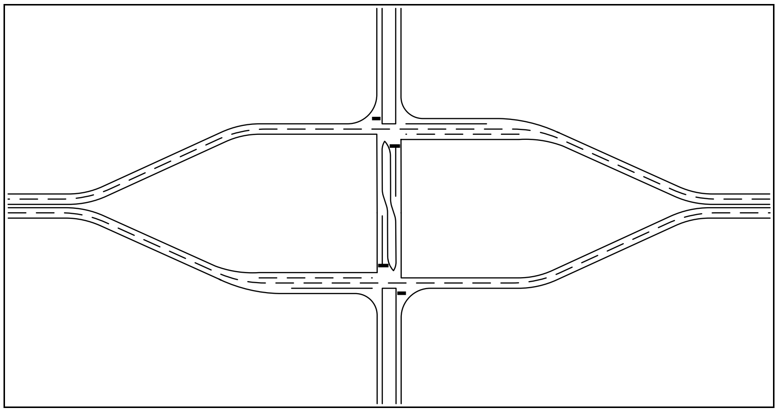
Split tee intersections with the offset to the right (see Figure 910-3) have the additional disadvantages of overlapping main line left-turn lanes, the increased possibility of wrong way movements, and a traffic signal design (if required) that will be even more complicated. Do not design a split tee intersection with an offset to the right less than the required intersection spacing (see 910.05(4)) unless traffic is restricted to right-in/right-out only.



Split Tee Intersections
Figure 910-3

(4) Split Intersections

Split intersections provide wide medians on divided multilane highways, which separate the traveled ways of the through roadway to allow storage of left-turning and crossing traffic (see Figure 910-4). Traffic on the crossroad makes the through and left-turn movements in two stages, reducing the required sight distance and the probability of the driver misjudging the required gap. The median width must be sufficient to store all crossing and left-turning vehicles to avoid potential conflicts with through traffic. The minimum median width is 100 feet, with 200 to 300 feet being desirable.



Split Intersections
Figure 910-4

(5) Nonstandard Configurations

Low average daily traffic (ADT) can hide operational problems. Do not design intersections with nonstandard configurations such as:

- Intersections with offset legs, except for split tee intersections (see 910.04(3)).
- Intersections with more than four legs.
- Tee intersections with the major traffic movement making a turn.
- Wye intersections that are not a one-way merge or diverge.

A roundabout might be an alternative to these nonstandard configurations (see 910.04(1) and Chapter 915).

With justification and approval from the Region Traffic Engineer, existing intersections with nonstandard configurations may remain in place when an analysis shows no collision history related to the configuration.

910.05 Design Considerations

Intersection design requires consideration of all potential users of the facility. This involves addressing the needs of a diverse mix of user groups, including passenger cars, heavy vehicles of varying classifications, bicycles, and pedestrians. Often, meeting the needs of one user group requires a compromise in service to others. Intersection design balances these competing needs, resulting in appropriate levels of operation for all users.

In addition to reducing the number of conflicts, minimize the conflict area as much as possible while still providing for the required design vehicle (see 910.06). This is done to control the speed of turning vehicles and reduce vehicle, bicyclist, and pedestrian exposure.

(1) Nongeometric Considerations

Geometric design considerations, such as sight distance and intersection angle, are important. Equally important are perception, contrast, and a driver's age. Perception is a factor in the majority of collisions. Regardless of the type of intersection control, the safe function of any intersection depends on the driver's ability to perceive what is happening with respect to the surroundings and other vehicles, whether it is the speed of the vehicles in front when approaching an intersection or the speed of approaching vehicles when selecting an acceptable gap in traffic to enter an intersection. In order to choose an acceptable gap, the driver must first clearly identify the approaching vehicle(s) and then determine the speed. The driver uses visual clues provided by the immediate surroundings in making these decisions. Thus, given equal sight distance, it may be easier for the driver to judge a vehicle's oncoming speed when there are more objects to pass by in the driver's line of sight. Contrast allows us to discern one object from another. Contrast sensitivity is affected by available light and the weather.

(2) Intersection Angle

An important intersection design characteristic is the intersection angle. The desirable intersection angle is 90°, with 75° to 105° allowed for new, reconstructed, or realigned intersections.

Existing intersections with an intersection angle between 60° and 120° may remain. Intersection angles outside this range tend to restrict visibility; increase the area required for turning; increase the difficulty of making a turn; increase the crossing distance and time for vehicles and pedestrians; and make traffic signal arms difficult or impossible to design.

(3) Lane Alignment

Design intersections with entrance lanes aligned with the exit lanes. Do not put angle points on the roadway alignments within intersection areas or on the through roadway alignment within 100 feet of the edge of traveled way of a crossroad. This includes short radius curves where both the PC and PT are within the intersection area. However, angle points within the intersection are allowed at intersections with a minor through movement, such as at a ramp terminal (see Figure 910-10).

When feasible, locate intersections such that curves do not begin or end within the intersection area. It is desirable to locate the PC and PT at least 250 feet from the intersection so that a driver can settle into the curve before the gap in the striping for the intersection area.

(4) Intersection Spacing

Adequate intersection spacing is required to provide for safety and the desired operational characteristics for the highway. The minimum spacing for highways with limited access control is covered in Chapters 1430. For other highways, the minimum spacing is dependent on the Highway Access Management Class. (See Chapter 1435 for minimum intersection spacing on managed access highways.)

As a minimum, provide enough space between intersections for left-turn lanes and storage length. Space signalized intersections and intersections expected to be signalized to maintain efficient signal operation. Space intersections so that queues will not block an adjacent intersection.

Evaluate existing intersections that are spaced less than shown in Chapters 1430 and 1435. Evaluate closing or restricting movements at intersections with operational problems. Document the spacing of existing intersections to remain in place and their effects on operation, capacity, and circulation.

(5) Design Vehicle

The geometric design of an intersection requires identifying and addressing the needs of all intersection users. There are competing design objectives when considering the turning requirements of larger vehicles and the crossing requirements of pedestrians. To reduce the operational impacts of large design vehicles, larger turn radii are used. This results in increased pavement areas, longer pedestrian crossing distances, and longer traffic signal arms.

To reduce the intersection area, a smaller design vehicle is used or encroachment is allowed. This reduces the potential for vehicle/pedestrian conflicts, decreases pedestrian crossing distance, and controls the speeds of turning vehicles.

If the selected design vehicle is too small, a capacity reduction and greater speed differences between turning vehicles and through vehicles might result. If the vehicle is larger than necessary, the pavement areas, pedestrian crossing distances, and traffic signal arms will also be larger than needed. (See 910.06 for information on selecting a design vehicle and acceptable encroachments.)

(6) Sight Distance

For traffic to move safely through intersections, drivers need to be able to see stop signs, traffic signals, and oncoming traffic in time to react accordingly.

Provide decision sight distance in advance of stop signs, traffic signals, and roundabouts. Where decision sight distance is not feasible, stopping sight distance may be provided. (See Chapter 650 for guidance.)

Drivers approaching an intersection on the through roadway need to be able to see the intersection far enough ahead to assess developing situations and take appropriate action. Locate new intersections where decision sight distance is available for through traffic. At crosswalks, provide decision sight distance to an area the width of the crosswalk and 6 feet from the edge of traveled way. Where decision sight distance is not feasible, stopping sight distance may be provided. (See Chapter 650 for guidance on decision and stopping sight distances.)

The driver of a vehicle that is stopped, waiting to cross or enter a through roadway, needs obstruction-free sight triangles in order to see enough of the through roadway to safely complete all legal maneuvers before an approaching vehicle on the through roadway can reach the intersection. (See 910.09 for guidance on intersection sight distance sight triangles.)

(7) Crossroads

When the crossroad is a city street or county road, design the crossroad beyond the intersection area according to the applicable design criteria given in Chapter 440.

When the crossroad is a state facility, design the crossroad according to the applicable design level and functional class (see Chapters 325, 430, and 440). Continue the cross slope of the through roadway shoulder as the grade for the crossroad. Use a vertical curve that is at least 60 feet long to connect to the grade of the crossroad.

Evaluate the profile of the crossroad in the intersection area. To prevent operational problems, the crown slope of the main line might need to be adjusted in the intersection area.

Design the grade for stop-controlled legs so that the cross slope for the crosswalk is not greater than 2%. For all other legs, adjust the grade so that the maximum crosswalk cross slope is 5%. (See Chapter 1025 for additional crosswalk information.)

In areas that experience accumulations of snow and ice for all legs that will require traffic to stop, design a maximum grade of ±4% for a length equal to the anticipated queue length for stopped vehicles.

(8) Rural Expressway At-Grade Intersections

At-grade intersections on high-speed rural expressways can result in safety problems. The main problem is right-angle, far-side collisions for crossroad traffic making a left-turn or crossing maneuver. Evaluate grade separations at all intersections on rural expressways.

Design high-speed at-grade intersections on rural expressways as indirect left turns, split intersections, or roundabouts.

The State Traffic Engineer's approval is required for any new intersection or signal on a rural expressway.

(9) Interchange Ramp Terminals

When stop control or traffic signal control is selected, the design to be used or modified is shown in Figure 910-10. Higher-volume intersections with multiple ramp lanes are designed individually.

In urban and suburban areas, match the design speed at the ramp terminal to the speed of the crossroad.

Where stop control or signal control is implemented, the intersection configuration requirements for ramp terminals are normally the same as for other intersections. One exception to this is that an angle point is allowed between an off-ramp and an on-ramp. This is because the through movement of traffic getting off the freeway, going through the intersection, and back on the freeway is minor.

Another exception is at ramp terminals where the through movement is eliminated (for example at a single point interchange). For ramp terminals that have two wye connections, one for right turns and the other for left turns and no through movement, the intersection angle has little meaning and does not need to be considered.

Due to the probable development of large traffic generators adjacent to an interchange, width for a median on the local road is desirable whenever such development is believed to be imminent. This allows for future left-turn channelization. Use median channelization when justified by capacity determination and analysis or by the need to provide a smooth traffic flow.

Adjust the alignment of the intersection legs to fit the traffic movements and to discourage wrong-way movements. Use the allowed intersecting angles of 75° to 105° (60° to 120° for modified design level) to avoid broken back or reverse curves in the ramp alignment.

910.06 Design Vehicle Selection

When selecting a design vehicle for an intersection, the needs of all users and the costs must be considered. The primary use of the design vehicle is to determine radii requirements for each leg of the intersection. It is possible for each leg to have a different design vehicle. Figure 910-5 shows commonly used design vehicle types.

Evaluate the existing and anticipated future traffic to select a design vehicle that is the largest vehicle that normally uses the intersection. Figure 910-6 shows the minimum design vehicles. Provide justification to use a smaller vehicle; include a traffic analysis showing that the proposed vehicle is appropriate.

To minimize the disruption to other traffic, design the intersection to allow the design vehicles to make each turning movement without encroaching on curbs, opposing lanes, or same-direction lanes at the entrance leg. Use turning path templates (see Figures 910-20a through 20c, templates from another published source, or computer-generated templates) to verify that the design vehicle can make the turning movements.

Encroachment on the same-direction lanes of the exit leg and the shoulder might be necessary to minimize crosswalk distances; however, this might negatively impact vehicular operations. Document and justify the operational tradeoffs associated with this encroachment. When encroachment on the shoulder is required, increase the pavement structure to support the anticipated traffic.

Design Symbol	Vehicle Type
P	Passenger car, including light delivery trucks.
BUS	Single-unit bus
A-BUS	Articulated bus
SU	Single-unit truck
WB-40	Semitrailer truck, overall wheelbase of 40 ft
WB-50	Semitrailer truck, overall wheelbase of 50 ft
WB-67	Semitrailer truck, overall wheelbase of 67 ft
MH	Motor home
P/T	Passenger car pulling a camper trailer
MH/B	Motor home pulling a boat trailer

Design Vehicle Types
Figure 910-5

Intersection Type	Design Vehicle
Junction of Major Truck Routes	WB-67
Junction of State Routes	WB-50
Ramp Terminals	WB-50
Other Rural	WB-50
Industrial	WB-40
Commercial	SU[1][2]
Residential	SU[1][2]

Notes:

[1] To accommodate pedestrians, the P vehicle may be used as the design vehicle if justification, with a traffic analysis, is documented.

[2] When the intersection is on a transit or school bus route, use the BUS design vehicle as a minimum. (See Chapter 1060 for additional guidance on transit facilities.)

Minimum Intersection Design Vehicle
Figure 910-6

In addition to the design vehicle, intersections must often be designed to accommodate a larger vehicle. When vehicles larger than the design vehicle are allowed and are anticipated to occasionally use the intersection, make certain that they can make the turn without leaving the paved shoulders or encroaching on a sidewalk. The amount of encroachment allowed is dependent on the frequency of the vehicle and the resulting disruption to other traffic. Use the WB-67 as the largest vehicle at all state route-to-state route junctions. Document and justify any required encroachment into other lanes and any degradation of intersection operation.

910.07 Design Elements

The geometric design of an intersection requires identifying and addressing the needs of all intersection users. There can be competing design objectives when considering the turning requirements of the design vehicle and the crossing requirements of pedestrians. To reduce the operational impacts of large trucks, right-turn radii are designed so that the truck can complete its turn without encroaching on the adjacent lanes. This results in larger corner radii; increased pavement area and pedestrian crossing distances; a larger conflict area; and higher turning speeds for smaller vehicles.

When pedestrian issues are a primary concern, the design objective becomes one of reducing the potential for vehicle/pedestrian conflicts. This is done by minimizing pedestrian crossing distances and controlling the speeds of turning vehicles. This normally leads to right-corner designs with smaller turning radii. The negative impacts include possible capacity reductions and greater speed differences between turning vehicles and through vehicles.

Pedestrian refuge islands can also improve pedestrian safety. Pedestrian refuge islands minimize the crossing distance, reduce the conflict area, and minimize the impacts on vehicular traffic. When designing islands, speeds can be reduced by designing the turning roadway with a taper or large radius curve at the beginning of the turn and a small radius curve at the end. This allows larger islands while forcing the turning traffic to slow down.

Channelization, the separation or regulation of traffic movements into delineated paths of travel, can facilitate the safe and orderly movement of vehicles, bicycles, and pedestrians. Channelization includes left-turn lanes, right-turn lanes, speed change lanes (both acceleration and deceleration lanes), and islands.

(1) Right-Turn Corners

Figure 910-11 shows right-turn corner designs for the design vehicles. These are considered the minimum pavement area to accommodate the design vehicles without encroachment on the adjacent lane at either leg of the curve.

With <u>an evaluate upgrade</u>, right-turn corner designs given in Figure 910-11 may be modified. Document the benefits and impacts of the modified design, including changes to vehicle-pedestrian conflicts; vehicle encroachment on the shoulder or adjacent same direction lane at the exit leg; capacity restrictions for right-turning vehicles or other degradation of intersection operations; and the effects on other traffic movements. To verify that the design vehicle can make the turn, include a plot of the design showing the design vehicle turning path template.

(2) Left-Turn Lanes <u>and Turn Radii</u>

Left-turn lanes provide storage, separate from the through lanes, for left-turning vehicles waiting for a signal to change or for a gap in opposing traffic. (See 910.07(4) for a discussion on speed change lanes.)

Design left-turn channelization to provide sufficient operational flexibility to function under peak loads and adverse conditions.

(a) **One-Way Left-Turn Lanes** are separate storage lanes for vehicles turning left from one roadway onto another. When recommended, one-way left-turn lanes may be an economical way to lessen delays and accident potential involving left-turning vehicles. In addition, they can allow deceleration clear of the through traffic lanes. When evaluating left-turn lanes, include impacts to all intersection movements and users.

At signalized intersections, use a traffic signal analysis to determine whether a left-turn lane is needed and what the storage requirements are (see Chapter 850).

At unsignalized intersections, use the following as a guide to determine whether or not to provide one-way left-turn lanes:

- A traffic analysis indicates that a left-turn lane will reduce congestion. On two-lane highways, use Figure 910-12a, based on total traffic volume (DHV) for both directions and percent left-turn traffic, to determine whether further investigation is needed. On four-lane highways, use Figure 910-12b to determine whether a left-turn lane is recommended.
- An accident study indicates that a left-turn lane will reduce accidents.
- Restrictive geometrics require left-turning vehicles to slow greatly below the speed of the through traffic.
- There is less than decision sight distance at the approach to the intersection.

An HCM analysis may also be used to determine whether left-turn lanes are necessary to maintain the desired level of service.

Determine the storage length required on two-lane highways by using Figures 910-13a through 13c. On four-lane highways, use Figure 910-12b. These lengths do not consider trucks. Use Figure 910-7 for storage length when trucks are present.

Storage* Length (ft)	% Trucks in Left-Turn Movement				
	10	20	30	40	50
100	125	125	150	150	150
150	175	200	200	200	200
200	225	250	275	300	300
250	275	300	325	350	375
300	350	375	400	400	400

*Length from Figures 910-12b, 13a, 13b, or 13c.

Left-Turn Storage With Trucks (ft)
Figure 910-7

Use turning templates to verify that left-turn movements for the design vehicle(s) do not have conflicts. Design opposing left-turn design vehicle paths with a minimum 4-foot (12-foot desirable) clearance between opposing turning paths. Existing signalized intersections that do not meet the 4-foot clearance may remain with split signal phasing, an evaluate upgrade, and concurrence from the Region Traffic Office.

Where one-way left-turn channelization with curbing is to be provided, ensure that surface water will drain.

Provide illumination at left-turn lanes in accordance with the guidelines in Chapter 840.

At signalized intersections with high left-turn volumes, double left-turn lanes may be needed to maintain the desired level of service. A throat width of 30 to 36 feet is desirable on the exit leg of the turn to offset vehicle offtracking and the difficulty of two vehicles turning abreast. Use turning path templates to verify that the design vehicle can complete the turn. Where the design vehicle is a WB-40 or larger, it is preferred to provide for the design vehicle in the outside lane and an SU vehicle turning abreast rather than two design vehicles turning abreast.

Figures 910-14a through 14e show one-way left-turn lane geometrics. Figure 910-14a shows widening to accommodate the new lane. Figures 910-14b, 14c, and 14d show the use of a median. Figure 910-14e shows the minimum protected left turn with a median.

1. **Widening** (see Figure 910-14a). It is desirable that offsets and pavement widening be symmetrical about the centerline or baseline. Where right of way or topographic restrictions, crossroad alignments, or other circumstances preclude symmetrical widening, pavement widening may be on one side only.
2. **Divided Highways** (see Figures 910-14b through 14d). Widening is not required for left-turn lane channelization where medians are 11 feet wide or wider. For medians between 13 feet and 23 feet or where the acceleration

lane is not provided, it is desirable to design the left-turn lane adjacent to the opposing lane (shown in Figure 910-14b) to improve sight distance and increase opposing left-turn clearances.

A median acceleration lane (shown in Figures 910-14c and 14d) may be provided where the median is 23 feet or wider. The median acceleration lane might not be necessary at a signalized intersection. When a median acceleration lane is to be used, design it in accordance with 910.07(4), Speed Change Lanes. Where medians have sufficient width, provide a 2-foot shoulder adjacent to a left-turn lane.

3. **Minimum Protected Left Turn With a Median** (see Figure 910-14e). At intersections on divided highways where channelized left-turn lanes are not provided, provide the minimum protected storage area.

With an evaluate upgrade, the left-turn lane designs given in Figures 910-14a through 14e may be modified. Document the benefits and impacts of the modified design, including changes to vehicle-pedestrian conflicts; vehicle encroachment; deceleration length; capacity restrictions for turning vehicles or other degradation of intersection operations; and the effects on other traffic movements. The modified design must be able to accommodate the design vehicle and provide for the striping requirements of the *Standard Plans* and the MUTCD. To verify that the design vehicle can make the turn, include a plot of the design showing the design vehicle turning path template.

(b) **Two Way Left-Turn Lanes** (TWLTL) are located between opposing lanes of traffic. They are used by vehicles making left turns from either direction, from or onto the roadway.

Use TWLTLs only on managed access highways where there are no more than two through lanes in each direction. Evaluate installation of TWLTLs where:

- An accident study indicates that a TWLTL will reduce accidents.
- There are existing closely spaced access points or minor street intersections.
- There are unacceptable through traffic delays or capacity reductions because of left-turning vehicles.

A TWLTL can reduce delays to through traffic, reduce rear-end accidents, and provide separation between opposing lanes of traffic. However, they do not provide a safe refuge for pedestrians and can encourage strip development with additional closely spaced access points. Evaluate other alternatives (such as prohibiting midblock left turns and providing for U-turns) before using a TWLTL. (See Chapters 440 and 1435 for additional restrictions on the use of TWLTLs.)

The basic design for a TWLTL is illustrated in Figure 910-14f. Additional criteria are:

- The desirable length of a TWLTL is not less than 250 feet.
- Provide illumination in accordance with the guidelines in Chapter 840.
- Pavement markings, signs, and other traffic control devices must be in accordance with the MUTCD and the *Standard Plans*.
- Provide clear channelization when changing from TWLTLs to one-way left-turn lanes at an intersection.

(3) Right-Turn Lanes

Right-turn movements influence intersection capacity even though there is no conflict between right-turning vehicles and opposing traffic. Right-turn lanes might be needed to maintain efficient intersection operation. Use the following guidelines to determine when to provide right-turn lanes at unsignalized intersections.

- Recommendation from Figure 910-15 based on same-direction approach and right-turn traffic volumes for multilane roadways with a posted speed 45 mph or above and for all two-lane roadways.
- An accident study indicates that a right-turn lane will result in an overall accident reduction.
- The presence of pedestrians who require right-turning vehicles to stop.
- Restrictive geometrics that require right-turning vehicles to slow greatly below the speed of the through traffic.
- Less than decision sight distance at the approach to the intersection.

For unsignalized intersections, see 910.07(4), Speed Change Lanes, for guidance on right-turn lane lengths. For signalized intersections, use a traffic signal analysis to determine whether a right-turn lane is needed and the length requirement (see Chapter 850).

A capacity analysis may be used to determine whether right-turn lanes are necessary to maintain the desired level of service.

Where adequate right of way exists, providing right-turn lanes is relatively inexpensive and can provide increased safety and operational efficiency.

The right-turn pocket or the right-turn taper (see Figure 910-16) may be used at any minor intersection where a right-turn lane is not required. These designs will cause less interference and delay to the through movement by offering an earlier exit to right-turning vehicles.

If the right-turn pocket is used, Figure 910-16 shows taper lengths for various posted speeds.

(4) Speed Change Lanes

A speed change lane is an auxiliary lane primarily for the acceleration or deceleration of vehicles entering or leaving the through traveled way. Speed change lanes are normally provided for at-grade intersections on multilane divided highways with access control. Where roadside conditions and right of way allow, speed change lanes may be provided on other through roadways. Justification for a speed change lane depends on many factors, including speed, traffic volumes, capacity, type of highway, the design and frequency of intersections, and accident history.

A deceleration lane (Figure 910-17) is advantageous because, if a deceleration lane is not provided, the driver leaving the highway must slow down in the through lane regardless of following traffic.

An acceleration lane (Figure 910-18) is not as advantageous because entering drivers can wait for an opportunity to merge without disrupting through traffic. However, acceleration lanes for left-turning vehicles provide a safe benefit by allowing the turn to be made in two movements.

When either deceleration or acceleration lanes are to be used, design them in accordance with Figures 910-17 and 18. When the design speed of the turning traffic is greater than 20 mph, design the speed change lane as a ramp in accordance with Chapter 940. When a deceleration lane is used with a left-turn lane, add the deceleration length to the storage length.

(5) Drop Lanes

A lane may be dropped at an intersection with a turn-only lane or beyond the intersection. Do not allow a lane-reduction taper to cross an intersection or end less than 100 feet before an intersection. (See Chapter 620 for lane reduction pavement transitions.)

When a lane is dropped beyond signalized intersections, provide a lane of sufficient length to allow smooth merging. For facilities with a posted speed of 45 mph or higher, use a minimum length of 1500 feet. For facilities with a posted speed less than 45 mph, provide a lane of sufficient length so that the advanced lane reduction warning sign will be placed not less than 100 feet beyond the intersection area.

When a lane is dropped beyond unsignalized intersections, provide a lane beyond the intersection not less than the acceleration lane length from Figure 910-18.

(6) Shoulders

With justification, shoulder width requirements may be reduced within areas channelized for intersection turning lanes or speed change lanes. Apply left shoulder width criteria to the median shoulder of divided highways. On one-way couplets, apply the width criteria for the right shoulder to both the right and left shoulders.

For roadways without curb sections, the shoulder adjacent to turn lanes and speed change lanes may be reduced to 2 feet on the left and 4 feet on the right. When a curb and sidewalk section is used with a turn lane or speed change lane 400 feet or less in length, the shoulder abutting the turn lane may be eliminated. In instances where curb is used without sidewalk, provide a minimum of 4-foot-wide shoulders on the right. Where curbing is used adjacent to left-turn lanes, the shoulder may be eliminated. Adjust the design of the intersection as necessary to allow for vehicle tracking.

Reducing the shoulder width at intersections facilitates the installation of turn lanes without unduly affecting the overall width of the roadway. A narrower roadway also reduces pedestrian exposure in crosswalks and discourages motorists from using the shoulder to bypass other turning traffic.

On routes where provisions are made for bicycles, continue the bicycle facility between the turn lane and the through lane. (See Chapter 1020 for information on bicycle facilities.)

(7) Islands

An island is a defined area within an intersection between traffic lanes for the separation of vehicle movements or for pedestrian refuge. Within an intersection, a median is considered an island. Design islands to clearly delineate the traffic channels to drivers and pedestrians.

Traffic islands perform the following functions:

- Channelization islands control and direct traffic movements
- Divisional islands separate traffic movements
- Refuge islands provide refuge for pedestrians
- Islands can provide for the placement of traffic control devices and luminaires
- Islands can provide areas within the roadway for landscaping

(a) **Size and Shape**. Divisional and refuge islands are normally elongated and at least 4 feet wide and 20 feet long.

Channelization islands are normally triangular. In rural areas, 75 ft^2 is the minimum island area and 100 ft^2 is desirable. In urban areas where posted speeds are 25 mph or less, smaller islands are acceptable. Use islands with at least 200 ft^2 if pedestrians will be crossing or traffic control devices or luminaires will be installed.

Design triangular-shaped islands as shown in Figures 910-19a through 19c. The shoulder and offset widths illustrated are for islands with vertical curbs 6 inches or higher. Where painted islands are used, such as in rural areas, these widths are desirable but may be omitted. (See Chapter 641 for <u>desirable</u> turning roadway widths.)

Island markings may be supplemented with reflective raised pavement markers.

Barrier-free access must be provided at crosswalk locations where raised islands are used (see Chapter 1025).

(b) **Location**. Design the approach ends of islands to provide adequate visibility to alert motorists to their presence. Position the island so that a smooth transition in vehicle speed and direction is attained. Begin transverse lane shifts far enough in advance of the intersection to allow gradual transitions. Avoid introducing islands on a horizontal or vertical curve. If the use of an island on a curve cannot be avoided, provide adequate sight distance, illumination, or extension of the island.

(c) **Compound Right-Turn Lane**. To design large islands, the common method is to use a large radius curve for the turning traffic. While this does provide a larger island, it also encourages higher turning speeds. Where pedestrians are a concern, higher turning speeds are undesirable. An alternative is a compound curve with a large radius followed by a small radius (see Figure 910-19b). This design forces the turning traffic to slow down.

(d) **Curbing**. Provide vertical curb 6 inches or higher for:

- Islands with luminaires, signals, or other traffic control devices.
- Pedestrian refuge islands.

Also consider curbing for:

- Divisional and channelizing islands.
- Landscaped islands.

In general, unless required for the uses listed above, it is preferred not to use curbs on facilities with a posted speed of 45 mph or greater.

Avoid using curbs if the same objective can be attained with pavement markings.

Refer to Chapter 440 for additional information and requirements on the use of curbs.

910.08 U-Turns

For divided multilane highways without full access control that have access points where the median prevents left turns, evaluate the demand for locations that allow U-turns. Normally, U-turn opportunities are provided at intersections. However, where intersections are spaced far apart, U-turn median openings may be required between intersections to accommodate U-turns. Use the desirable U-turn spacing (see Figure 910-8) as a guide to determine when to provide U-turn median openings between intersections. When the U-turning volumes are low, longer spacing may be used.

Locate U-turn median openings where intersection sight distance can be provided.

	Desirable	Minimum
Urban[1]	1,000 ft	[2]
Suburban	½ mi	¼ mi[3]
Rural	1 mi	½ mi

Notes:

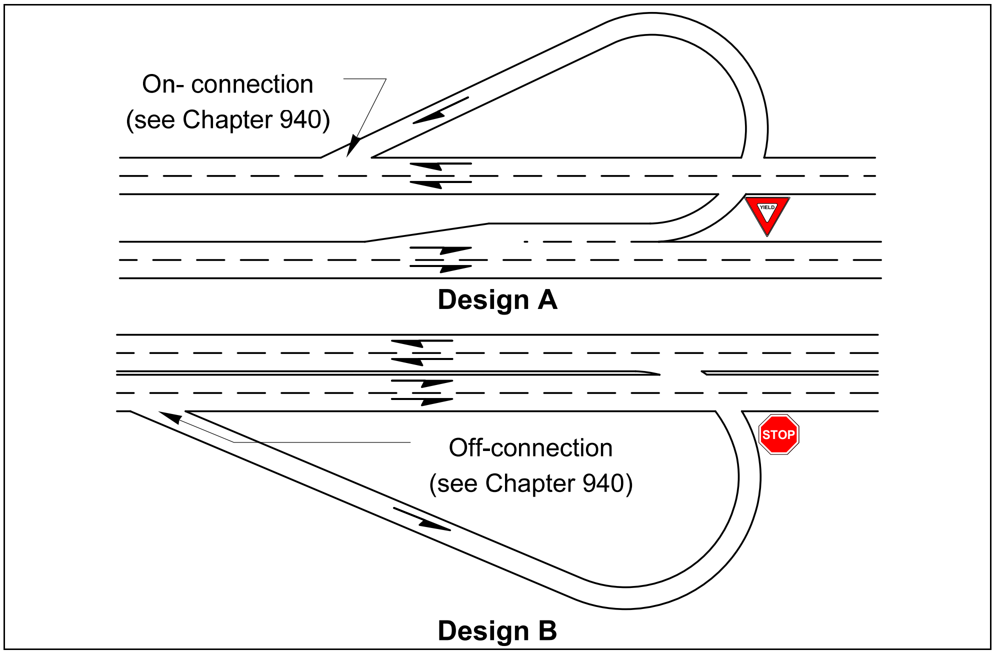
[1] For design speeds greater than 45 mph, use suburban spacing.

[2] The minimum spacing is the acceleration lane length from a stop (Figure 910-18) plus 300 ft.

[3] For design speeds 60 mph or greater, the minimum spacing is the acceleration lane length from a stop (Figure 910-18) plus 300 ft.

U-Turn Spacing
Figure 910-8

When designing U-turn median openings, use Figure 910-21 as a guide. Where the median is less than 40 feet wide and a large design vehicle is required, provide a U-turn roadway (see Figure 910-9). Design A, with the U-turn roadway after the left-turn, is preferred. Use Design A when the median can accommodate a left-turn lane. Use Design B only with narrow medians where left-turn channelization cannot be built in the median.



U-Turn Roadway
Figure 910-9

Document the need for U-turn locations and the spacing used, and justify the selected design vehicle. <u>If the design vehicle is smaller than the largest vehicle using the facility, provide an alternate route.</u>

U-turns at signal-controlled intersections do not require the acceleration lanes shown in Figure 910-21. For new U-turn locations at signal-controlled intersections, ensure that right-turning vehicles from side streets will not conflict with U-turning vehicles. Warning signs on the cross street might be appropriate.

910.09 Intersection Sight Distance

For traffic to move safely through intersections, drivers need to be able to see stop signs, traffic signals, and oncoming traffic in time to react accordingly.

Provide decision sight distance, where feasible, in advance of stop signs, traffic signals, and roundabouts. (See Chapter 650 for guidance.)

The driver of a vehicle that is stopped and waiting to cross or enter a through roadway needs obstruction-free sight triangles in order to see enough of the through roadway to safely complete all legal maneuvers before an approaching vehicle on the through roadway can reach the intersection. Use Figure 910-22a to determine minimum sight distance along the through roadway.

The sight triangle is determined as shown in Figure 910-22b. Within the sight triangle, lay back the cut slopes and remove, lower, or move hedges, trees, signs, utility poles, <u>signal poles,</u> and anything else large enough to be a sight obstruction. Eliminating parking <u>will remove</u> obstructions to sight distance. In order to maintain the sight distance, the sight triangle must be within the right of way or a state maintenance easement (see Chapter 1410).

The minimum setback distance for the sight triangle is 18 feet from the edge of traveled way. This is for a vehicle stopped 10 feet from the edge of traveled way. The driver is almost always 8 feet or less from the front of the vehicle; therefore, 8 feet are added to the setback. When the stop bar is placed more than 10 feet from the edge of traveled way, providing the sight triangle to a point 8 feet back of the stop bar is desirable.

Provide a clear sight triangle for a P vehicle at all intersections. In addition, provide a clear sight triangle for the SU vehicle for rural highway conditions. If there is significant combination truck traffic, use the WB-50 or WB-67 rather than the SU. In areas where SU or WB vehicles are minimal and right of way restrictions prohibit adequate sight triangle clearing, only the P vehicle sight distance needs to be provided.

At existing intersections, when sight obstructions within the sight triangle cannot be removed due to limited right of way, the intersection sight distance may be modified. A driver who does not have the desired sight distance will creep out until the sight distance is available; therefore, the setback may be reduced to 10 feet. Document the right of way width and provide a brief analysis of the intersection sight distance clarifying the reasons for reduction. Verify and document that there is not an accident problem at the intersection. Document the intersection location and the available sight distance in the Design Variance Inventory (see Chapter 330) as a design exception.

If the intersection sight distance cannot be provided using the reductions in the preceding paragraph, where stopping sight distance is provided for the major roadway, the intersection sight distance, at the 10-foot setback point, may be reduced to the stopping sight distance required for the major roadway, with an evaluate upgrade and HQ Design Office review and concurrence. (See Chapter 650 for required stopping sight distance.) Document the right of way width and provide a brief analysis of the intersection sight distance clarifying the reasons for reduction. Verify and document that there is not an accident problem at the intersection. Document the intersection location and the available sight distance in the Design Variance Inventory (see Chapter 330) as an evaluate upgrade.

In some instances, intersection sight distance is provided at the time of construction, but subsequent vegetative growth has degraded the sight distance available. The growth may be seasonal or occur over time. In these instances, intersection sight distance will be restored through the periodically scheduled maintenance of vegetation in the sight triangle within the WSDOT right of way or state maintenance easement.

At intersections controlled by traffic signals, provide sight distance for right-turning vehicles.

Designs for movements that cross divided highways are influenced by median widths. If the median is wide enough to store the design vehicle, with a 3-foot clearance at both ends of the vehicle, sight distances are determined in two steps. The first step is for crossing from a stopped position to the median storage; the second step is for the movement, either across or left into the through roadway.

Design sight distance for ramp terminals as at-grade intersections with only left- and right-turning movements. An added element at ramp terminals is the grade separation structure. Figure 910-22b gives the sight distance guidance in the vicinity of a structure. In addition, when the crossroad is an undercrossing, check the sight distance under the structure graphically using a truck eye height of 6 feet and an object height of 1.5 feet.

Document a brief description of the intersection area, sight distance restrictions, and traffic characteristics to support the design vehicle and sight distances chosen.

910.10 Traffic Control at Intersections

Intersection traffic control is the process of moving traffic safely through areas of potential conflict where two or more roadways meet. Signs, signals, channelization, and physical layout are the major tools used to establish intersection control.

There are three objectives to intersection traffic control that can greatly improve intersection operations.

- **Maximize Intersection Capacity**. Since two or more traffic streams cross, converge, or diverge at intersections, the capacity of an intersection is normally less than the roadway between intersections. It is usually necessary to assign right of way through the use of traffic control devices to maximize capacity for all users of the intersection. Turn prohibitions may be used to increase intersection capacity.
- **Reduce Conflict Points**. The crossing, converging, and diverging of traffic creates conflicts that increase the potential for accidents. Establishing appropriate controls can reduce the possibility of two cars attempting to occupy the same space at the same time. Pedestrian accident potential can also be reduced by appropriate controls.
- **Prioritize Major Street Traffic**. Traffic on major routes is normally given the right of way over traffic on minor streets to increase intersection operational efficiency.

If a signal is being considered or exists at an intersection that is to be modified, a preliminary signal plan is required (see Chapter 850). If a new signal permit is required, it must be approved before the design is approved.

A proposal to install a traffic signal or a roundabout on a state route, either NHS or Non-NHS, with a posted speed limit of 45 mph or higher requires an analysis of alternatives, approved by the Region Traffic Engineer, with review and comment by the HQ Design Office, prior to proceeding with the design. Include the following alternatives in the analysis:

- Channelization, providing deceleration lanes, storage, and acceleration lanes for left- and right-turning traffic
- Right-off/right-on with U-turn opportunities
- Grade separation
- Roundabouts
- Traffic control signals

Include a copy of the analysis with the preliminary signal plan or roundabout justification.

910.11 Signing and Pavement Marking

Use the MUTCD and the *Standard Plans* for signing and pavement marking criteria. Provide a route confirmation sign on all state routes shortly after major intersections. (See Chapter 820 for additional information on signing.)

Painted or plastic pavement markings are normally used to delineate travel paths. For pavement marking details, see the MUTCD, Chapter 830, and the *Standard Plans*.

Contact the Region or HQ Traffic Office for additional information when designing signing and pavement markings.

910.12 Procedures

Document design considerations and conclusions in accordance with Chapter 330. For highways with limited access control, see Chapter 1430 for requirements.

(1) Approval

An intersection is approved in accordance with Chapter 330. When required, the following items must be completed before an intersection may be approved:

- Traffic analysis
- Deviations approved in accordance with Chapter 330
- Approved Traffic Signal Permit (DOT Form 242-014 EF) (see Chapter 850)
- HQ Design Office approval for intersections with roundabouts (see Chapter 915 for approval procedures)

(2) Intersection Plans

Intersection plans are required for any increases in capacity (turn lanes) at an intersection, modification of channelization, or change of intersection geometrics. Support the need for intersection or channelization modifications with history; school bus and mail route studies; hazardous materials route studies; pedestrian use; public meeting comments; and so forth.

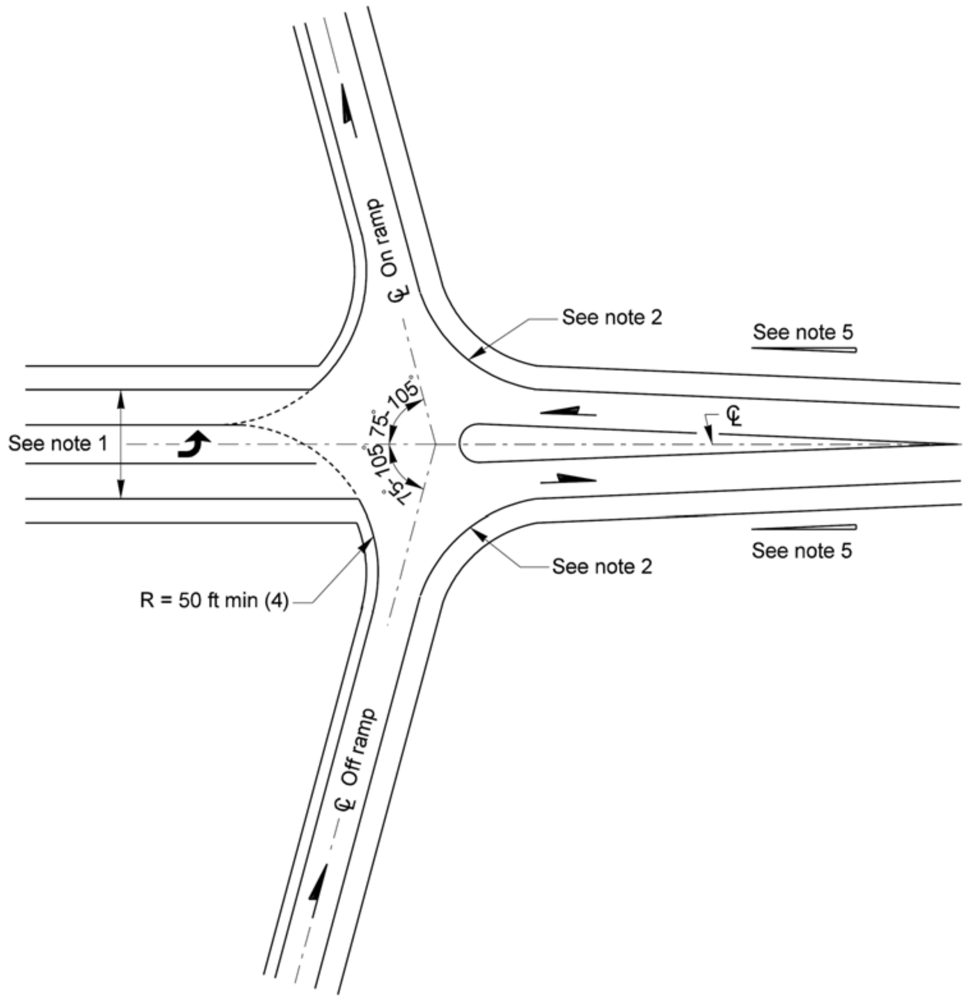
For information to be included on the Intersection Plan for Approval, see the Intersection/Channelization Plan for Approval Checklist on the following web site:
www.wsdot.wa.gov/design/projectdev/

(3) Local Agency or Developer-Initiated Intersections

There is a separate procedure for local agency or developer-initiated projects at intersections with state routes. The project initiator submits an intersection plan and the documentation of design decisions that led to the plan to the Region for approval. For those plans requiring a design variance, the deviation or evaluate upgrade must be approved in accordance with Chapter 330 prior to approval of the plan. After the plan approval, the Region prepares a construction agreement with the project initiator (see the *Utilities Manual*).

910.13 Documentation

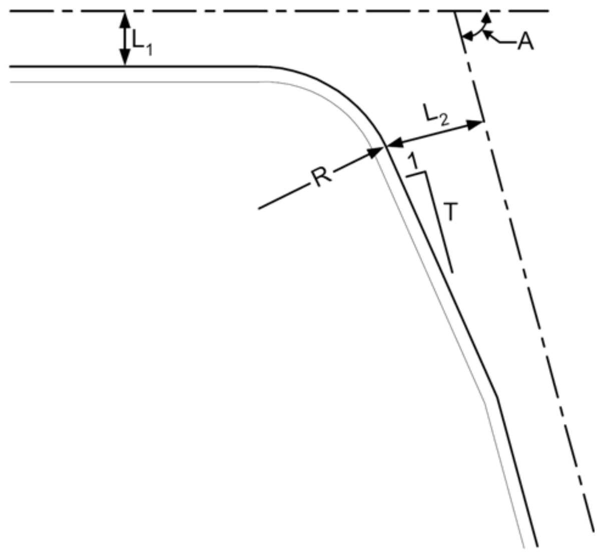
For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/



Notes:

[1] 12-ft through lanes and 13-ft left-turn lane desirable.
[2] For right-turn corner design, see Figure 910-11.
[3] Intersections may be designed individually.
[4] Use templates to verify that the design vehicle can make the turn.
[5] For taper rates, see Figure 910-14a, Table 1.

Interchange Ramp <u>Terminal</u> Details
Figure 910-10



L_1 = Minimum available roadway width[2] that the vehicle is turning from

L_2 = Available roadway width[2] for the vehicle leaving the intersection

R = Radius to the edge of traveled way

T = Taper rate (length per unit of width of widening)

A = Delta angle of the turning vehicle

Vehicle	A	R	L1[1]	L2[2]	T	Vehicle	A	R	L1[1]	L2[2]	T
WB-67	60	85	11	22	7	WB-40	60	55	11	15	7.5
	75	75	11	21	8		75	55	11	15	7.5
	90	70	11	21	8		90	55	11	14	7.5
	105	55	11	24	7		105	45	11	16	7.5
	120	50	11	24	7		120	45	11	15	7.5
WB-50	60	55	11	19	6	SU & BUS	All	50	11	11	25
	75	55	11	18	6	P	All	35	11	11	25
	90	55	11	17	6						
	105	50	11	17	6						
	120	45	11	18	6						

Notes:

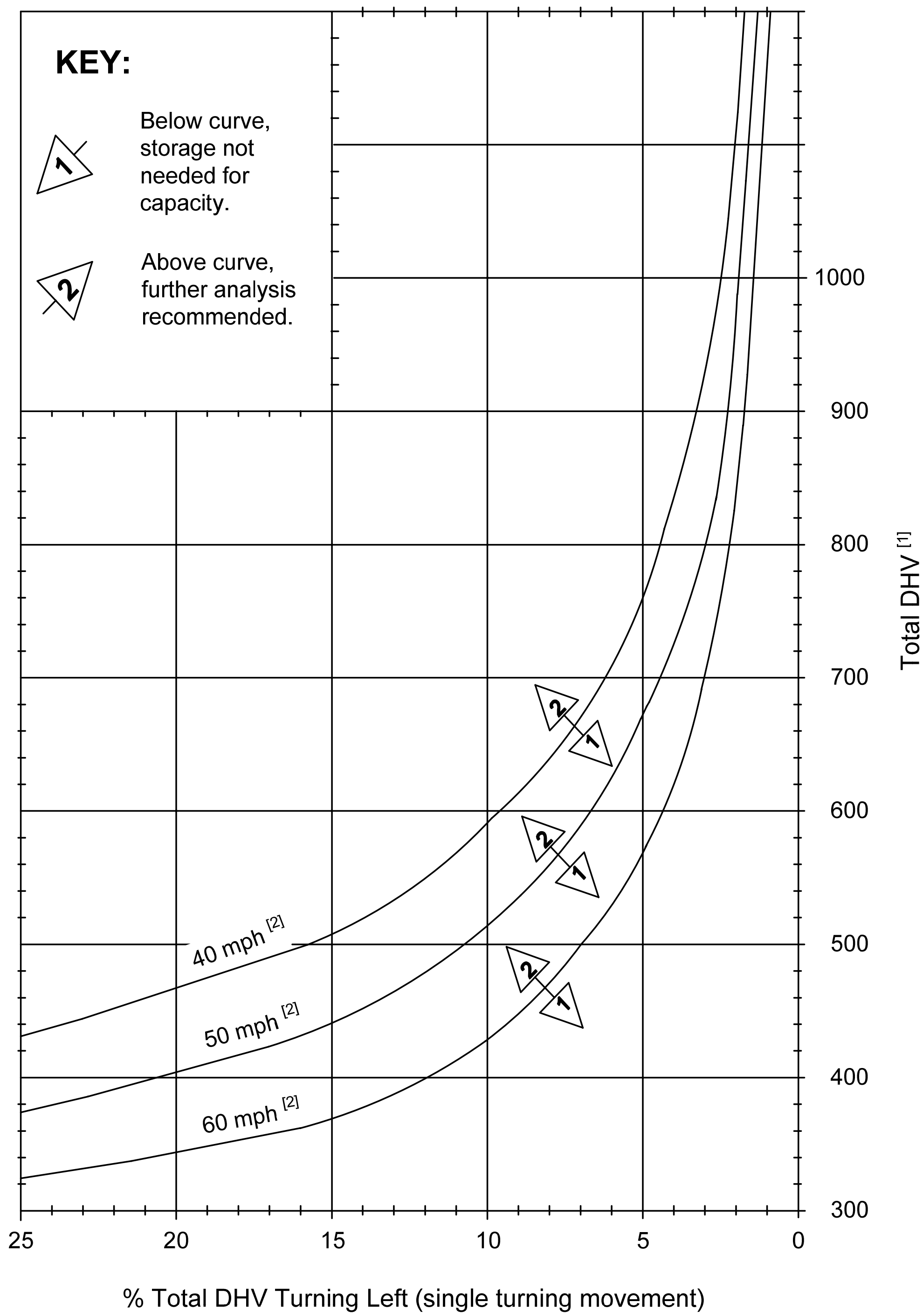
[1] When available roadway width is less than 11 ft, widen at 25:1.

[2] Available roadway width includes the shoulder, less a 2-ft clearance to a curb, and all the same-direction lanes of the exit leg at signalized intersections.

[3] All distances given in feet and angles in degrees.

Right-Turn Corner

Figure 910-11

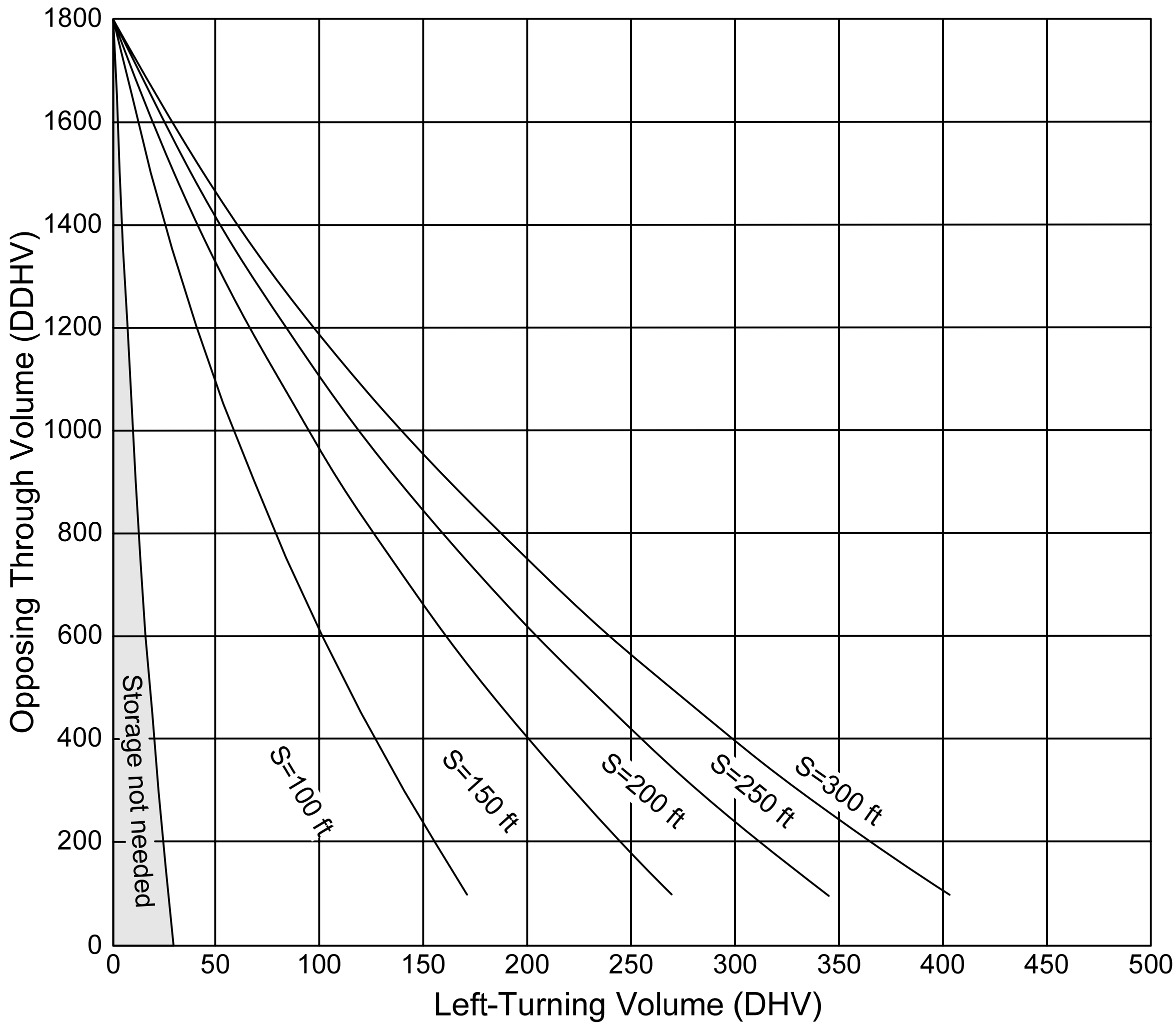


Notes:

[1] DHV is total volume from both directions.

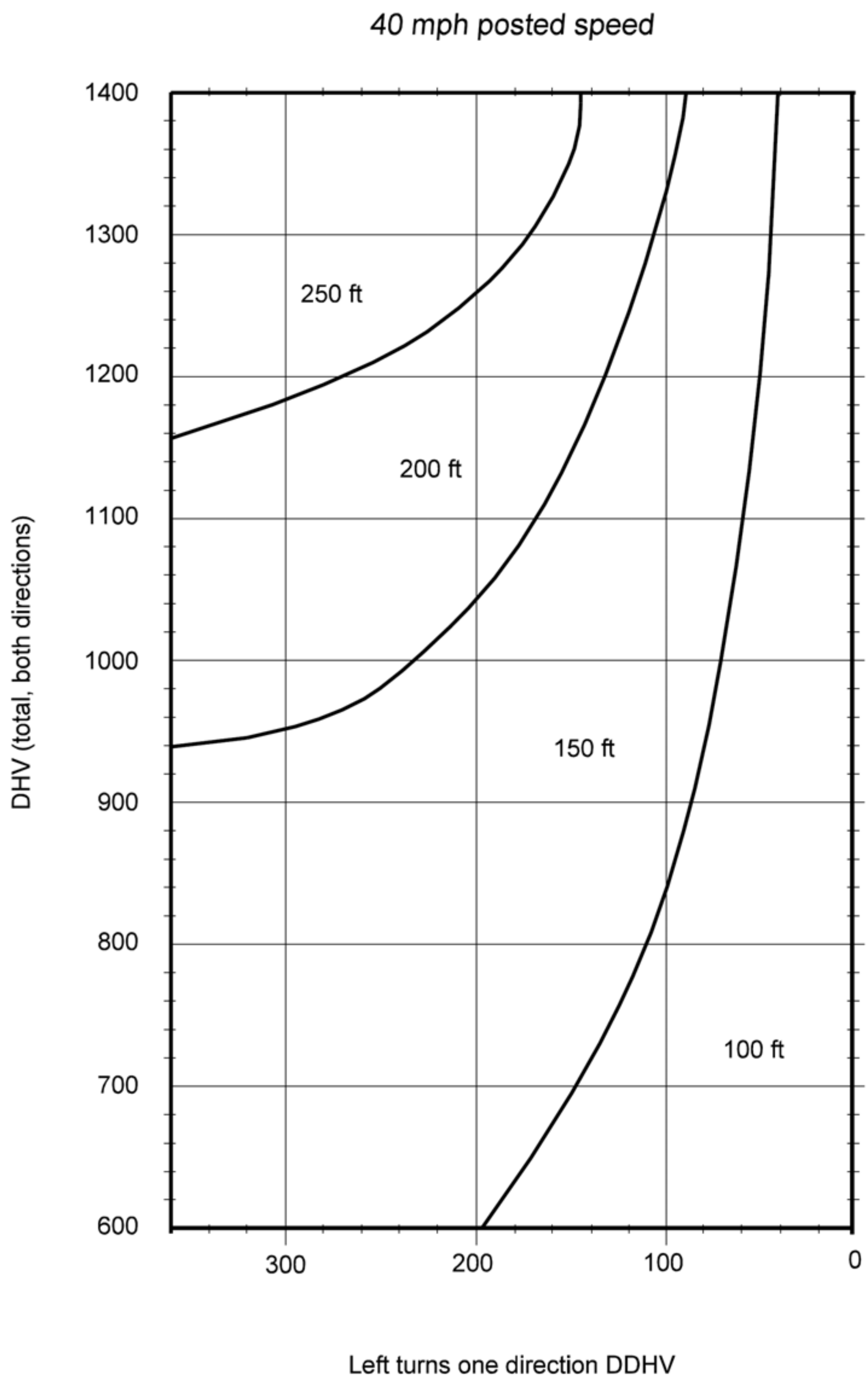
[2] Speeds are posted speeds.

Left-Turn Storage Guidelines: Two-Lane, Unsignalized
Figure 910-12a

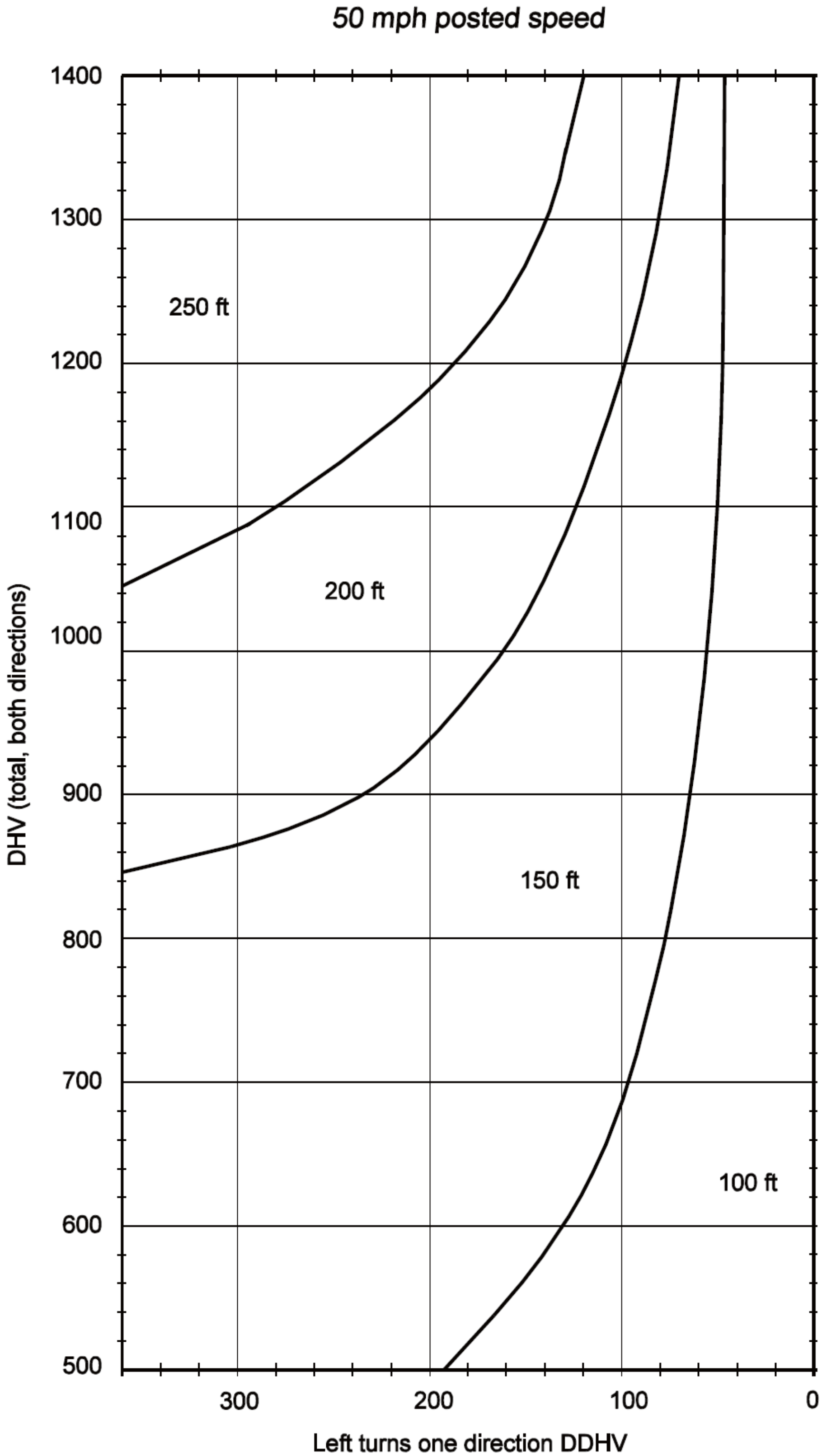


Note:
S = Left-turn storage length

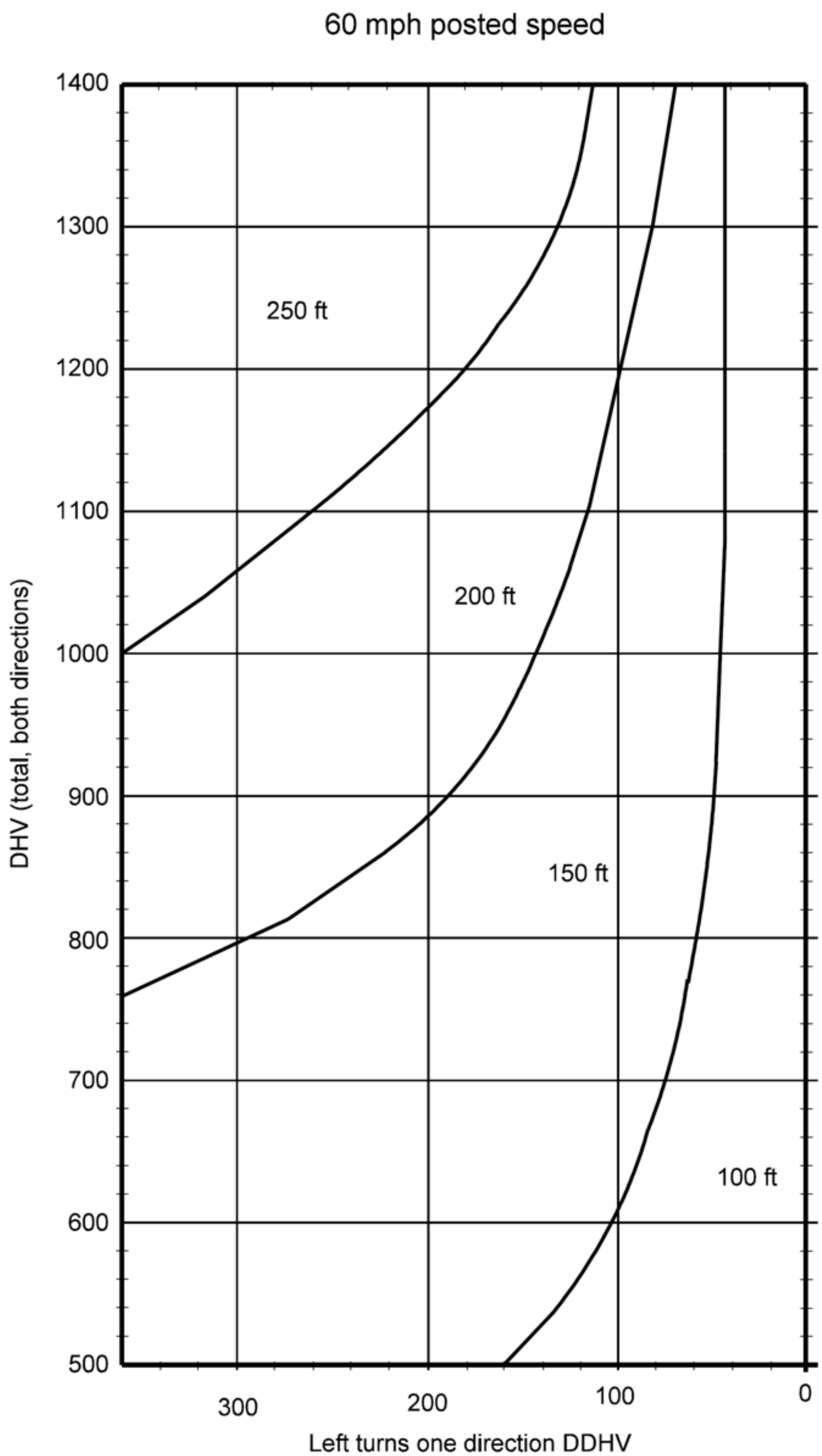
Left-Turn Storage Guidelines: Four-Lane, Unsignalized
Figure 910-12b



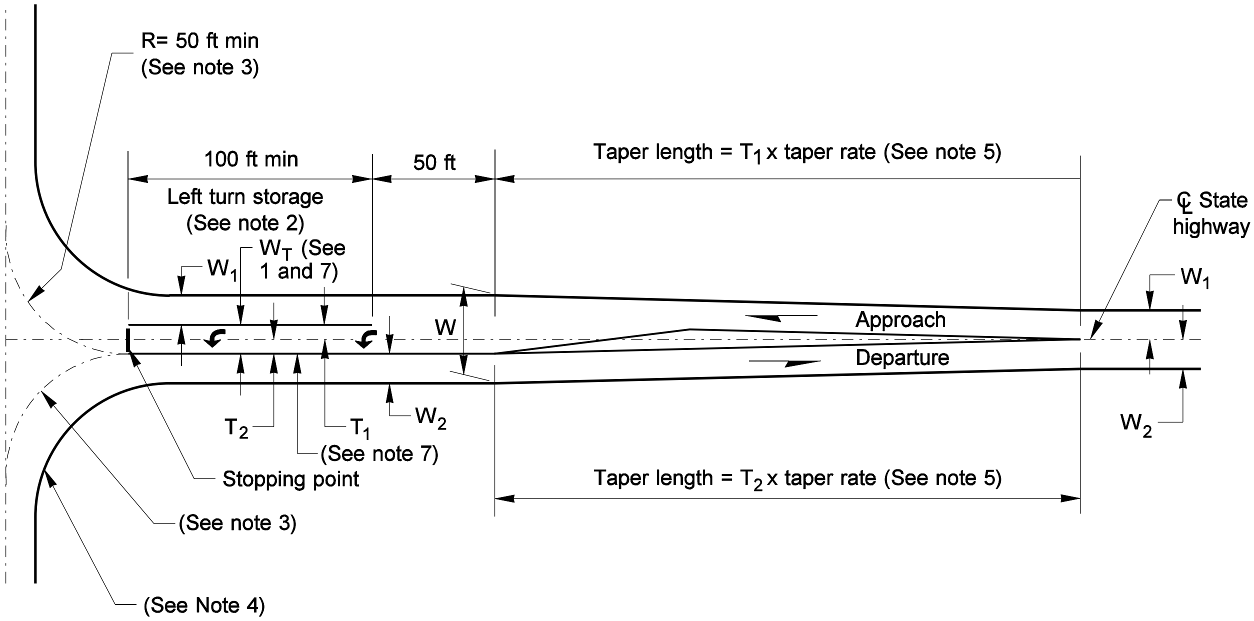
Left-Turn Storage Length: Two-Lane, Unsignalized
Figure 910-13a



Left-Turn Storage Length: Two-Lane, Unsignalized
Figure 910-13b



Left-Turn Storage Length: Two-Lane, Unsignalized
Figure 910-13c



Notes:

[1] The minimum width of the left-turn storage lane (T1+T2) is 11 ft. The desirable width is 12 ft.

[2] For left-turn storage length, see Figures 910-12b for 4-lane roadways or 13a through 13c for 2-lane roadways.

[3] Desirable radius not less than 50 ft. Use templates to verify that the design vehicle can make the turn.

[4] For right-turn corner design, see Figure 910-11.

[5] For desirable taper rates, see Table 1. With justification, taper rates from Table 2, Figure 910-14c, may be used.

[6] For pavement marking details, see the *Standard Plans* and the MUTCD.

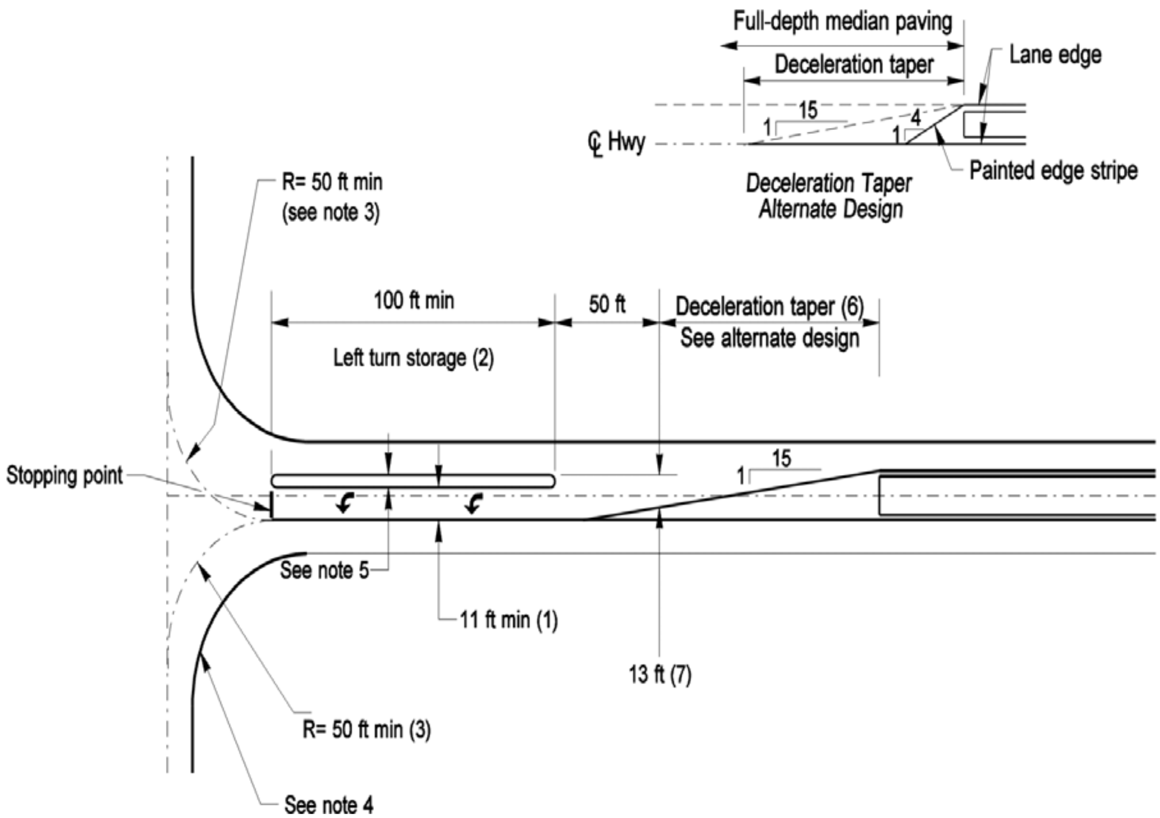
[7] When curb is provided, add the width of the curb and the required shoulders to the left-turn lane width. For required shoulder widths at curbs, see 910.07(6) and Chapter 440.

W_1 = Approaching through lane
W_2 = Departing lane
T_1 = Width of left-turn lane on approach side of centerline
T_2 = Width of left-turn lane on departure side of centerline
W_T Total width of left-turn lane
W = Total width of channelization (W_1+W_2+T_1+T_2)

Posted Speed	Desirable Taper Rate[6]
55 mph	55:1
50 mph	50:1
45 mph	45:1
40 mph	40:1
35 mph	35:1
30 mph	30:1
25 mph	25:1

Table 1

Median Channelization: Widening
Figure 910-14a



Notes:

[1] Lane width of 13 ft is desirable.

[2] For left-turn storage length, see Figures 910-12b for 4-lane roadways or 13a through 13c for 2-lane roadways.

[3] Desirable radius not less than 50 ft. Use templates to verify that the design vehicle can make the turn.

[4] For right-turn corner design, see Figure 910-11.

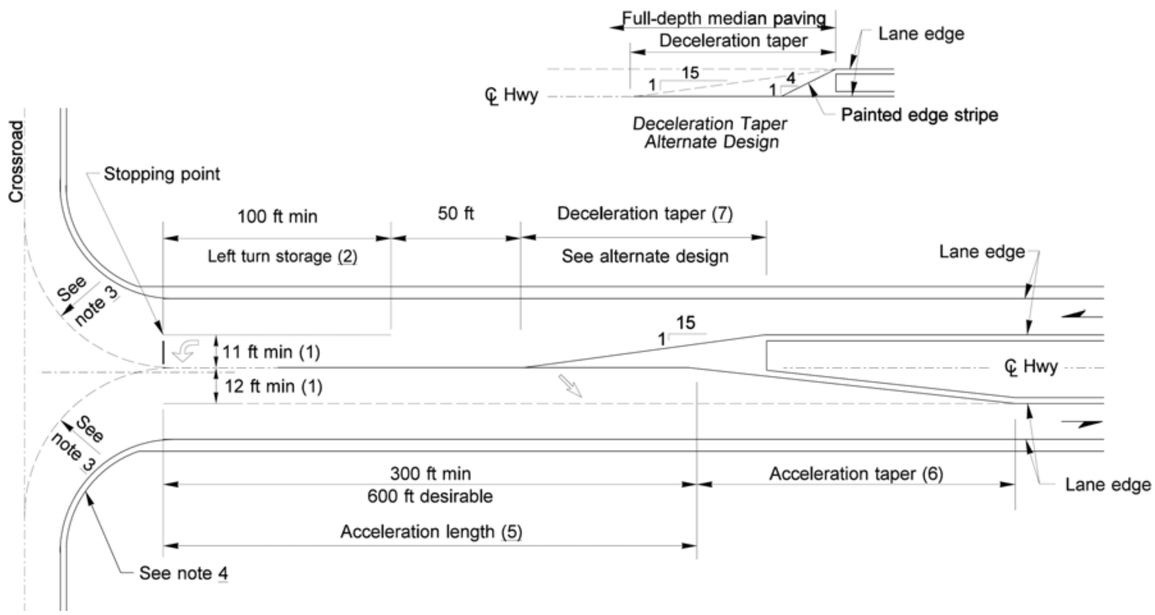
[5] For median widths greater than 13 ft, it is desirable to locate the left-turn lane adjacent to the opposing through lane with excess median width between the same direction through lane and the turn lane.

[6] For increased storage capacity, the left-turn deceleration taper alternate design may be used.

[7] Reduce to lane width for medians less than 13 ft wide.

[8] For pavement marking details, see the *Standard Plans* and the MUTCD.

Median Channelization: Median Width 11 ft or More
Figure 910-14b



Notes:

[1] Lane widths of 13 ft are desirable for both the left-turn storage lane and the median acceleration lane.

[2] For left-turn storage length, see Figures 910-12b for 4-lane roadways or 13a through 13c for 2-lane roadways.

[3] Desirable radius not less than 50 ft. Use templates to verify that the design vehicle can make the turn.

[4] For right-turn corner design, see Figure 910-11.

[5] The minimum total length of the median acceleration lane is shown in Figure 910-18.

[6] For acceleration taper rate, see Table 2.

[7] For increased storage capacity, the left-turn deceleration taper alternate design may be used.

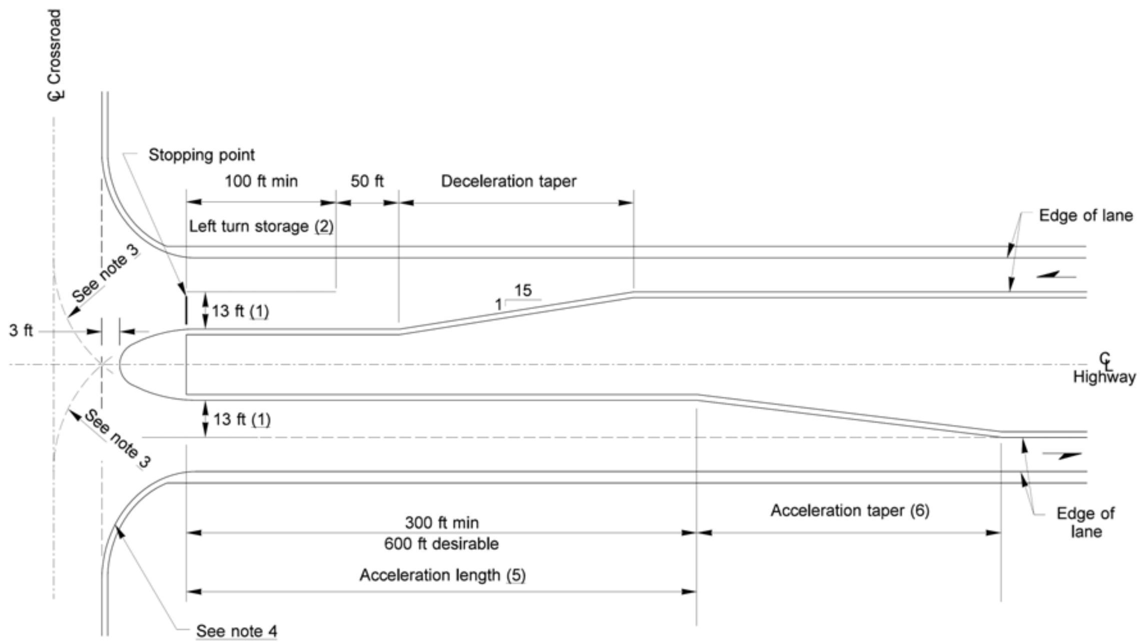
[8] For pavement marking details, see the *Standard Plans* and the MUTCD.

Posted Speed	Taper Rate
55 mph	55:1
50 mph	50:1
45 mph	45:1
40 mph	27:1
35 mph	21:1
30 mph	15:1
25 mph	11:1

Table 2

Median Channelization: Median Width 23 ft to 26 ft

Figure 910-14c



Notes:

[1] May be reduced to 11 ft, with justification.

[2] For left-turn storage length, see Figures 910-12b for 4-lane roadways or 13a through 13c for 2-lane roadways.

[3] Desirable radius not less than 50 ft. Use templates to verify that the design vehicle can make the turn.

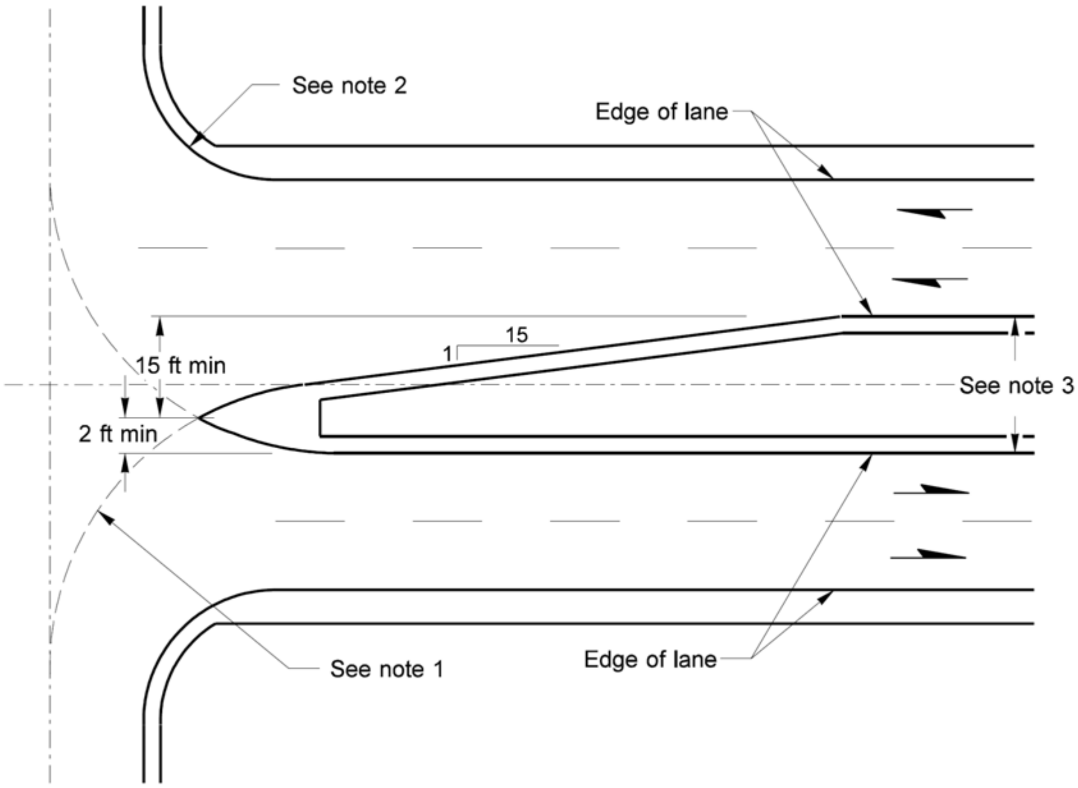
[4] For right-turn corner design, see Figure 910-11.

[5] The minimum length of the median acceleration lane is shown in Figure 910-18.

[6] For acceleration taper rate, see Figure 910-14c, Table 2.

[7] For pavement marking details, see the *Standard Plans* and the MUTCD.

Median Channelization: Median Width of More Than 26 ft
Figure 910-14d



Notes:

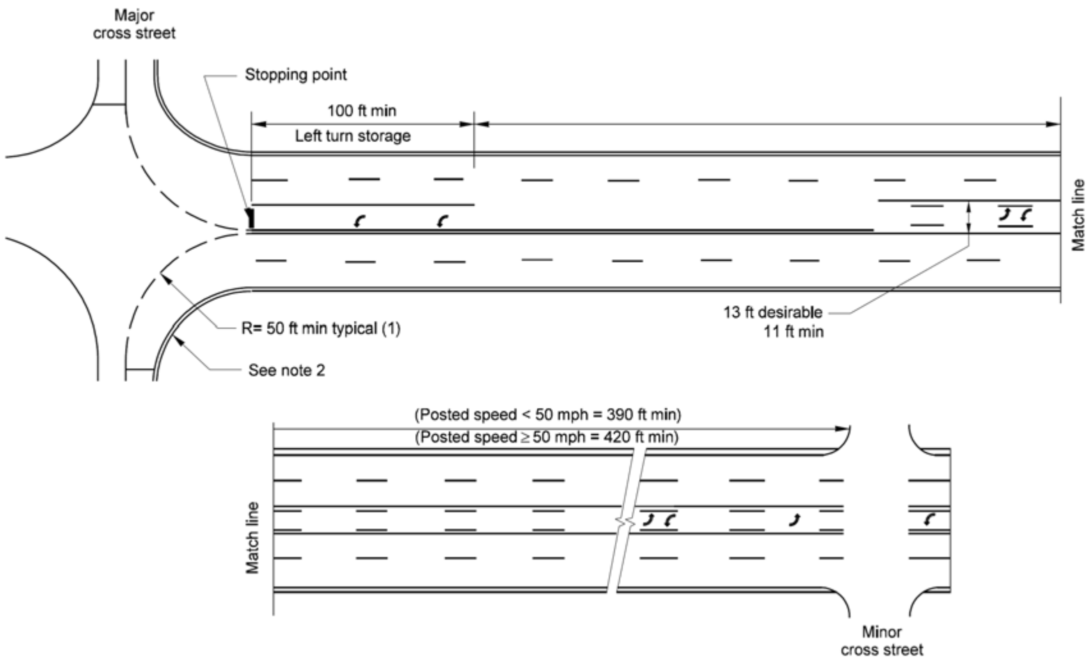
[1] Desirable radius not less than 50 ft. Use templates to verify that the design vehicle can make the turn.

[2] For right-turn corner design, see Figure 910-11.

[3] For median width 17 ft or more. For median width less than 17 ft, widen to 17 ft or use Figure 910-14b.

[4] For pavement marking details, see the *Standard Plans* and the MUTCD.

Median Channelization: Minimum Protected Storage
Figure 910-14e



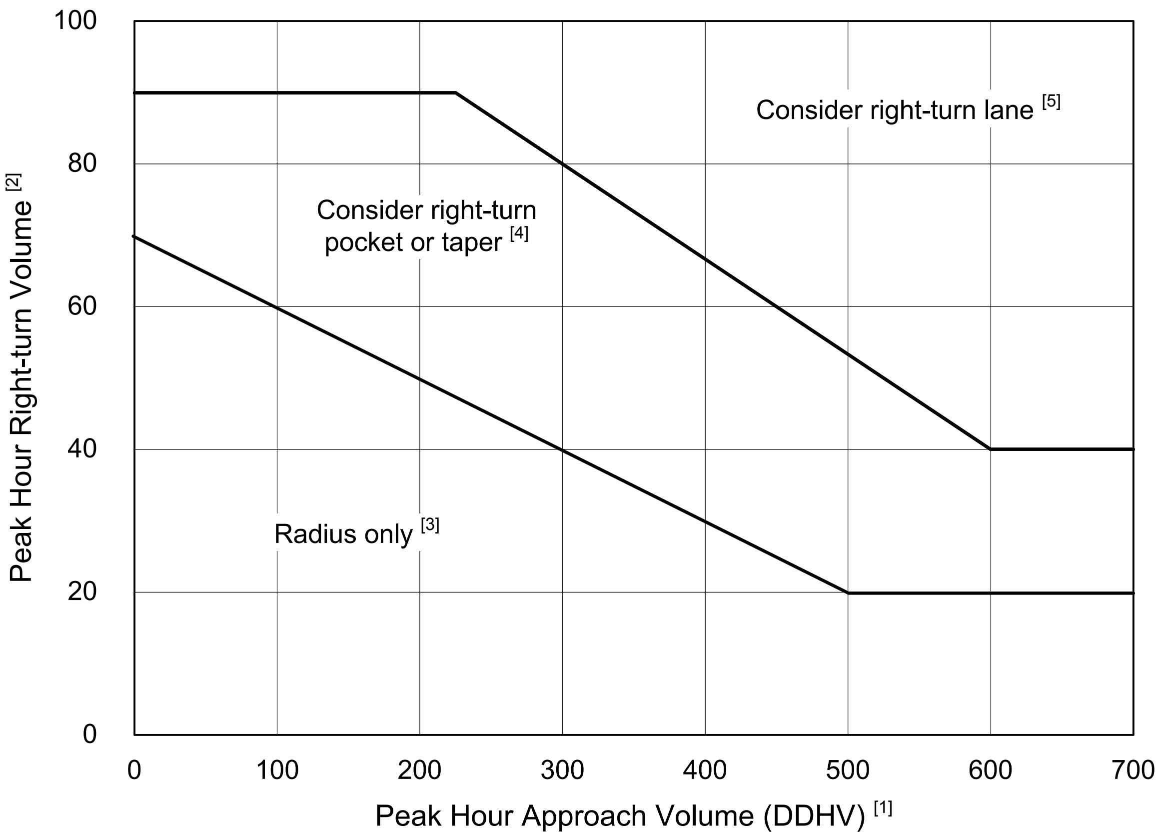
Notes:

[1] Desirable radius not less than 50 ft. Use templates to verify that the design vehicle can make the turn.

[2] For right-turn corner design, see Figure 910-11.

[3] For pavement marking details and signing criteria, see the *Standard Plans* and the MUTCD.

Median Channelization: Two-way Left-Turn Lane
Figure 910-14f



Notes:

[1] For two-lane highways, use the peak hour DDHV (through + right-turn).
For multilane, high-speed highways (posted speed 45 mph or above), use the right-lane peak hour approach volume (through + right-turn).

[2] When all three of the following conditions are met, reduce the right-turn DDHV by 20.
- The posted speed is 45 mph or less
- The right-turn volume is greater than 40 VPH
- The peak hour approach volume (DDHV) is less than 300 VPH

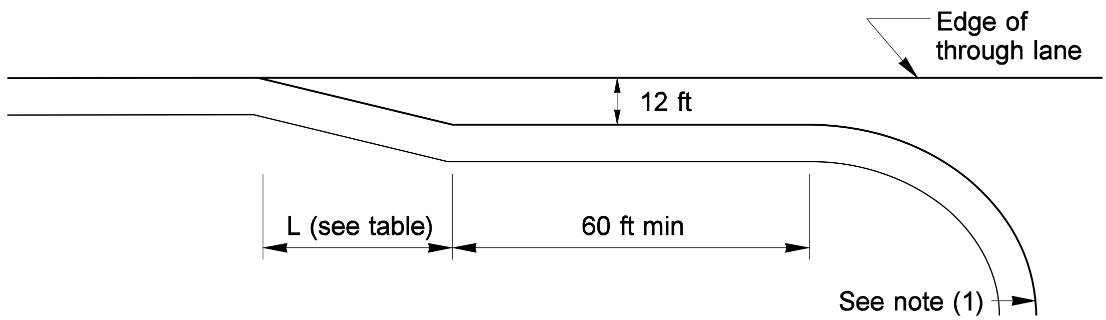
[3] For right-turn corner design, see Figure 910-11.

[4] For right-turn pocket or taper design, see Figure 910-16.

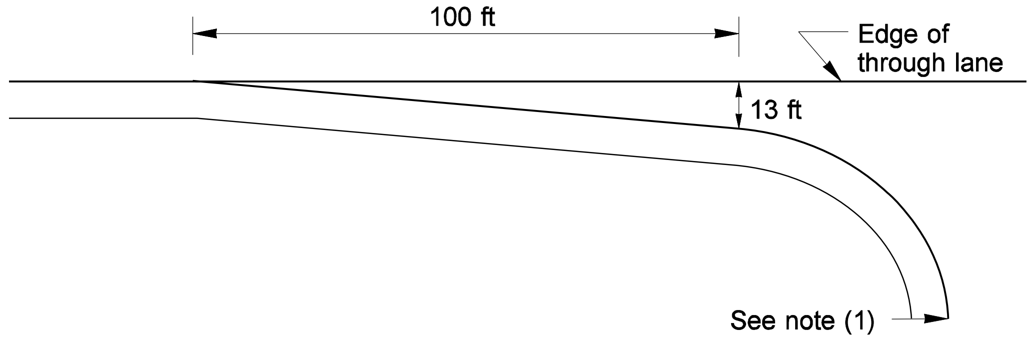
[5] For right-turn lane design, see Figure 910-17.

[6] For additional guidance, see 910.07(3).

Right-Turn Lane Guidelines[6]
Figure 910-15



Right-Turn Pocket



Right-Turn Taper

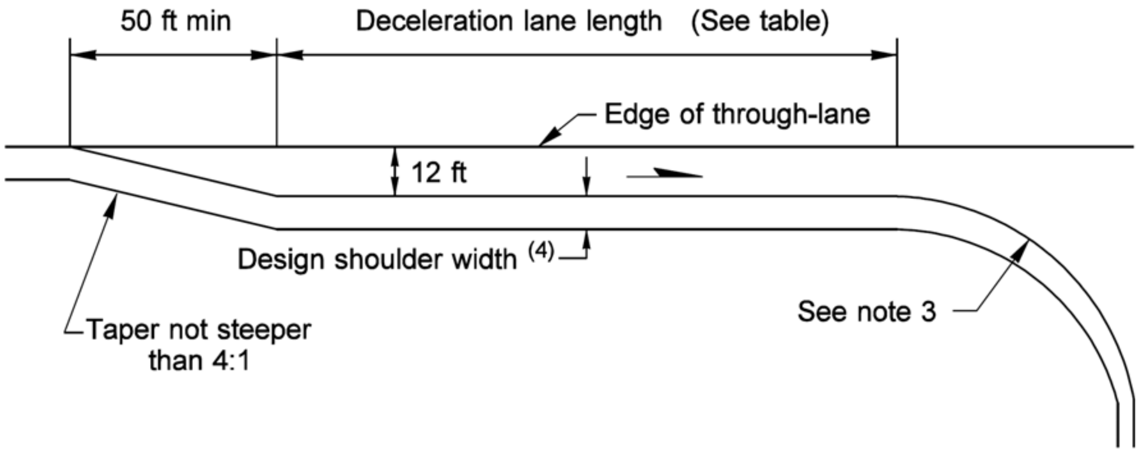
Posted Speed Limit	L
Below 40 mph	40 ft
40 mph or above	100 ft

Notes:

[1] 12 ft desirable.

[2] For right-turn corner design, see Figure 910-11.

Right-Turn Pocket and Right-Turn Taper
Figure 910-16



Highway Design Speed (mph)	Turning Roadway Design Speed (mph)		
	Stop[1]	15	20
30	235	200[2]	170[2]
35	280	250	210
40	320	295	265
45	385	350	325
50	435	405	385
55	480	455	440
60	530	500	480
65	570	540	520
70	615	590	570

Minimum Deceleration Lane Length (ft)

Grade	Upgrade	Downgrade
3% to less than 5%	0.9	1.2
5% or more	0.8	1.35

Adjustment Multiplier for Grades 3% or Greater

Notes:

[1] For use when the turning traffic is likely to stop before completing the turn (for example, where pedestrians are present).

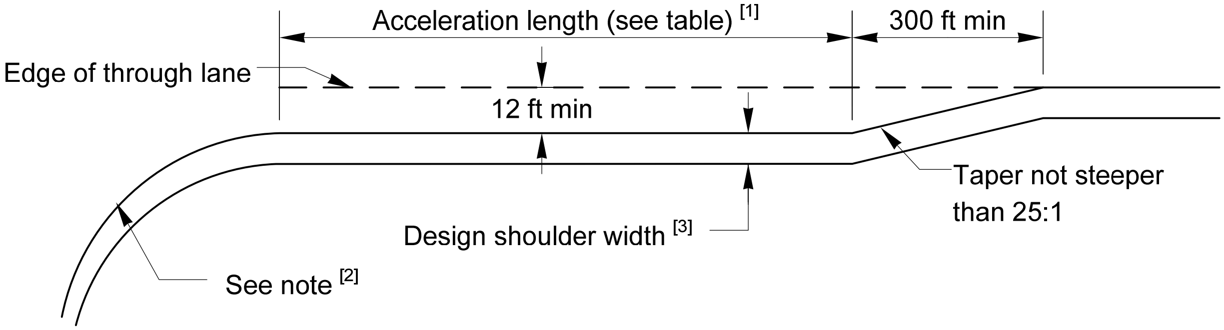
[2] When adjusting for grade, do not reduce the deceleration lane to less than 150 ft.

[3] For right-turn corner design, see Figure 910-11.

[4] May be reduced (see 910.07).

[5] For pavement marking details, see the *Standard Plans* and the MUTCD.

Right-Turn Lane
Figure 910-17



Highway Design Speed (mph)	Turning Roadway Design Speed (mph)		
	Stop	15	20
30	180	140	
35	280	220	160
40	360	300	270
45	560	490	440
50	720	660	610
55	960	900	810
60	1200	1140	1100
65	1410	1350	1310
70	1620	1560	1520

Minimum Acceleration Lane Length (ft)[1]

Highway Design Speed (mph)	% Grade	Upgrade	Downgrade
40	3% to less than 5%	1.3	0.7
50		1.3	0.65
60		1.4	0.6
70		1.5	0.6
40	5% or more	1.5	0.6
50		1.5	0.55
60		1.7	0.5
70		2.0	0.5

Adjustment Multiplier for Grades 3% or Greater

Notes:

[1] At free-right turns (no stop required) and all left turns, the minimum acceleration lane length is not less than 300 ft.

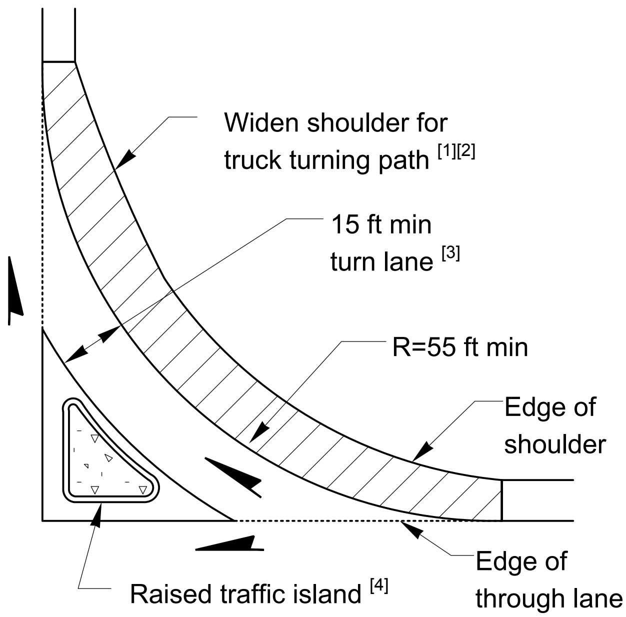
[2] For right-turn corner design, see Figure 910-11.

[3] May be reduced (see 910.07(6)).

[4] For pavement-marking details, see the *Standard Plans* and the MUTCD.

Acceleration Lane

Figure 910-18



Small Traffic Island Design [5]

Notes:

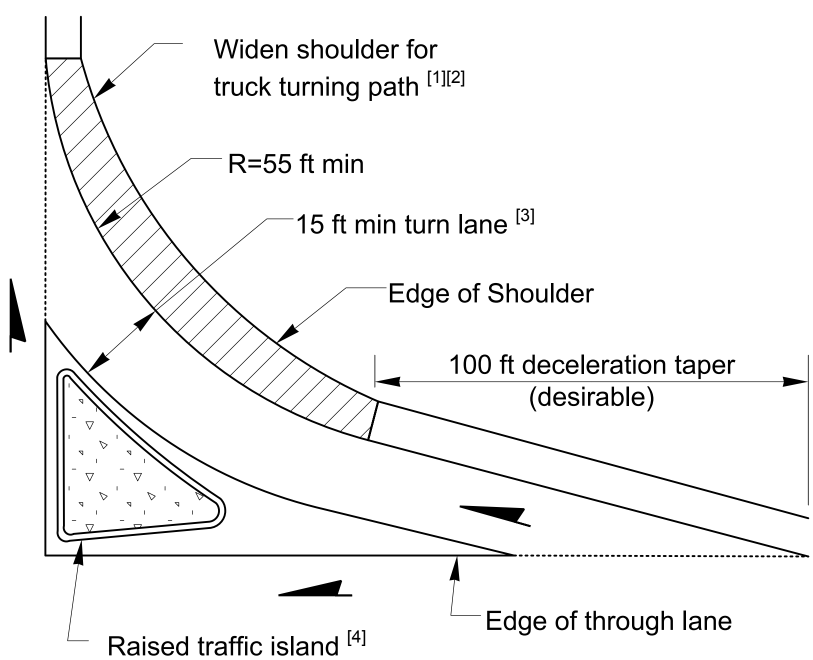
[1] Widen shoulders when adequate right-turn radii or roadway width cannot be provided for large trucks. Design widened shoulder pavement the same depth as the right-turn lane.

[2] Use the truck turning path templates for the design vehicle and a minimum of 2 ft clearance between the wheel paths and the face of curb or edge of shoulder to determine the width of the widened shoulder.

[3] For desirable turning roadway widths, see Chapter 641.

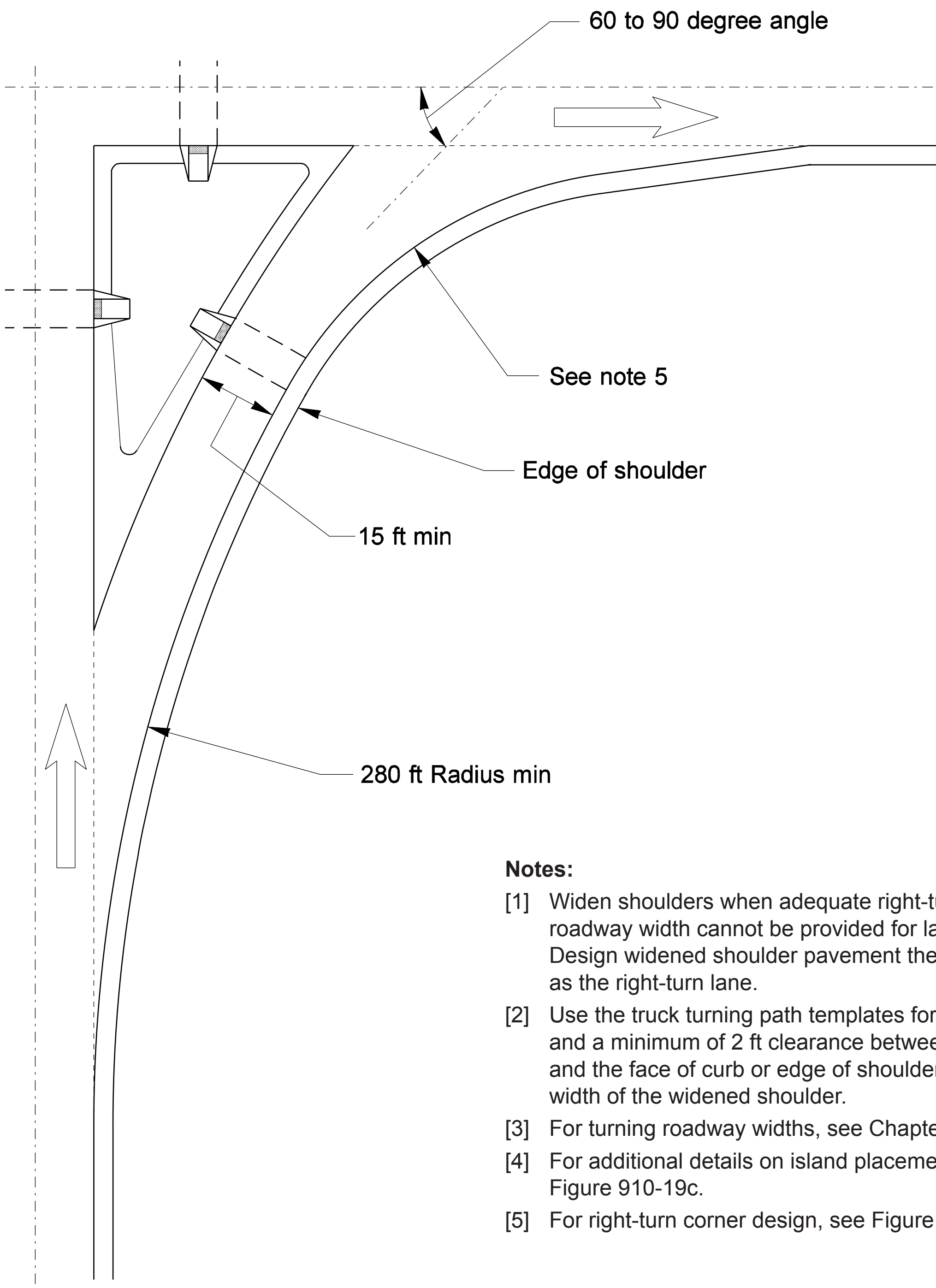
[4] For additional details on island placement, see Figure 910-19c.

[5] Small traffic islands have an area of 100 ft^2 or less; large traffic islands have an area greater than 100 ft^2.



Large Traffic Island Design [5]

Traffic Island Designs
Figure 910-19a



Notes:

[1] Widen shoulders when adequate right-turn radii and roadway width cannot be provided for large trucks. Design widened shoulder pavement the same depth as the right-turn lane.

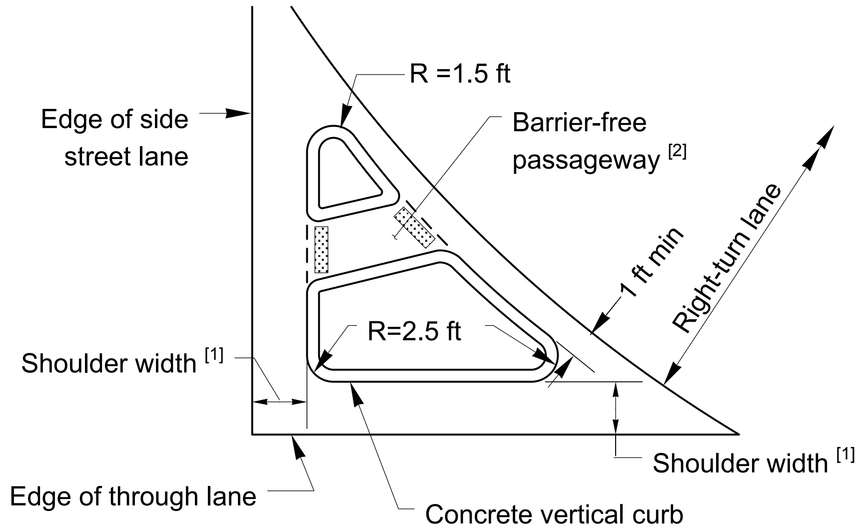
[2] Use the truck turning path templates for the design vehicle and a minimum of 2 ft clearance between the wheel paths and the face of curb or edge of shoulder to determine the width of the widened shoulder.

[3] For turning roadway widths, see Chapter 641.

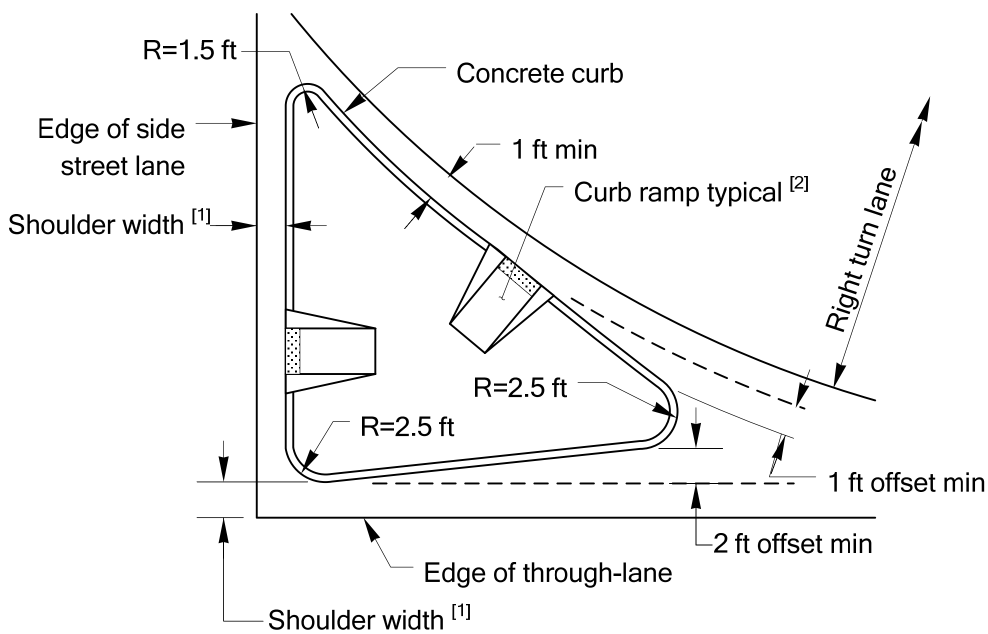
[4] For additional details on island placement, see Figure 910-19c.

[5] For right-turn corner design, see Figure 910-11.

Traffic Island Designs (Compound Curve)
Figure 910-19b



Small Raised Traffic Island [3]



Large Raised Traffic Island

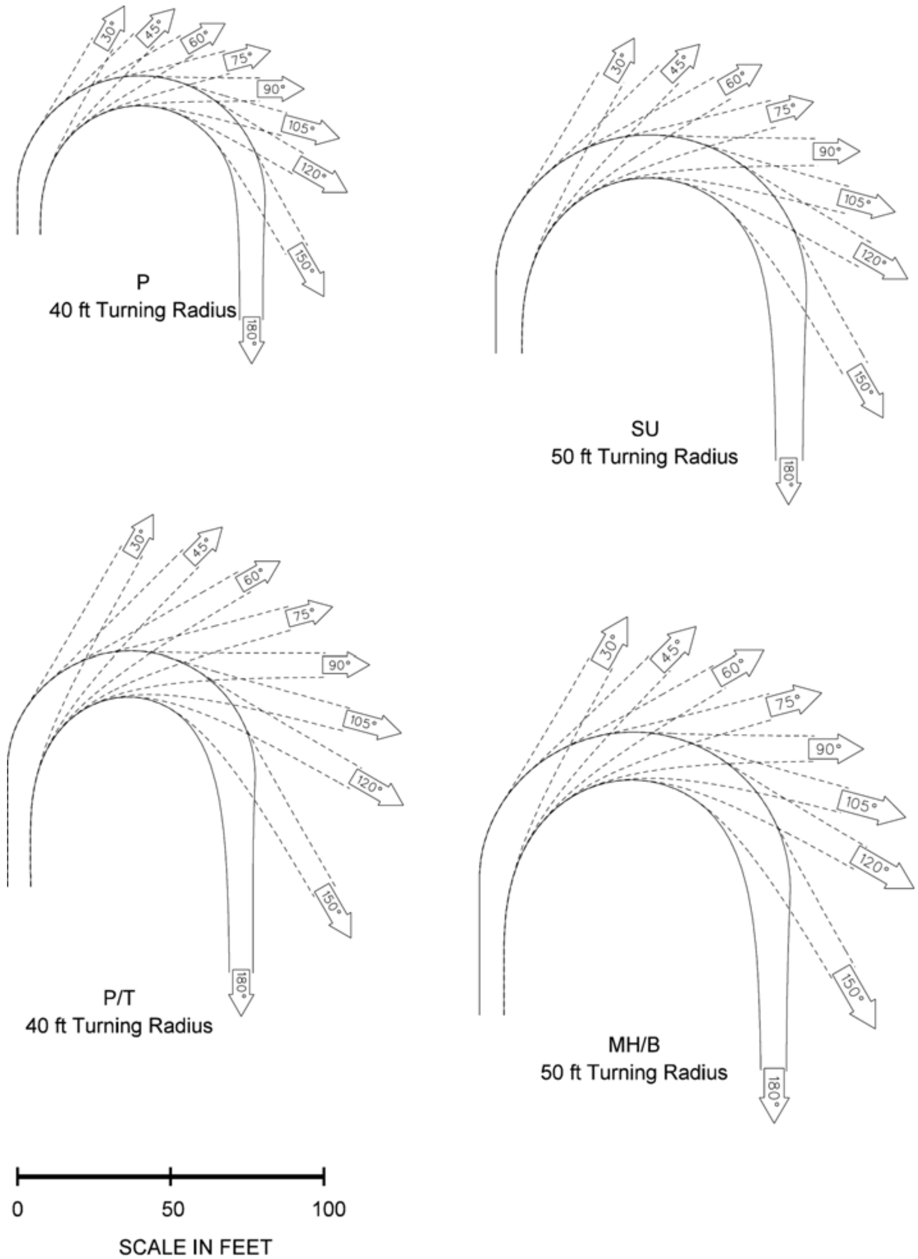
Notes:

[1] For minimum shoulder width <u>at curbs</u>, see Chapter 440. For additional information on shoulders at <u>turn lanes</u>, see 910.07(6).

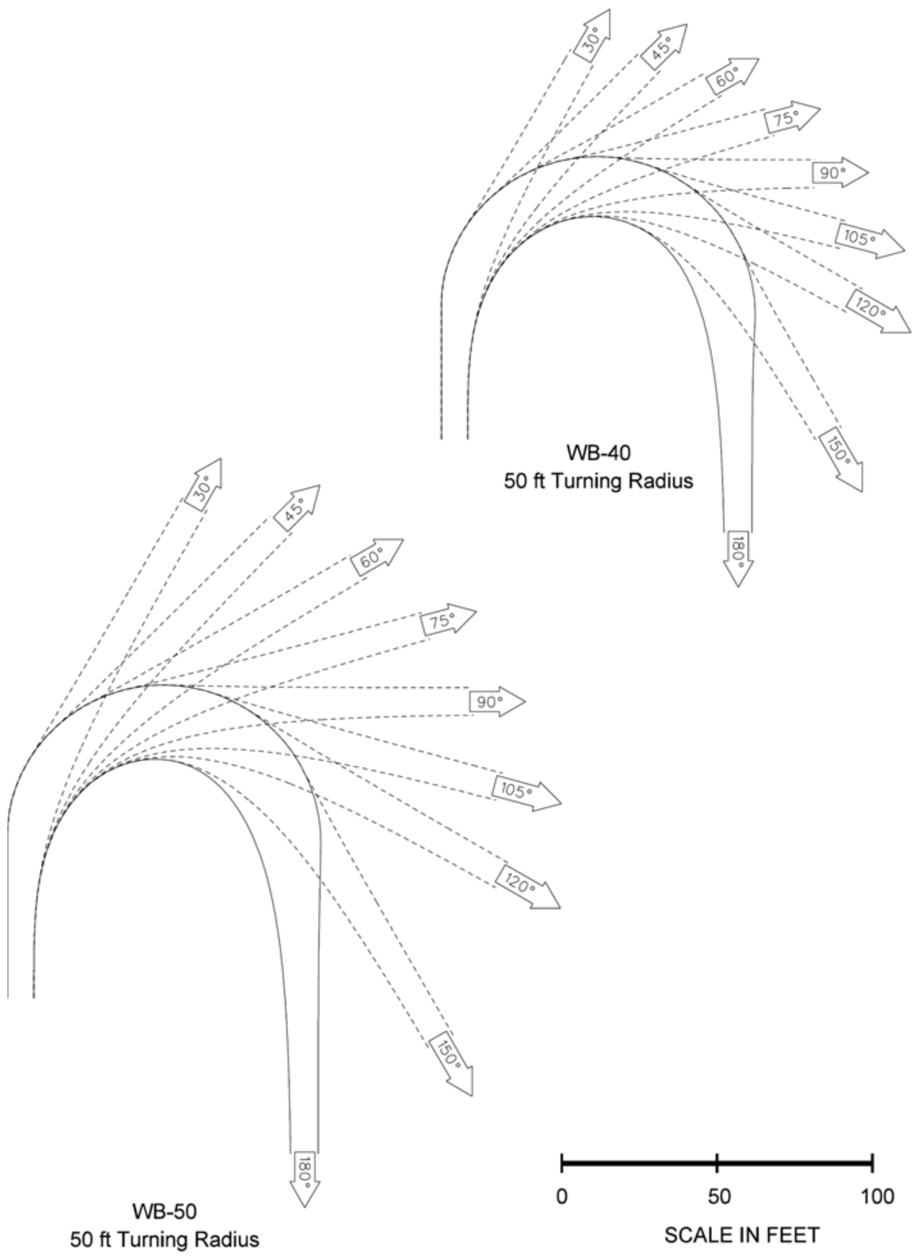
[2] Provide barrier-free passageways or curb ramps when required (see Chapter 1025).

[3] Small traffic islands have an area of 100 ft^2 or less; large traffic islands have an area greater than 100 ft^2.

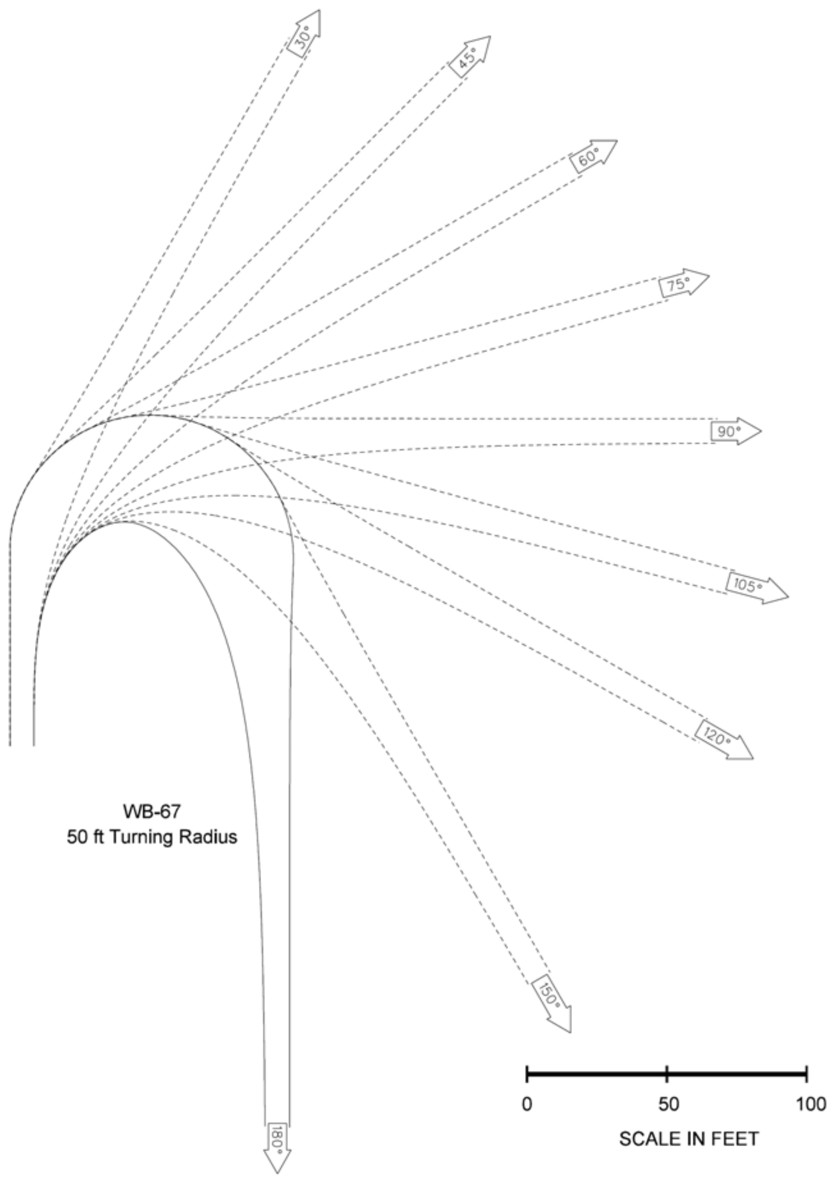
Traffic Island Designs
Figure 910-19c



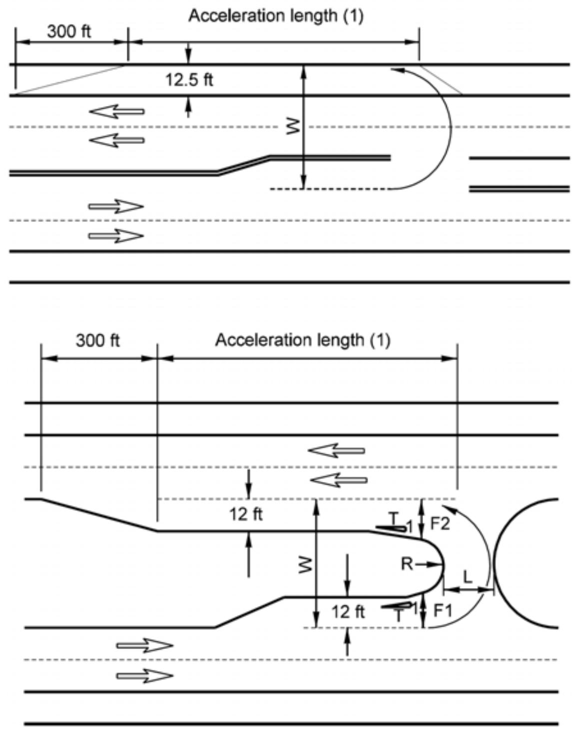
Turning Path Template
Figure 910-20a



Turning Path Template
Figure 910-20b



Turning Path Template
Figure 910-20c



Vehicle	W	R	L	F1	F2	T
P	52	14	14	12	12	—
SU	87	30	20	13	15	10:1
BUS	87	28	23	14	18	10:1
WB-40	84	25	27	15	20	6:1
WB-50	94	26	31	16	25	6:1
WB-67	94	22	49	15	35	6:1
MH	84	27	20	15	16	10:1
P/T	52	11	13	12	18	6:1
MH/B	103	36	22	15	16	10:1

U-Turn Design Dimensions

Notes:

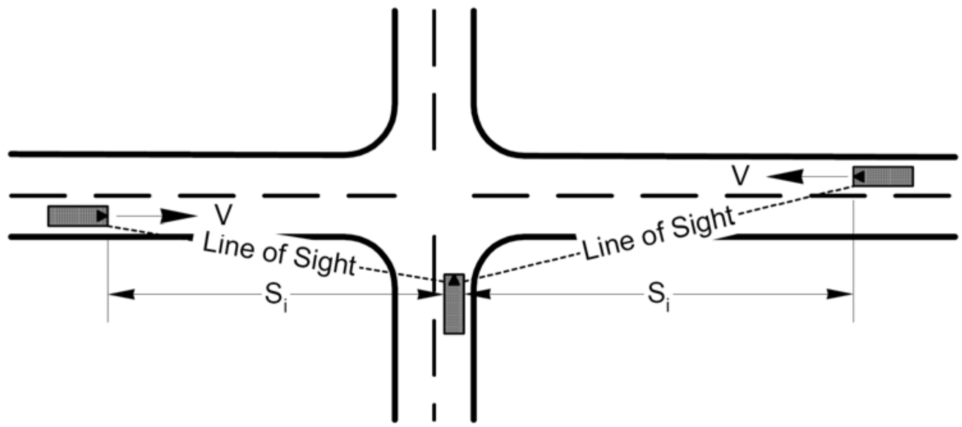
[1] The minimum length of the acceleration lane is shown in Figure 910-18. Acceleration lane may be eliminated at signal-controlled intersections.

[1] All dimensions in feet.

[1] When U-turn uses the shoulder, provide 12.5-ft shoulder width and shoulder pavement designed to the same depth as the through lanes for the acceleration length and taper.

U-Turn Median Openings

Figure 910-21



$S_i = 1.47Vtg$		
Where:		
S_i	=	Intersection Sight Distance (ft)
V	=	Design speed of the through roadway (mph)
t_g	=	Time gap for the minor roadway traffic to enter or cross the through roadway (sec)

Intersection Sight Distance Equation
Table 1

Design Vehicle	Time Gap (t_g) in Sec
Passenger car (P)	7.5
Single-unit trucks and buses (SU & BUS)	9.5
Combination trucks (WB-40, WB-50, & WB-67)	11.5
Note: Values are for a stopped vehicle to turn left onto a two-lane two-way roadway with no median and grades 3% or less.	

Intersection Sight Distance Gap Times (t_g)
Table 2

The t_g values listed in Table 2 require the following adjustments:

Crossing or right-turn maneuvers:

All vehicles subtract 1.0 sec

Multilane roadways:

Left turns, for each lane in excess of one, to be crossed and for medians wider than 4 ft:

Passenger cars add 0.5 sec

All trucks and buses add 0.7 sec

Crossing maneuvers, for each lane in excess of two, to be crossed and for medians wider than 4 ft:

Passenger cars add 0.5 sec

All trucks and buses add 0.7 sec

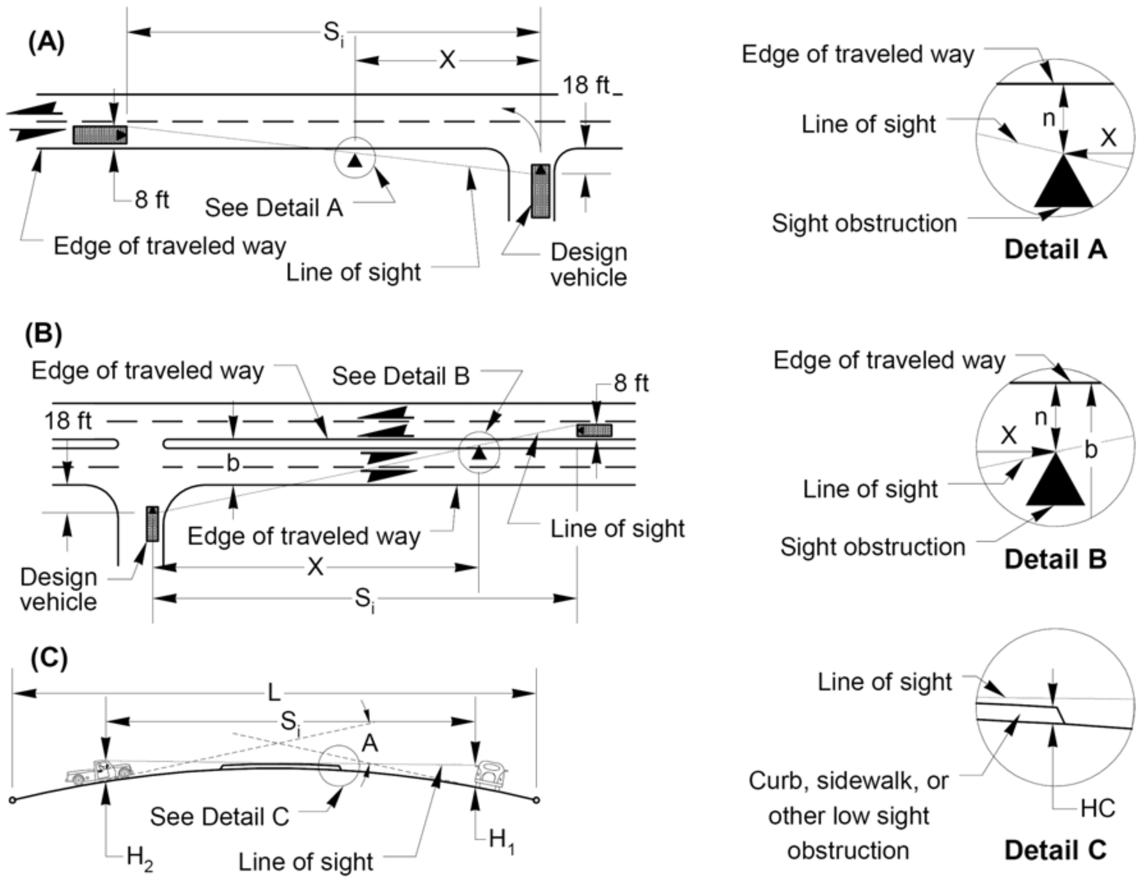
Note: Where medians are wide enough to store the design vehicle, determine the sight distance as two maneuvers.

Crossroad grade greater than 3%:

All movements upgrade, for each percent that exceeds 3%:

All vehicles add 0.2 sec

Sight Distance at Intersections
Figure 910-22a



For sight obstruction driver cannot see over:

$$S_i = \frac{(26+b)(x)}{(18+b-n)}$$

Where:

- S_i = Available intersection sight distance (ft)
- n = Offset from sight obstruction to edge of lane (ft)
- b = Distance from near edge of traveled way to near edge of lane approaching from right (ft) (b=0 for sight distance to the left)
- X = Distance from centerline of lane to sight obstruction (ft)

For crest vertical curve over a low sight obstruction where S<L:

$$S = \sqrt{\frac{100L\left[\sqrt{2(H_1-HC)}+\sqrt{2(H_2-HC)}\right]^2}{A}}$$

$$L = \frac{AS^2}{100\left[\sqrt{2(H_1-HC)}+\sqrt{2(H_2-HC)}\right]^2}$$

Where:

- S = Available sight distance (ft)
- H_1 = Eye height (3.5 ft for passenger cars; 6 ft for all trucks)
- H_2 = Object height (3.5 ft)
- HC = Sight obstruction height (ft)
- L = Vertical curve length (ft).
- A = Algebraic difference in grades (%)

Sight Distance at Intersections
Figure 910-22b

Chapter 915 Roundabouts

915.01 General

Modern roundabouts are circular intersections at grade. They are an effective intersection type with fewer conflict points and lower speeds, and they provide for easier decision making than conventional intersections. They also require less maintenance than traffic signals and have a traffic-calming effect. Well-designed roundabouts have been found to reduce all crashes (especially fatal and severe injury collisions), traffic delays, fuel consumption, and air pollution. For additional information and details on roundabouts, see *Roundabouts: An Informational Guide*.

Selection of a roundabout as the preferred intersection type is based on an engineering analysis that examines traffic volumes and patterns, including space requirements and right of way availability.

Modern roundabouts differ from older circular intersections in three ways: they have splitter islands that provide entry deflection to slow down entering vehicles; they have yield-at-entry, which requires entering vehicles to yield to vehicles in the roundabout to allow free flow of circulating traffic; and they have a smaller diameter that constrains circulating speeds.

915.02 References

Federal/State Laws and Codes

Americans with Disabilities Act of 1990 (ADA)

Revised Code of Washington (RCW) 47.05.021, Functional classification of highways

Washington Administrative Code (WAC) 468-58-080, Guides for control of access on crossroads and interchange ramps

Chapter 468-95 WAC, "Manual on uniform traffic control devices for streets and highways" (MUTCD)
www.wsdot.wa.gov/biz/trafficoperations/mutcd.htm

Design Guidance

ADA Accessibility Guidelines for Buildings and Facilities (ADAAG), U.S. Access Board
www.access-board.gov/adaag/html/adaag.htm

ADA Standards for Accessible Design, U.S. Department of Justice
www.usdoj.gov/crt/ada/adahom1.htm

Local Agency Guidelines (LAG), M 36-63, WSDOT

Manual on Uniform Traffic Control Devices for Streets and Highways, USDOT, FHWA, as adopted and modified by WAC 468-95

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

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2004

Crash Reductions Following Installation of Roundabouts in the United States, Insurance Institute for Highway Safety, March 2000
www.nysdot.gov/portal/page/portal/main/roundabouts/files/insurance_report.pdf

Guide to Traffic Engineering Practice, Part 6 – Roundabouts (Austroad Guide), Sydney, Australia: Austroad, 1993

Highway Capacity Manual (HCM), Special Report 209, Transportation Research Board, National Research Council

NCHRP Synthesis 264, Modern Roundabout Practice in the United States, Transportation Research Board, 1998 at: onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_264.pdf

Roundabouts: An Informational Guide, FHWA-RD-00-067, USDOT, FHWA www.tfhrc.gov/safety/00068.htm

Roundabout Design Guidelines, Ourston & Doctors, Santa Barbara, California, 1995

The Traffic Capacity of Roundabouts, TRRL Laboratory Report 942, Kimber, R.M., Crowthorne, England: Transport and Road Research Laboratory, 1980

Use of Roundabouts, ITE Technical Council Committee 5B-17, Feb. 1992 www.ite.org/traffic/documents/JBA92A42.pdf

The Design of Roundabouts: State of the Art Review, Brown, Mike, Transportation Research Laboratory, Department of Transport. London, HMSO, 1995

Understanding Flexibility in Transportation Design – Washington, WSDOT, 2005 www.wsdot.wa.gov/eesc/design/Urban/

915.03 Definitions

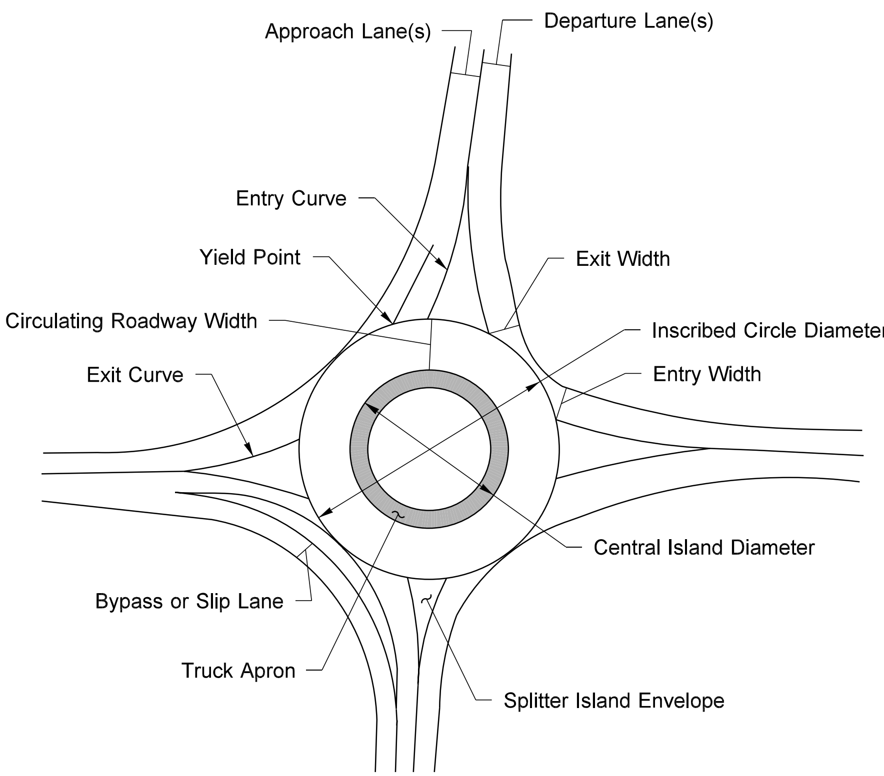
approach design speed The design speed of the roadway leading into the roundabout.

approach lanes The lane or set of lanes for traffic approaching the roundabout (see Figure 915-1).

central island The area of the roundabout including the truck apron that is surrounded by the circulating roadway.

central island diameter The diameter of the central island, including the truck apron (see Figure 915-1).

circulating lane A lane used by vehicles circulating in the roundabout.



Roundabout Elements
Figure 915-1

Chapter 1435 Managed Access

1435.01 General

Access management is the systematic regulation of the location, spacing, design, and operation of driveway, city street, and county road connections to state highways. This chapter describes the access management process for granting permission to connect to managed access highways within cities and unincorporated areas. For an overview of access control, as well as the references list and definitions of terminology for this chapter, see Chapter 1420, "Access Control."

In Washington State, managed access highways include all state highways that are not limited access highways. State highways that are planned for or established as limited access, as listed in the Access Control Tracking System database (www.wsdot.wa.gov/eesc/design/access/), are treated as managed access highways until the limited access rights are acquired.

Access to managed access highways is regulated by the governmental entity with jurisdiction over a highway's roadsides. Access connection permits are issued on managed access highways. WSDOT has access connection permitting authority over all state highways outside incorporated towns and cities. Incorporated towns and cities have access connection permitting authority for city streets that are part of state highways, as specified in RCW 47.24.020. When a project is developed on a state highway, state law requires that existing permitted access connections be evaluated to determine whether they are consistent with all current department spacing, location, and design standards (see 1435.05).

1435.02 References

(1) Federal/State Laws and Codes

See Chapter 1420, "Access Control."

(2) Design Guidance

See Chapter 325, "Design Matrix Procedures."

See Chapter 700, "Roadside Safety."

See Chapter 910, "Intersections At Grade."

See Chapter 920, "Road Approaches."

See Chapter 1420, "Access Control."

1435.03 Definitions

local roads For the purposes of this chapter, local roads are nonstate highways that are publicly owned.

median Used to separate opposing traffic and control access. Restrictive medians limit left turns to defined locations typically through the use of raised medians or barrier (see Chapter 440).

MPO Metropolitan Planning Organization.

RTPO Regional Transportation Planning Organization.

For additional definitions, see Chapter 1420, "Access Control."

1435.04 Design Considerations

Evaluate Access Connections when the Access column on the design matrices (see Chapter 325) indicates Evaluate Upgrade (EU) or Full Design Level (F). Use the Access Control Tracking System database (www.wsdot.wa.gov/eesc/design/access/) to identify the route classification and determine access connection requirements. Review all connections and verify whether they are in the Roadway Access Management Permit System (RAMPS) database. Contact the Region Development Services Office or the Headquarters (HQ) Access and Hearings Unit for permission to access the RAMPS database.

If a nonconforming connection is identified, consider relocating, modifying, or eliminating the connection. It is not the intent of the managed access program that modifications to the connection will change the general functionality of the property.

Where current department standards cannot be met while providing the same general functionality, the connection shall be classified as nonconforming and the appropriate documentation processed as discussed below. This documentation is part of the permit process.

1435.05 Managed Access Highway Classes

The principal objective of the managed access classification system is to maintain the safety and capacity of existing highways. This is accomplished by establishing access management criteria, which is to be adhered to in the planning and regional approval of access connections to the state highway system.

The classification system for state managed access highways consists of five classes. The classes are organized from Class 1, the most restrictive class for higher speeds and volumes, to Class 5, the least restrictive class for lower speeds and volumes. In general, most state highways outside the incorporated limits of a city or town have been designated as Class 1 or Class 2 highways, with only the most urban and lowest-speed state highways within an incorporated town or city designated as Class 5. Figure 1435-2 shows the five classes of highways, with a brief description of each class. WSDOT keeps a record of the assigned managed access classifications, by route and milepost, in the Access Control Tracking System database:
www.wsdot.wa.gov/eesc/design/access/

One of the goals of the state law is to restrict or keep access connections to a minimum in order to help preserve the safety, operation, and functional integrity of the state highway. On Class 1 highways mobility is the primary function, while on Class 5 highways access needs have priority over mobility needs. Class 2 highways also favor mobility, while Class 3 and Class 4 highways generally achieve a balance between mobility and access.

The most notable distinction between the five highway classes is the minimum spacing requirements of access connections. Minimum distances between access points on the same side of the highway are shown in Figure 1435-2.

In all five highway classes, access connections are to be located and designed to minimize interference with transit facilities and high occupancy vehicle (HOV) facilities on state highways where such facilities exist or are proposed in state, regional, metropolitan, or local transportation plans. In these cases, if reasonable access is available to the local road/street system, access is to be provided to the local road/street system rather than directly to the state highway. The functional characteristics and the legal requirements for each class are as follows:

(1) Class 1

(a) **Functional Characteristics**. Class 1 highways provide for high-speed and/or high-volume traffic movements for interstate, interregional, and intercity (and some intracity) travel needs. Service to abutting land is subordinate to providing service to major traffic movements.

Highways in Class 1 are typically distinguished by a highly-controlled, limited number of (public and private) access points, restrictive medians with limited median openings on multilane facilities, and infrequent traffic signals.

(b) **Legal Requirements**

1. It is the intent that Class 1 highways be designed to have a posted speed limit of 50 to 65 mph. Spacing of intersecting streets, roads, and highways is planned with a minimum spacing of 1 mile. Spacing of ½ mile may be allowed, but only when no reasonable alternative access exists.
2. Private access connections to the state highway are not allowed, except when the property has no other reasonable access to the local road/street system. When a private access connection must be provided, the following conditions apply:
    - The access connection continues until such time other reasonable access to a highway with a less restrictive access control class or access to the local road/street system becomes available and is allowed.
    - The minimum distance to another access point (public or private) is 1320 feet along the same side of the highway. Nonconforming access connection permits may be issued to provide access connections to parcels whose highway frontage, topography, or location otherwise precludes issuance of a conforming access connection permit; however, variance permits are not allowed.

- No more than one access connection may be provided to an individual parcel or to contiguous parcels under the same ownership.
- All private access connections are for right turns only on multilane facilities, unless special conditions justify the exception and are documented by a traffic analysis in the access connection permit application that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.
- Additional access connections to the state highway are not allowed for newly created parcels resulting from property divisions. All access for these parcels must be provided by an internal road/street network. Access to the state highway will be at existing permitted locations or at revised locations.

3. Restrictive medians are provided on multilane facilities to separate opposing traffic movements and to prevent unauthorized turning movements.

(2) Class 2

(a) **Functional Characteristics**. Class 2 highways provide for medium-to-high-speed and medium-to-high-volume traffic movements over medium and long distances for interregional, intercity, and intracity travel needs. Direct access service to abutting land is subordinate to providing service to traffic movements.

Highways in Class 2 are typically distinguished by existing or planned restrictive medians on multilane facilities and by large minimum distances between (public and private) access points.

(b) **Legal Requirements**

1. It is the intent that Class 2 highways be designed to have a posted speed limit of 35 to 50 mph in urbanized areas and 45 to 55 mph in rural areas. Spacing of intersecting streets, roads, and highways is planned with a minimum spacing of ½ mile. Less than ½-mile intersection spacing may be allowed, but only when no reasonable alternative access exists.

   In urban areas and developing areas where higher volumes are present or growth that will require signalization is expected in the foreseeable future, it is imperative that the location of any public access point be planned carefully to ensure adequate signal progression. The addition of all new access points, public or private, that might require signalization will require an engineering analysis that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

2. Private access connections to the state highway system are allowed only when the property has no other reasonable access to the local road/street system or when access to the local road/street system will cause unacceptable traffic operational conditions or safety concerns on that system. When a private access connection must be provided, the following conditions apply:
   - The access connection continues until such time other reasonable access to a highway with a less restrictive access control class or acceptable access to the local road/street system becomes available and is allowed.

- The minimum distance to another (public or private) access point is 660 feet on the same side of the highway. Nonconforming access connection permits may be issued to provide access to parcels whose highway frontage, topography, or location precludes issuance of a conforming access connection permit.
- Only one access connection is allowed for an individual parcel or to contiguous parcels under the same ownership, unless the highway frontage exceeds 1320 feet and it can be shown that the additional access connection will not adversely affect the desired function of the state highway in accordance with the assigned managed access Class 2 or the safety or operation of the state highway.
- Variance permits may be allowed if there are special conditions and the exception can be justified to the satisfaction of the department by a traffic analysis in the access connection permit application that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.
- All private access connections are for right turns only on multilane facilities, unless there are special conditions and the exception can be justified to the satisfaction of the department by a traffic analysis in the access connection permit application that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43, and only if left-turn channelization is provided.
- Additional access connections to the state highway are not allowed for newly created parcels that result from property divisions. All access for these parcels must be provided by an internal road/street network. Access to the state highway will be at existing permitted locations or at revised locations.

3. On multilane facilities, restrictive medians are provided to separate opposing traffic movements and to prevent unauthorized turning movements. However, a nonrestrictive median or a two-way left-turn lane may be used when special conditions exist and main line volumes are below 20,000 average daily traffic (ADT).

(3) Class 3

(a) **Functional Characteristics**. Class 3 highways provide for moderate travel speeds and moderate traffic volumes for medium and short travel distances for intercity, intracity, and intercommunity travel needs. There is a reasonable balance between access and mobility needs for highways in this class. This class is to be used primarily where the existing level of development of the adjoining land is less intensive than maximum buildout and where the probability of significant land use change and increased traffic demand is high.

Highways in Class 3 are typically distinguished by planned restrictive medians on multilane facilities and by meeting minimum distances between (public and private) access points. Two-way left-turn lanes may be used where special conditions justify them and main line traffic volumes are below 25,000 ADT. Development of properties with internal road/street networks and joint access connections are encouraged.

(b) **Legal Requirements**

1. It is the intent that Class 3 highways be designed to have a posted speed limit of 30 to 40 mph in urbanized areas and 45 to 55 mph in rural areas. In rural areas, spacing of intersecting streets, roads, and highways is planned with a minimum spacing of ½ mile. Less than ½-mile intersection spacing may be allowed, but only when no reasonable alternative access exists.

   In urban areas and developing areas where higher volumes are present or growth that will require signalization is expected in the foreseeable future, it is imperative that the location of any public access point be planned carefully to ensure adequate signal progression. Where feasible, major intersecting roadways that might ultimately require signalization are planned with a minimum of ½-mile spacing. The addition of all new access points, public or private, that may require signalization will require an engineering analysis that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

2. Private Access Connections
   - No more than one access connection may be provided to an individual parcel or to contiguous parcels under the same ownership, unless it can be shown that additional access connections will not adversely affect the desired function of the state highway in accordance with the assigned managed access Class 3 and will not adversely affect the safety or operation of the state highway.
   - The minimum distance to another (public or private) access point is 330 feet on the same side of the highway. Nonconforming access connection permits may be issued to provide access to parcels whose highway frontage, topography, or location precludes issuance of a conforming access connection permit.
   - Variance permits may be allowed if there are special conditions and the exception can be justified to the satisfaction of the department by a traffic analysis in the access connection permit application that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

(4) Class 4

(a) **Functional Characteristics**. Class 4 highways provide for moderate travel speeds and moderate traffic volumes for medium and short travel distances for intercity, intracity, and intercommunity travel needs. There is a reasonable balance between direct access and mobility needs for highways in this class. This class is to be used primarily where the existing level of development of the adjoining land is more intensive and where the probability of major land use changes is less than on Class 3 highway segments.

Highways in Class 4 are typically distinguished by existing or planned nonrestrictive medians. Restrictive medians may be used to mitigate unfavorable operational conditions such as turning, weaving, and crossing conflicts. Minimum access connection spacing requirements apply if adjoining properties are redeveloped.

(b) **Legal Requirements**

1. It is the intent that Class 4 highways be designed to have a posted speed limit of 30 to 35 mph in urbanized areas and 35 to 45 mph in rural areas. In rural areas, spacing of intersecting streets, roads, and highways is planned with a minimum spacing of ½ mile. Less than ½-mile intersection spacing may be allowed, but only when no reasonable alternative access exists.

   In urban areas and developing areas where higher volumes are present or growth that will require signalization is expected in the foreseeable future, it is imperative that the location of any public access point be planned carefully to ensure adequate signal progression. Where feasible, major intersecting roadways that might ultimately require signalization are planned with a minimum of ½-mile spacing. The addition of all new access points, public or private, that may require signalization will require an engineering analysis that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

2. Private Access Connections:
   - No more than one access connection may be provided to an individual parcel or to contiguous parcels under the same ownership, unless it can be shown that additional access connections will not adversely affect the desired function of the state highway in accordance with the assigned managed access Class 4 and will not adversely affect the safety or operation of the state highway.
   - The minimum distance to another (public or private) access point is 250 feet on the same side of the highway. Nonconforming access connection permits may be issued to provide access connections to parcels whose highway frontage, topography, or location precludes issuance of a conforming access connection permit.
   - Variance permits may be allowed if there are special conditions and the exception can be justified to the satisfaction of the department by a traffic analysis in the access connection permit application that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

(5) Class 5

(a) **Functional Characteristics**. Class 5 highways provide for moderate travel speeds and moderate traffic volumes for primarily short travel distances for intracity and intracommunity trips and for access to state highways of a higher class. Access needs generally may be higher than the need for through-traffic mobility without compromising the public health, welfare, or safety. These highways will normally have nonrestrictive medians.

(b) **Legal Requirements**

1. It is the intent that Class 5 highways be designed to have a posted speed limit of 25 to 35 mph. In rural areas, spacing of intersecting streets, roads, and highways is planned with a minimum spacing of ¼ mile. Less than ¼-mile spacing may be allowed where no reasonable alternative exists. In urban areas and developing areas where higher volumes are present or growth

that will require signalization is expected in the foreseeable future, it is imperative that the location of any public access point be planned carefully to ensure adequate signal progression. Where feasible, major intersecting roadways that might ultimately require signalization are planned with a minimum of ¼-mile spacing. The addition of all new access points, public or private, that might require signalization will require an engineering analysis that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

2. Private Access Connections
    - No more than one access connection may be provided to an individual parcel or to contiguous parcels under the same ownership, unless it can be shown that additional access connections will not adversely affect the desired function of the state highway in accordance with the assigned managed access Class 5 and will not adversely affect the safety or operation of the state highway.
    - The minimum distance to another (public or private) access point is 125 feet on the same side of the highway. Nonconforming access connection permits may be issued to provide access to parcels whose highway frontage, topography, or location precludes issuance of a conforming access connection permit.
    - Variance permits may be allowed if there are special conditions and the exception can be justified to the satisfaction of the department by a traffic analysis in the access connection permit application that is signed and sealed by a qualified professional engineer who is registered in accordance with RCW 18.43.

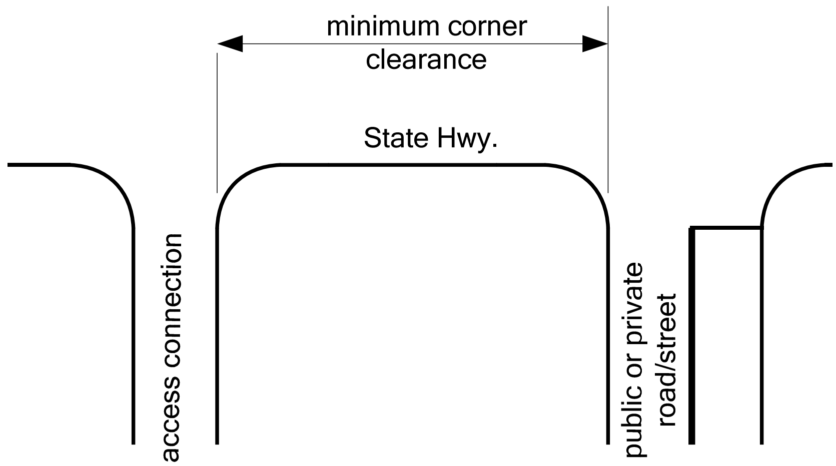
(6) Changes in Managed Access Classification

WSDOT, RTPOs, MPOs, or other entities such as a city, town, or county may initiate a review of managed access classifications per the process identified by WAC 468-52. In all cases, WSDOT shall consult with the RTPOs, MPOs, and local agencies and take into consideration comments received during the review process. For city streets that are designated as state highways, the department will obtain concurrence in the final classification assignment from the city or town.

The modified highway classification list shall be submitted to Headquarters for approval by the State Design Engineer (SDE) or designee. WSDOT Regions shall notify the RTPOs, MPOs, and local governmental entities in writing of the final determination of the reclassification.

1435.06 Corner Clearance Criteria

In addition to the five access control classes, there are also corner clearance criteria that must be used for access connections near intersections (see Figure 1435-1).



WITH RESTRICTIVE MEDIAN		
Position	**Access Allowed**	**Minimum (ft)**
Approaching Intersection	Right In/Right Out	115
Approaching Intersection	Right In Only	75
Departing Intersection	Right In/Right Out	230*
Departing Intersection	Right Out Only	100
WITHOUT RESTRICTIVE MEDIAN		
Position	**Access Allowed**	**Minimum (ft)**
Approaching Intersection	Full Access**	230*
Approaching Intersection	Right In Only	100
Departing Intersection	Full Access	230*
Departing Intersection	Right Out Only	100

* 125 ft may be used for Class 5 facilities with a posted speed of 35 mph or less.
** Full Access = All four movements (Right in/out; Left in/out)

Minimum Corner Clearance:
Distance From Access Connection to Public Road or Street
Figure 1435-1

Corner clearance spacing must meet or exceed the minimum access point spacing requirements of the applicable managed access highway class. A single access connection may be placed closer to the intersection, in compliance with the permit application process specified in WAC 468-51 and in accordance with the following criteria:

(a) The minimum corner clearance criteria in Figure 1435-1 may be used where access point spacing cannot be obtained due to property size and where a joint use access connection cannot be secured or where it is determined by WSDOT not to be feasible because of conflicting land use or conflicting traffic volumes or operational characteristics.

(b) Some local agencies have adopted corner clearance as a design element in their design standards (these standards are to meet or exceed WSDOT standards). Coordinate with the local agency regarding corner clearance of an access connection on or near an intersecting local road or street.

(c) When a joint-use access connection or an alternate road/street system access (meeting or exceeding the minimum corner clearance requirements) becomes available, the permit holder must close the permitted access connection, unless the permit holder shows to WSDOT's satisfaction that such closure is not feasible.

1435.07 Access Connection Categories

Whenever an access connection permit is issued on a managed access state highway, the permit must also specify one of four access connection categories: Category I to Category IV. Categories I through III are based on the maximum vehicular usage of the access connection. Category IV specifies temporary use, usually for less than a year. Access connection permits must specify the category and the maximum vehicular usage of the access connection in the permit.

All access connections are determined by WSDOT to be in one of the following categories (per WAC 468-51-040).

(1) Category I

"Category I – minimum connection" provides connection to the state highway system for up to ten single-family residences, a duplex, or a small multifamily complex of up to ten dwelling units that use a common access connection. The category also applies to permanent access connections to agricultural and forestlands, including field entrances; access connections for the operation, maintenance, and repair of utilities; and access connections serving other low-volume traffic generators expected to have average weekday vehicle trip ends (AWDVTE) of 100 or less.

(2) Category II

"Category II – minor connection" provides connection to the state highway system for medium-volume traffic generators expected to have an AWDVTE of 1500 or less, but not included in Category I.

(3) Category III

"Category III – major connection" provides connection to the state highway system for high-volume traffic generators expected to have an AWDVTE exceeding 1500.

(4) Category IV

"Category IV – temporary connection" provides a temporary, time-limited connection to the state highway system for a specific property for a specific use with a specific traffic volume. Such uses include, but are not limited to, logging, forestland clearing, temporary agricultural uses, temporary construction, and temporary emergency access. The department reserves the right to remove any temporary access connection at its sole discretion and at the expense of the property owner after the expiration of the permit. Further, a temporary access connection permit does not bind the department, in any way, to the future issuance of a permanent access connection permit at the temporary access connection location.

1435.08 Access Connection Permit

RCW 47.50 requires all access connections to be permitted. This can be accomplished by the permitting process (see 1435.09) or by the connection being "grandfathered" (in place prior to July 1, 1990).

All new access connections to state highways, as well as alterations and improvements to existing access connections, require an access connection permit. Every owner of property that abuts a managed access state highway has the right to reasonable access, but not a particular means of access. This right may be restricted with respect to the highway if reasonable access can be provided by way of another local road/street.

When a new private road or street is to be constructed, approval by the permitting authority is required for intersection design, spacing, and construction work on the right of way. However, if an access connection permit is issued, it will be rendered null and void if and when the road or street is duly established as a local road or street by the local governmental entity.

It is the responsibility of the applicant or permit holder to obtain all necessary local, state, and federal approvals and permits (which includes all environmental permits and documentation). The access connection permit only allows the applicant permission to connect to the state highway. It is also the responsibility of the applicant to acquire any and all property rights necessary to provide continuity from the applicant's property to the state highway.

The alteration or closure of any existing access connection caused by changes to the character, intensity of development, or use of the property served by the access connection or the construction of any new access connection must not begin before an access connection permit is obtained.

If a property owner or permit holder who has a valid access connection permit wishes to change the character, use, or intensity of the property or development served by the access connection, the permitting authority must be contacted to determine whether an upgraded access connection permit will be required.

The applicant must obtain design approval as shown in Chapter 330, Figures 330-2a and 2b.

1435.09 Permitting and Design Documentation

An access connection permit is obtained from the department by submitting the appropriate application form, including the fee, plans, traffic data, and access connection information, to the department for review. All access connection and roadway design documents for Category II and III permits must bear the seal and signature of a professional engineer registered in Washington State.

The permitting process begins with the application. Upon submittal of the application with all the attached requirements, it is reviewed and either denied or accepted. If denied, the department must notify the applicant in writing stating the reasons, and the applicant will have thirty (30) days to submit a revised application. Once the application is approved and the permit is issued, the applicant may begin construction.

The Access Manager in each Region keeps a record of all access points, including those that are permitted and those that are grandfathered (see 1435.10). A permit for a grandfathered access point is not required but may be issued for record-keeping reasons.

(1) Conforming Access Connection Permit

Conforming access connection permits may be issued for access connections that conform to the functional characteristics and all legal requirements for the designated class of the highway.

(2) Nonconforming Access Connection Permit

Nonconforming access connection permits may be issued for short-term access connections pending the availability of a future joint-use access connection or local road/street system access:

- For location and spacing not meeting requirements.
- For Category I through IV permits.
- After an analysis and determination by the department that a conforming access connection cannot be made at the time of permit application submittal.
- After a finding that the denial of an access connection will leave the property without a reasonable means of access to the local road/street system.

In such instances, the permit is to be noted as being a nonconforming access connection permit and may contain the following specific restrictions and provisions:

- Limits on the maximum vehicular use of the access connection
- The future availability of alternate means of reasonable access for which a conforming access connection permit can be obtained
- The removal of the nonconforming access connection at the time the conforming access is available
- The properties to be served by the access connection
- Other conditions as necessary to carry out the provisions of RCW 47.50

(3) Variance Access Connection Permit

Variance access connection is a special nonconforming or additional access connection permit issued for long-term use where future local road/street system access is not foreseeable:

- For location and spacing not meeting requirements or for an access connection that exceeds the number allowed for the class.
- After an engineering study demonstrates, to the satisfaction of the department, that the access connection will not adversely affect the safety, maintenance, or operation of the highway in accordance with its assigned managed access class.

In such instances, the permit is to be noted as being a variance access connection permit and may contain the following specific restrictions and provisions:

- Limits on the maximum vehicular use of the access connection
- The properties to be served by the access connection
- Other conditions as necessary to carry out the provisions of RCW 47.50

This permit will remain valid until modified or revoked by the permitting authority, unless an upgraded permit is required due to changes in property site use (see 1435.09(1)).

A variance access connection permit must not be issued for an access connection that does not conform to minimum corner clearance requirements (see 1435.06).

(4) Design Exceptions and Deviations

(a) **Outside Incorporated City Limits**. A deviation request will be required for nonconforming access connections if corner clearance criteria are not met. If a deviation is needed, the HQ Design Office is to be involved early in the process.

A Design Exception (DE) may be allowed for a single-family residence if the corner clearance criteria are not met. Such an access will be outside the corner radius and as close as feasible to the property line farthest away from the intersection. If two or more residences are served by the same driveway not meeting the corner clearance criteria, then a deviation request will be required.

For WSDOT projects, a short memo is retained in the Design Documentation Package (DDP) stating that the approved nonconforming permit satisfies the requirement of the DE. The DE is recorded in the Design Variance Inventory System (DVIS). Any deviations will be included in the DDP as well.

For non-WSDOT projects, the Region Development Services Office or Local Programs Office is responsible for entering DEs into the DVIS.

(b) **Within Incorporated Cities**. In accordance with RCW 35.78.030 and RCW 47.50, incorporated cities and towns have jurisdiction over access permitting on streets designated as state highways. Accesses located within incorporated cities and towns are regulated by the city or town and no deviation by WSDOT will be required. Document decisions made on these accesses in the DDP.

1435.10 Other Considerations

(1) Changes in Property Site Use With Permitted Access Connection

The access connection permit is issued to the permit holder for a particular type of land use generating specific projected traffic volumes at the final stage of proposed development. Any changes made in the use, intensity of development, type of traffic, or traffic flow require the permit holder, an assignee, or the property owner to contact the department to determine whether further analysis is needed because the change is significant and will require a new permit and modifications to the access connection (WAC 468-51-110).

A significant change is one that will cause a change in the category of the access connection permit or one that causes an operational, safety, or maintenance problem on the state highway system based on objective engineering criteria or available accident data. Such data will be provided to the property owner and/or permit holder and tenant upon written request (WAC 468-51-110).

(2) Existing Access Connections

(a) **Closure of Grandfathered Access Connections**. Any access connections that were in existence and in active use on July 1, 1990, are grandfathered.

The grandfathered access connection may continue unless:

- There are changes from the 1990 AWDVTE.
- There are changes from the 1990 established use.
- The department determines that the access connection does not provide minimum acceptable levels of highway safety and mobility based on accident and/or traffic data or accepted traffic engineering criteria; a copy of which must be provided to the property owner, permit holder, and/or tenant upon written request (WAC 468-51-130).

(b) **Department Construction Projects**

1. Notification

   The department must notify affected property owners, permit holders, business owners, and emergency services in writing, where appropriate, whenever the department's work program requires the modification, relocation, or replacement of their access connections. In addition to written notification, the department will facilitate, where appropriate, a process that may include, but is not limited to, public notices, meetings, or hearings, as well as individual meetings.

2. Modifications – Considerations

   When the number, location, or design of existing access connections to the state highway is being modified by a department construction project, the resulting modified access connections must provide the same general functionality for the existing property use as they did before the modification, taking into consideration the existing site design, normal vehicle types, and traffic circulation requirements. These are evaluated on an individual basis. It is important to remember that the intent is not to damage the property owner by removing nonconforming access connections, but to eliminate access connections that are both nonconforming and not needed.

   The permitting authority evaluates each property individually to make a determination about which category of access connection and which design template (see Chapter 920) will be reasonable. If it is a commercial parcel, determine whether the business can function with one access connection. Each parcel, or contiguous parcels under the same ownership being used for the same purpose, is only allowed one access connection. If the business cannot function properly with only one access connection, a variance permit may be issued for additional access connections. If the property is residential, only one access connection is allowed; however, certain circumstances might require an additional access connection (see 1435.09(4)).

3. Costs – Replacement of or Modifications to Existing Access Connections

   The costs of modifying or replacing the access points are borne by the department if the department construction project caused the replacement or modification. Modification of the connection may require a change to the existing permit.

(3) Work by Permit Holder's Contractor

The department requires that work done by the owner's contractor be accomplished at the completion of the department's contract or be scheduled so as not to interfere with the department's contractor. The department may require a surety bond prior to construction of the access connection in accordance with WAC 468-51-070.

1435.11 Preconstruction Conference

All new access connections, including alterations and improvements to existing access connections to the highway, require an access connection permit. The permitting authority may require a preconstruction conference prior to any work being performed on the access. The preconstruction conference must be attended by those necessary to ensure compliance with the terms and provisions of the permit. Details regarding the individual access connections will be included in the construction permit. This may include access connection widths, drainage requirements, surfacing requirements, mailbox locations, and other information (WAC 468-51-090).

1435.12 Adjudicative Proceedings

As listed below, any person who has standing to challenge any of the following departmental actions may request an adjudicative proceeding (an appeal to an Administrative Law Judge) within thirty (30) days of the department's written decision (WAC 468-51-150).

- Denial of an access connection permit application pursuant to WAC 468-51-080
- Permit conditions pursuant to WAC 468-51-150
- Permit modifications pursuant to WAC 468-51-120
- Permit revocation pursuant to WAC 468-51-120
- Closure of permitted access connection pursuant to WAC 468-51-120
- Closure of grandfathered access connection pursuant to WAC 468-51-130

An appeal of a decision by the department can only be requested if the administrative fee has been paid. If the fee has not been paid, the permit application is considered incomplete and an adjudicative proceeding cannot be requested.

Following is a brief summary of the adjudicative proceeding process. For the purpose of this summary, the responsibilities of the department are separated into those actions required of the Region and those actions required of Headquarters. The summary is written as if the appealable condition was a denial of an access connection request.

1. The Region receives an access connection permit application, with fee.
2. The Region processes the application and makes a determination that the access connection request will be denied.
3. The Region sends the applicant a written letter denying the access connection. Included in this letter is notification that the applicant has thirty (30) days to request an adjudicative proceeding if the applicant disagrees with the Region's denial decision. The Region must notify affected property owners, permit holders, business owners, tenants, lessees, and emergency services, as appropriate.

4. The applicant requests, within thirty (30) days, an adjudicative proceeding.
5. The Region reviews its initial denial decision and determines whether there is any additional information presented that justifies reversing the original decision.
6. If the Region determines that the original denial decision will stand, the Region then forwards copies of all applicable permit documentation to the Access and Hearings Manager (AHM) at Headquarters for review and processing.
7. The AHM reviews the permit application and sends the permit documentation and appeal request to the Office of the Attorney General (AG).
8. If the initial findings of the AG agree with the Region's denial decision, the AG's Office sends the applicant a written letter, with the AG's signature, informing the applicant that a hearing will be scheduled for the applicant to appeal in person the department's decision to deny access.
9. The Region reserves a location and obtains a court reporter, and Headquarters obtains an Administrative Law Judge (ALJ) to conduct the proceeding. The AG, by written letter, notifies the applicant of the time and place for the hearing. The AG's Office has ninety (90) days from receipt of the applicant's appeal to approve or deny the appeal application, schedule a hearing, or decide not to conduct a hearing. The actual hearing date can be set beyond this ninety-day (90-day) review period.
10. The AG's Office leads the department's presentation and works with the Region regarding who will testify and what displays and other information will be presented to the ALJ. The AHM will typically not attend these proceedings.
11. After hearing all the facts, the ALJ issues a decision, usually within a few weeks after the proceedings. However, the ALJ has ninety (90) days in which to serve a written Initial Order stating the decision.
12. The ALJ's decision is final unless the applicant, or the department through the AHM, decides to appeal the ALJ's decision to the State Design Engineer. This second appeal must occur within twenty (20) days of the ALJ's written decision.
13. If appealed to the State Design Engineer, the State Design Engineer has ninety (90) days to review the Initial Order and all the facts and supporting documentation and issue a Final Order. The review by the State Design Engineer does not require the applicable parties to be present and may involve only a review of the material submitted at the adjudicative proceeding.
14. The State Design Engineer's decision is final unless appealed within thirty (30) days to the Washington State Superior Court.

The above represents a general timeline if all appeals are pursued. Based on the noted timelines, it can take nearly a year before a Final Order is issued. If appealed to Superior Court, up to an additional 18 months can be added to the process. In any case, contact the Region Development Services Engineer for further guidance and direction if an appeal might be forthcoming.

1435.13 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

Class	Nonconforming[1]	Variance[2]	Conforming[3]	Access Point Spacing**	Limitations[4]
Class 1 Mobility is the primary function	Yes*	No	No	1320 ft	• One access only to contiguous parcels under same ownership • Private access connection is not allowed unless no other reasonable access exists (must use local road/street system if possible)
Class 2 Mobility is favored over access	Yes*	Yes*	No	660 ft	• One access connection only to contiguous parcels under same ownership unless frontage > 1320 ft • Private access connection not allowed unless no other reasonable access exists (must use local road/street system if possible)
Class 3 Balance between mobility and access in areas with less than maximum buildout	Yes	Yes	Yes	330 ft	• One access connection only to contiguous parcels under same ownership • Joint access connection for subdivisions preferred; private connection allowed, with justification
Class 4 Balance between mobility and access in areas with less than maximum buildout	Yes	Yes	Yes	250 ft	One access connection only to contiguous parcels under same ownership, except with justification
Class 5 Access needs may have priority over mobility	Yes	Yes	Yes	125 ft	More than one access connection per ownership, with justification

Notes:

* The access connection continues only until such time other reasonable access to a highway with a less restrictive class or acceptable access to the local road/street system becomes available and is allowed.

** Minimum, on the same side of the highway.

[1] See 1435.09(2).

[2] See 1435.09(3).

[3] See 1435.09(1).

[4] Unless grandfathered (see 1435.08).

Managed Access Highway Class Description
Figure 1435-2

A

B

C

D

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V

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