Chapter 1100 Design Process

1100.01 General (Section Rewritten 2023)

The Washington State Department of Transportation (WSDOT) is committed to context- appropriate, functional, accessible, and complete active transportation networks. WSDOT's goal is to optimize existing system capacity and safety and reduce the environmental impacts of the transportation system by encouraging and supporting a full array of modal choices. To accomplish this goal and to meet the needs of users of all ages and abilities, WSDOT works with community partners to identify changes needed across all jurisdictions to improve safety, mobility, and connectivity for active transportation users.

The design process accounts for the fact that 100% of Washingtonians use active transportation at some point during their trip whether walking to a transit hub or from a parked car to the store, bicycling to work, or rolling home from a ferry terminal. Active transportation facilities designed in alignment with industry practice contribute to the safety and mobility of all roadway users and ongoing development of a truly multimodal network.

A performance-based, practical design approach is used to guide the WSDOT design process, utilizing appropriate performance metrics, stakeholder input, and agency risk management practices to establish the most effective design.

This chapter provides an overview of practical solutions, practical design and the different elements that are examined and documented in design decisions.

*1100.01(1) Design and Pre-design Phase (*New Section 2023)

Preliminary Engineering, also known as project design phase, begins after a project is scoped. In some cases, a pre-design phase may be initiated to refine or validate project scope, schedule and budget for projects identified to have, or are likely to have, design element changes. The work described in Chapter 1100 – 1106 may take place during this pre-design phase and the decisions and analyses conducted are documented in an update to the Project Summary (CPDM approval), and in the Basis of Design (See Exhibit 300-2). Once the Basis of Design has been completed and approved along with an updated estimate, the pre-design phase is concluded, and the design phase begins. Separate instructions for pre-design are available and occasionally updated to provide additional guidance to region staff. Contact HQ Design for more information.

When design element(s) are expected to change and a BOD is typically required, exemptions from a pre-design phase can be approved by the ASDE.

1100.01(2) Responsibilities (New Section 2023)

The Project Engineer or region designee assigned to the project is responsible for carrying out the design process in accordance with policies and guidance in this manual. Furthermore, the Project Engineer or region designee is accountable for deliverables and decisions made during that process, and overseeing the required work in accordance with their professional responsibilities per RCW 18-43.

The Project Engineer or region designee is supported by the members of their project and advisory teams (see Section 1100.04(2)), as well as other subject matter experts and administrative staff throughout the agency or under contract who contribute and participate in accordance with their own professional and legal responsibilities.

1100.02 Design Principles

1100.02(1) Practical Solutions

The Practical Solutions approach prioritizes innovative, timely, and cost-effective decisions that are made in coordination with stakeholders and partners. It considers each situation and encourages incremental, flexible, and sustainable investment decisions by focusing on identified performance needs and engaging stakeholders at the right time.

Practical Solutions is applicable to everything the agency does, including the way programs and services are administered, managed, planned, programmed, designed, constructed, operated, and maintained. It is a performance-based approach to transportation and organizational decision making (see Executive Order (EO) E 1090.01 for more information). It is specifically reflected in the processes and procedures described in this Chapter, and the Basis of Design documentation template.

It is also a data-driven approach that uses tools, data analytics, performance measures, and stakeholder input to (1) seek lower-cost approaches and efficiencies in expanding and operating the multimodal transportation system to reduce travel demand and the need for building costly new infrastructure, (2) identify, evaluate, analyze, and manage risk to WSDOT's strategic objectives, and (3) identify and implement agency efficiencies. Practical Solutions includes one or a combination of strategies, including, but not limited to, Transportation Systems Management and Operations (TSMO), off-system solutions, Transportation Demand Management (TDM), and incremental strategic capital solutions. The goal is to identify and solve needs and problems as quickly and cost-effectively as possible.

1100.02(2) Safe System Approach (New Section 2023)

The Safe System Approach to road safety is a holistic approach based on the following elements: safe roads, safe speeds, safe vehicles, safe road users, and post-crash care. In the Safe System Approach, WSDOT has a primary responsibility of road infrastructure planning, design, and operations. This includes speed management, multimodal context-sensitive geometric design, traffic systems management and operations, roadside features and road user actions affected by road infrastructure design and operations (such as signage, lighting, and striping), and the safety management systems that support analysis and decision making. Within these elements, the Safe System Approach applies the following principles:

- **Eliminate death and serious injuries:** While no crashes of any type are desirable, the Safe System Approach prioritizes elimination of crashes that result in death and serious injuries.
- **Support safe road use:** Road users will inevitably make mistakes that can lead to crashes. The transportation system and vehicles can be designed and operated to reduce the injury outcomes from those errors. A forgiving system accommodates reasonable and predictable human limitations and behavior (such as diligence, perception, and attention). Roads that are developed in this manner as "self- enforcing and self-explaining roads" make it more difficult for errors to occur, and when the errors do occur, they result in fewer fatal and serious injuries.

- **Reduce large crash forces:** Road users have limits for tolerating crash forces before death or serious injury occurs. Therefore, it is important within the Safe System Approach to manage the transfer of kinetic energy through adoption of design and operational elements that account for and reduce crash speeds and impact angles to be within survivable limits.
- **Responsibility is shared:** All stakeholders (such as transportation system designers, managers, road users, vehicle manufacturers, and policy makers) commit to reducing fatal and serious injury crashes and to working together. The focus is placed on the larger context and network of contributing factors and characteristics from which traffic death and serious injury arise, instead of the individual road users.
- **Strengthen all parts:** All parts of the transportation system are strengthened to reinforce each other so that if one part fails, the other parts still protect road users. In this way redundancy is provided for the elements that make up the safe system.
- **Safety is proactive:** Proactive (systemic safety) approaches address context, contributing factors, and crash types and help to reduce the potential for fatal and serious injury crashes. These approaches complement traditional, reactive crash reduction programs that focus on individual sites and segments with a history of observed crashes using the methods outlined by the American Association of State Highway and Transportation Officials (AASHTO) Highway Safety Manual.

1100.02(2)(a) Safe System Roles and Responsibilities (New Section 2023)

Executive order E1085.01 directs WSDOT executives and employees to incorporate the Safe System Approach into WSDOT practices to align with the Safe System Approach to road safety. Implementing the Safe System approach includes:

- Working collaboratively with internal and external safety stakeholders to analyze safety performance and develop strategies that move us toward zero fatal and serious injury crashes.
- Aligning and maintaining a quantitative approach to analysis across project development functions that complies with the intent, methods, and tools defined by the AASHTO *Highway Safety Manual*, where they are practicable.
- Incorporating an equity analysis in accordance with findings from modal crash data and the environmental justice requirements of the Healthy Environment for All (HEAL) Act.
- Prioritizing design and operational decisions that support safety for all users based on the context of the road, particularly in locations affected by legacy state transportation facilities and where gaps in walking and biking facilities exist, as outlined by the Active Transportation Plan.
- Explicitly identifying and addressing a project's expected effects on crash exposure and network connectivity for vulnerable road users. This acts to prevent increased exposure to fatal and serious injury crashes through needed multimodal facility and operational improvements. Where prevention is not possible, provide mitigation to reduce crash severity and propose future solutions to further reduce exposure.

1100.03 Complete Streets (New Section 2023)

Projects with Complete Streets are designed and operated to promote use and mobility for all users, including pedestrians, bicyclists, or transit riders. Complete Streets prioritizes more comfortable and equitable, context sensitive network connectivity for all roadway users through close coordination with our local partners and stakeholders. This is aligned with WSDOT's policy and commitment to develop and maintain an interconnected and integrated multimodal transportation system that provides all Washington travelers with reasonably safe, sustainable, and equitable access. A project is determined to have complete streets need, and may incorporate complete streets elements, when identified through a screening process (see Section 1103.03(3)).

1100.03(1) Goals and Objectives (New Section 2023)

WSDOT complete streets designs are developed in cooperation with the affected community through community engagement to accomplish the following:

- Address unique Complete Streets concerns of overburdened communities.
- Address active transportation network gaps that have been identified through a WSDOT or local plan and/or through community engagement.
- Provide bicycle and pedestrian facilities that offer the required Level of Traffic Stress and Route Directness Index (See Chapter 1101 and Section 1231.05).
- Provide a separation from vehicular traffic that involves a vertical element when it is determined that a posted speed must be maintained at greater than 30 mph (see Chapter 1510, Chapter 1520).
- Provide adequate access to transit, including specific improvements for bicycles and pedestrians in High-Capacity Transit areas (refer to the WSDOT HCT Improvements Guide for more information).

Evaluate the use of Transportation System Management and Operations (or TSMO) solutions first to address project related needs, before committing to capital or constructed improvements.

1100.03(2) Complete Streets Teams (New Section 2023)

Region Complete Streets (or CS) Teams provide multidisciplinary, subject matter expertise input throughout project development of Complete Streets strategies and designs through their participation in planning, scoping, pre-design, design phases. CS Teams bring together staff with active transportation expertise and other knowledge relevant to complete streets from disciplines that may include, but are not limited to, region planning, public transportation, active transportation, transportation operations, transportation safety, engineering services/project development, maintenance, programming, construction, and communications. WSDOT Headquarters (HQ) staff with appropriate expertise may be called upon to supplement region teams as needed.

Region CS Teams have specific responsibilities when working as members of a project advisory team (see Section 1100.04(2))

1100.03(3) Project Screening (New Section 2023)

Complete streets requirements are normally determined during a screening process that takes place in advance of project design or pre-design. New projects of all types with a total project cost of $500,000 or more are subject to this screening process to determine whether the project will be designed and developed as a complete street or deferred in alignment with established processes.

This screening process accounts for whether projects are in incorporated cities, in other designated population centers (See WSDOT Population Centers Map) where active transportation gaps have been identified in WSDOT or local plans, or in population centers that are overburdened communities, designating those projects for complete streets design unless a documented justification to defer is approved by the Region Administrator or designee (see Section 1104.05. Note that complete streets screening also applies to projects on state limited access highways, on city streets that are not designated as state highway that pass through a state limited access facility (e.g., overpasses and underpasses), and on state routes within counties.

1100.03(4) Project Organization (New Section 2023)

Once a project has met the requirements of the screening process described above, that project incorporates a Complete Streets need into the design process per Section 1101.03 unless otherwise deferred by the Regional Administrator or designee. If Complete Streets needs are incorporated into a project, a Basis of Design is developed per Section 1100.05(1) unless approved by the ASDE.

Complete streets projects generally proceed using the process laid out in this chapter and the chapters that follow. Any differences in process or other requirements compared to other project types are called out in the appropriate guidance sections.

1100.04 Practical Design

Practical design is the design phase component of practical solutions, addressing the transportation-related need that's identified or evolves during the planning, scoping or design phase of a project. Practical design is data driven, employing performance metrics to seek low-cost approaches and efficiencies in expanding and operating the multimodal transportation system to reduce travel demand and the need for building costly new infrastructure that are identified in collaboration with other agencies, communities, and stakeholders. The objective is to identify low-cost solutions that meet the need(s), while considering benefits to the system as a whole and the role of incremental solutions as a way to address uncertainties identified in future scenarios.

The Basis of Design (BOD) is a template for the process WSDOT uses to document the practical design approach and may be employed during the project scoping, pre-design, or design phase.

The process consists of the following seven steps:

1. Assemble a project advisory team as needed (see Section 1100.04(2).
2. Clearly identify the baseline need. Define it in terms of performance, contributing factors, and underlying reasons for the baseline need (see Chapter 1101).
3. Identify the land use and transportation context (which includes environmental use and constraints) for the location (see Chapter 1102).
4. Select design controls compatible with the context (see Chapter 1103).
5. Formulate and evaluate potential alternatives, including TSMO strategies, that resolve the baseline need for the selected context and design controls (see Chapter 1104).
6. Select design elements that will be included in the alternatives (see Chapter 1105).
7. Determine design element dimensions consistent with performance needs, context, and design controls (see Chapter 1106).

See Section 1100.05(1) for more information about the BOD.

1100.04(1) Community Engagement

WSDOT staff engages the community affected by a project in order to inform decision-making, strengthen partnerships, increase credibility, and drive priorities. Community input informs the project development process from planning to design.

Engaging with the community helps us more fully understand:

- Performance issues and gaps
- Context identity
- Local environmental issues
- Modal priorities and needs

Refer to Chapter 210 Public Engagement and the *WSDOT Community Engagement Plan* for more information, and document the findings of community engagement efforts (see Section 1100.05(5)).

1100.04(2) Project and Advisory Teams

Collaborative decisions contribute to more successful delivery of the project. Engage external and internal stakeholders providing consent-based outcomes early in project development.

Once a Project Engineer and Project Team have been identified to lead the project development, an Advisory Team is convened by them with the appropriate subject matter expertise to inform design decision-making. In the case of a Complete Streets project, also consult region Complete Streets Team.

1100.04(3) Need and Performance Identification

The need for the project is the primary reason the project has been programmed at the location. Determine performance metrics and targets based on an assessment of this project's specific need, and other contextual needs developed through external partner and community engagement. Perform a contributing factors analysis that refines the identified need so more precise performance gaps and metrics can be identified. Include the specified baseline needs and the metrics associated with Complete Streets when applicable (see Chapter 1101).

Refer to Chapter 1101 and the Performance Based Design guidance document for more information: www.wsdot.wa.gov/publications/fulltext/design/ASDE/Practical_Design.pdf

1100.04(4) Context Determination

Context determination refers to the characteristics, activities, and functions within a geographical area. WSDOT's context determination process involves two interrelated topics: land use and transportation, referencing both the existing and future conditions. Chapter 1102 provides guidance for determining context.

1100.04(5) Design Control Selection

Design controls provide fundamental constraints for highway design. Five design controls are used to help guide design decisions:

- Design Year
- Modal Priority (except for Complete Streets projects)
- Access Control
- Design Speed
- Terrain Classification

Chapter 1103 presents guidance related to choosing design controls.

1100.04(6) Alternative Formulation and Evaluation

The goal during the design phase is to carry out the scope identified from pre-design or develop a solution that addresses the baseline need at the lowest cost. Other known or identified needs, termed "contextual needs", can be addressed in these solutions as well. Chapter 1101 provides a discussion on baseline and contextual needs, and Chapter 1104 discusses using these needs to develop and evaluate alternatives, as well as the role of the CS Team in alternatives development for Complete Streets.

When formulating solutions, provide alternatives that employ~~s~~ lower-cost approaches such as Transportation Systems Management and Operations (or TSMO). TSMO alternatives will address all or part of the baseline need and provide efficiencies that benefit multimodal transportation, reduce vehicle travel demand, while reducing the need for building costly new infrastructure.

In some cases, work performed during planning will identify strategies that can help guide the development of TSMO alternative(s).

The Alternative Strategies and Solutions subsection of the Guidance Documents discusses primary TSMO strategies and examples of solutions within those strategies.

Direct link to the Design Support Webpage

Direct link to the Guidance Documents

Direct link to Transportation Systems Management and Operations

1100.04(7) Design Element Selection and Dimensions

The selection of design elements is based entirely on the alternative selected to address the baseline need while balancing performance trade-offs. Chapter 1105 provides instruction for design element selection. Chapter 1106 provides information related to choosing dimensions for design elements.

1100.05 Documentation Tools

Basis of Design (BOD), Basis of Estimate (BOE), Design Parameter Sheets, and Alternative Comparison Tables are all documentation tools used to record decisions and analyses needed in development of a solution that is consistent with WSDOT's practical design approach. The tools can be found at: Design guidance & support | WSDOT (wa.gov)

1100.05(1) Basis of Design

The BOD organizes information around the practical design procedural steps (see Section 1100.04) necessary to support WSDOT's practical design approach. It provides a template for documenting each step in the process. The BOD includes the following information and sections:

- Planning Document Summary
- General Project Information
- Section 1 – Project Needs
- Section 2 – Context
- Section 3 – Design Controls
- Section 4 – Alternatives Analysis
- Section 5 – Design Element Selection

Exhibit 1100-1 shows the major activities associated with WSDOT's practical design approach and corresponding Design Manual chapters and Basis of Design sections.

Start compiling the BOD as early as possible. During planning or scoping, a BOD may be only partially completed. Information documented on the BOD provides an opportunity for greater consistency between strategies developed in planning and solutions developed in scoping and design. Information documented in the BOD comes through use of consent-based recommendations (see Section 1100.04(2)).

Contact the region Program Management regarding the need to initiate a BOD during the project-scoping phase. Since the BOD is ultimately a document that supports design decisions, the approval of a BOD, which ideally takes place at 30% design level or earlier, is a part of, and included in, the project Design Approval process (see Chapter 300). Note that if a BOD has been prepared for a project and no design elements were changed, ASDE approval of the BOD is not required.

Basis of Design: https://wsdot.wa.gov/engineering-standards/design-topics/design-tools-and-support#Tools

1100.05(1)(a) Basis of Design Exemptions

See Section 1100.04 for guidance regarding when a BOD is required for scoping projects. For design-phase projects, a BOD supports design decisions and is required on all projects where one or more design elements are changed (see Chapter 1105).

The need for a Basis of Design (BOD) may be waived, if the only design elements changed by a project are listed below, or the changed elements are described and documented in an approved intersection control evaluation (ICE) or crash analysis report (CAR), with approval of the Assistant State Design Engineer (ASDE).

- ADA
- Clear Zone
- Roadside Safety Hardware
- Signing
- Delineation
- Illumination
- Intelligent Transportation System (ITS)
- Signal Hardware

In any request from the ASDE for an exemption, describe how the circumstances presented by the project make a BOD unnecessary. Only ICE or CAR documents that describe the project need(s), alternatives considered, and performance tradeoffs used in the alternative selection will be considered documentation suitable to support a BOD exemption. Each request is evaluated on a case-by-case basis.

Note that if the project is a preservation program project, a Basis of Design is not required if the only design elements changed are listed in Chapter 1120, and the criteria/guidance provided in Chapter 1120 is followed. This exemption does not require approval and is documented in the DDP.

1100.05(2) Basis of Estimate

A Basis of Estimate is required for all project estimates and is updated throughout all phases of project development. Refer to the *Cost Estimating Manual for WSDOT Projects* for additional information on estimating and the Basis of Estimate.

1100.05(3) Alternatives Comparison Table

The Alternative Comparison Table (ACT) provides solutions evaluated in accordance with WSDOT's Practical Solutions approach. This table allows comparison of alternatives to identify the optimum solution. The table enables discussions of performance trade-offs. The Alternative Comparison Table is incorporated in Section 4 of the BOD form.

1100.05(4) Design Parameter Sheets

When a Basis of Design has been completed, prepare Design Parameter Sheets that document the dimensions selected for the various design elements chosen, and as also noted in Section 5 of the Basis of Design. Design Parameter Sheet template: https://wsdot.wa.gov/engineering-standards/design-topics/design-tools-and-support

1100.05(5) Documenting Community Engagement

Community engagement is a fundamental component of WSDOT's Practical Solutions strategy, and key to practical design implementation. Community engagement will be consistent with the *WSDOT Community Engagement Plan* (see www.wsdot.wa.gov/planning/) Community engagement for Complete Streets is outlined in Chapter 1104.

Document community engagement for all projects.

1100.06 References

1100.06(1) Federal/State Directives, Laws, and Codes

Revised Code of Washington (RCW) 47.04.280 – Transportation system policy goals

Revised Code of Washington (RCW) 47.05.010 – The statement of purpose for priority programming of transportation projects

Secretary's Executive Order 1090.01 – Advancing Practical Solutions

Exhibit 1100-1 Basis of Design Flowchart