Chapter 1 General Information Contents

Chapter 1 General Information

1.1 Manual Description

1.1.1 Purpose

The *Bridge Design Manual* (BDM) sets the standard for bridge and structure designs within the Washington State Department of Transportation's (WSDOT) right of way. This manual outlines WSDOT design details and methods, incorporating standard practices that are based on years of experience. The BDM also identifies where WSDOT standard of practices differ from the AASHTO specifications.

The design details and design methods of the BDM shall be used in the development of any bridge or structure project within the WSDOT right of way. Adherence to the BDM is expected for all bridge or structural projects that are located within the WSDOT right of way.

The *Bridge Design Manual* is a dynamic document, which constantly changes because of the creativity and innovative skills of our bridge designers and structural detailers. It is not intended as the sole reference for the design of unusual structures or to inhibit the designer in the exercise of engineering judgment. The information, guidance, and references contained herein are not intended as a substitute for experience, sound engineering judgment, and common sense.

1.1.1.A Use of *Bridge Design Manual* on Design-Build and Progressive Design-Build Projects

When a reference is made to "*Bridge Design Manual*" or "BDM" in the Design-Build Contract or Mandatory Standards, the Design-Builder shall proceed as follows:

- Refer first to *Bridge Design Manual* Chapter 15 "Structural Design Requirements for Design-Build Contracts". All requirements in *Bridge Design Manual* Chapter 15 are Contract requirements.
- If the Design-Build Contract or a Mandatory Standard references a specific section of the *Bridge Design Manual*, the Design-Builder shall review the applicable portions of *Bridge Design Manual* Chapter 15. If there are discrepancies between *Bridge Design Manual* Chapter 15 and the specific section reference, Chapter 15 shall have contractual precedence.
- All other portions of Chapters 1-14 of the *Bridge Design Manual* shall be considered a Reference Document, except for this section (BDM 1.1.1.A) or when referenced to from the Design Build Contract, Mandatory Standard or *Bridge Design Manual* Chapter 15.

1.1.2 Specifications

This manual and the following AASHTO Specifications are the basic documents used to design highway bridges and structures in Washington State:

- AASHTO *LRFD Bridge Design Specifications* (LRFD-BDS)
- AASHTO *Guide Specifications for LRFD Seismic Bridge Design* (LRFD-SGS)

The *Bridge Design Manual* is not intended to duplicate the AASHTO Specifications. This manual supplements the AASHTO Specifications by providing additional direction, design aides, examples, and information on office practice. The *Bridge Design Manual* takes precedence where conflict exists with the AASHTO Specifications. The State Bridge Design Engineer will provide guidance as necessary.

The prescriptive terms used in the BDM are defined as follows:

- The term “shall” indicates that a provision in the BDM is mandatory.
- The term “should” indicates a strong preference for a given criteria.
- The term “may” indicates a criterion that is usable, but other local and suitable documented, verified, and approved criterion may also be used in a manner consistent with the LRFD approach to bridge design.
- The term “recommended” is used to give guidance based on past experience.

References are listed at the end of each chapter.

1.1.3 Format

1.1.3.A General

The *Bridge Design Manual* consists of one volume with each chapter organized as follows:

Criteria or other information (white paper when printed)

Appendix A (yellow paper when printed) Design Aids

Appendix B (salmon paper when printed) Design Examples

1.1.3.B Chapters

1. General Information
2. Preliminary Design
3. Loads
4. Seismic Design and Retrofit
5. Concrete Structures
6. Structural Steel
7. Substructure Design
8. Walls and Buried Structures
9. Bearings and Expansion Joints
10. Signs, Barriers, Approach Slabs, Utilities

11. Detailing Practice
12. Quantities, Construction Costs, and Specifications
13. Bridge Load Rating
14. Accelerated and Innovative Bridge Construction
15. Structural Design Requirements For Design-Build Contracts

1.1.3.C Numbering System

1.1.3.C.1 *Numbering of Sections*

The numbering system for the criteria consists of a set of numbers followed by letters as required to designate individual subjects by chapter, section, and subsection.

Example:

Chapter 5 Concrete Structures (Chapter)

5.3 Reinforced Concrete Box Girder Bridges (Section)

5.3.2 Reinforcement (Subsection)

5.3.2.A Top Slab Reinforcement

1. Near Center of Span

A. Transverse Reinforcement

1.1.3.C.2 *Numbering of Sheets*

Each chapter starts a new page numbering sequence. The page numbers are located in the lower outside corners and begin with the chapter number, followed by the sequential page number.

Example: 5-1, 5-2, etc.

1.1.3.C.3 *Appendices*

Appendices are included to provide the designer with design aids (Appendix A) and examples (Appendix B). Design aids are generally standard in nature, whereas examples are modified to meet specific job requirements.

An appendix is numbered using the chapter followed by section number and then a hyphen and the letter of the appendix followed by consecutive numbers.

Example: 5.3-A1 (Box Girder Bridges) designates a design aid required or useful to accomplish the work described in Chapter 5, Section 3.

1.1.3.C.4 *Numbering of Tables and Figures*

Tables and figures shall be numbered using the chapter, section, subsection in which they are located, and then a hyphen followed by consecutive numbers.

Example: Figure 5.3.2-1 is the first figure found in Chapter 5, section 3, subsection 2.

1.1.4 Revisions

Revisions to this manual are related to emerging concepts, new state or federal legislation, and comments forwarded to the Bridge Design Office. Some revisions are simple spot changes, while others are major chapter rewrites. The current version of the manual is available online at: https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/bridge-design-manual-lrfd.

All pages include a revision number and publication date. When a page is revised, the revision number and publication date are revised. Revisions shall be clearly indicated in the text.

The process outlined below is followed for *Bridge Design Manual* revisions:

1. Revisions are prepared, checked and coordinated with chapter authors. This is completed through a share drive location with access privileges limited to Chapter Authors and SMEs only. The Chapter Author has final quality control responsibility.
2. Revisions are submitted to the State Bridge and Structures Engineer and the FHWA WA Division Bridge Engineer for approval. However, comments related to grammar and clarity can be sent directly to the BDM Coordinator without State Bridge and Structures Engineer or the FHWA approval.
3. After approval from the State Bridge and Structures Engineer and FHWA, the BDM Coordinator works with WSDOT Engineering Publications to revise the manual.
4. Revised pages from Engineering Publications are checked for accuracy by the Chapter Authors and corrected if necessary.
5. Engineering Publications will post the complete manual and revision at: https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/bridge-design-manual-lrfd
6. Engineering Publications will coordinate electronic and hard copy distributions.

1.1.5 Design Memorandums

The State Bridge Design Engineer may issue Design Memorandums as interim updates to this manual. Active Design Memorandums supersede the *Bridge Design Manual*. Active Design Memorandums are available at: https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/bridge-design-manual-lrfd/active-bridge-design-manual-memorandums.

When a design memorandum is issued, notice will be sent via GovDelivery. To sign up for GovDelivery notifications, register an email address at: https://public.govdelivery.com/accounts/WADOT/subscriber/new?topic_id=WADOT_740.

Check for active Design Memorandums on a regular basis.

1.2 Bridge and Structures Office Organization

1.2.1 General

The primary responsibilities of the Bridge and Structures Office are to:

- Provides structural engineering services for WSDOT.
- Provides technical advice and assistance to other governmental agencies and consultants on such matters.

The *Design Manual* states the following:

> Bridge design is the responsibility of the Bridge and Structures Office in WSDOT Headquarters. Any design authorized at the Region level is subject to review and approval by the Bridge and Structures Office.

1.2.2 Organizational Elements of the Bridge Office

1.2.2.A State Bridge and Structures Engineer

The State Bridge and Structures Engineer is responsible for structural engineering services for the department and manages staff and programs for structural design, contract plan preparation, inspections and assessments of existing bridges.

1.2.2.B State Bridge Design Engineer

The State Bridge Design Engineer is directly responsible to the Bridge and Structures Engineer for structural design and review, and advises other divisions and agencies on such matters.

1.2.2.B.1 *Structural Design Units*

The Structural Design Units are responsible for the design of bridges and other structures. Design includes preparation of contract plans. The units provide special design studies, develop design criteria, check shop plans, and review designs submitted by consultants. Frequently, the State Bridge Design Engineer assigns the units the responsibility for preparing preliminary bridge plans and other unscheduled work through the oversight of the Design Unit Manager.

The Design Unit Manager provides day-to-day leadership, project workforce planning, mentoring, and supervision for the design unit. The Design Unit Manager is assisted by one or more Assistant Supervisors who directly supervise a portion of the group and performs other tasks as delegated by the Design Unit Manager. Organization and job assignments within the unit are flexible and depend on projects underway at any particular time as well as the qualifications and experience level of individuals. The primary objective of the design units is to produce contract documents for bridges and structures within scope, schedule and budget. This involves designing, checking, reviewing, and detailing in an efficient and timely manner.

Structural Design Units include Specialists with particular areas of expertise including concrete, steel, seismic/foundation, expansion joints/bearings, and floating bridge and special structures. Mechanical, Electrical, and Operation of moveable bridges and special structures are managed by the Bridge Preservation Office staff. The Specialists act as a resource for the Bridge Office in their specialty and are responsible for keeping up-to-date on current AASHTO criteria, new design concepts and products, technical publications, construction and maintenance issues, and are the primary points of contact for industry representatives.

The Structural Design units are also responsible for the design and preparation of contract plans for modifications to bridges in service. These include bridge rail replacement, deck repair, seismic retrofits, emergency repairs when bridges are damaged by vehicle or ship collision or natural phenomenon, and expansion joint and drainage retrofits. They review proposed plans of utility attachments to existing bridges.

1.2.2.B.2 *Bridge Projects Unit*

The Bridge Projects Unit is responsible for project scoping, scoping-level cost estimates, bridge preliminary plans, bridge specifications and estimates, bridge design scheduling, consultant liaison activities, construction support, bridge architecture practices, and Bridge Office design-build practices. The Bridge Projects Unit Manager provides leadership, mentoring and supervision for staff efforts as described below:

1. The Bridge Projects Unit Manager is responsible for assigning support of Cost Risk Assessment's, Cost Estimate Validation Process, and workshop support.
2. The Bridge Projects Support Engineer directs preliminary design work, specification, cost estimates preparation, and project scoping.
3. The Preliminary Plan Engineers are responsible for bridge project planning from initial scoping to design type, size, and location (TSL) studies and reports. They are responsible for preliminary plan preparation of bridge and walls including assembly and analysis of site data, preliminary structural analysis, cost analysis, determination of structure type, and drawing preparation. They also check preliminary plans prepared by others, review highway project environmental documents and design reports, and prepare U. S. Coast Guard Permits.
4. The Specifications and Estimate (S&E) Engineers develop and maintain construction specifications and cost estimates for bridge projects. They also develop specifications and cost estimates for bridge contracts prepared by consultants and other government agencies, which are administered by WSDOT. They assemble and review the completed bridge PS&E before submittal to the Regions. They also coordinate the PS&E preparation with the Regions and maintain bridge construction cost records.

The Consultant Liaison Engineer prepares bridge consultant agreements and coordinates consultant PS&E development activities with those of the Bridge Office. The Consultant Liaison Engineer negotiates bridge design contracts with consultants.

The Construction Support Unit Engineers are responsible for checking the contractor's falsework, shoring, and forming plans. Shop plan review and approval are coordinated with the design units. Actual check of the shop plans is done in the design unit. Field requests for plan changes come through this office for a recommendation as to approval.

The State Bridge and Structures Architect is responsible for reviewing and approving bridge preliminary plans, retaining walls, preparing renderings, coordinating aesthetic activities with Regions (i.e. suggesting corridor themes and approving public art), and other duties to improve the aesthetics of our bridges and structures. The State Bridge and Structures Architect works closely with bridge office and region staff. During the design phase, designers should get the Architect's approval for any changes to architectural details shown on the approved preliminary plan.

The Scheduling Engineer monitors the design work schedule for the Bridge and Structures Office, updates the Bridge Design Schedule (BDS) and maintains records of bridge contract costs. Other duties include coordinating progress reports to Regions by the Unit Supervisors and S&E Engineers through the Project Delivery Information System (PDIS).

The Bridge Projects Unit is responsible for developing Design-Build policy within the Bridge Office, including updates for the RFP Template (owned by HQ Construction).

In addition, the Bridge Projects Unit is responsible for updating the *Bridge Design Manual*. The unit coordinates changes to the *Standard Specifications* and facilitates updates or revisions to WSDOT Bridge Office design standards.

1.2.2.B.3 *Bridge Design Technology Unit Manager*

The Bridge Design Technology Unit Manager is the statewide technical expert for structural engineering computing technology and manages the Bridge Design Technology Unit. This unit is responsible for Bridge Design Office IT matters, computer resource planning and implementation, support of computer aided design applications, liaison with Information Technology Division (ITD) and the statewide Computer Automated Engineering (CAE) group, liaison with WSDOT Communications office for matters related to the Bridges and Structures content on the agency web site, operation support of structural analysis, design, load rating, and contract plan preparation, and structural engineering software development activities.

1.2.2.C State Bridge Preservation Engineer

The State Bridge Preservation Engineer is the Statewide Program Manager of the bridge and tunnel inspection programs. The position ensures that WSDOT fulfills its federal responsibilities for inspection and load rating. It directs activities and develops programs to assure the structural and functional integrity of all state bridges in service. The Bridge Preservation Engineer directs emergency response activities when bridges are damaged.

1.2.2.C.1 *Bridge Preservation Office (BPO)*

The Bridge Preservation Office is responsible for planning and implementing an inspection program for the more than 3,200 fixed and movable state highway bridges, sign bridges and cantilever sign structures. In addition, BPO provides inspection services on some local agency bridges and on the state's ferry terminals. All inspections are conducted in accordance with the National Bridge Inspection Standards (NBIS).

BPO maintains the computerized Washington State Bridge Inventory System (WSBIS) of current information on more than 7,300 state, county, and city bridges in accordance with the NBIS. This includes load ratings for all bridges. BPO prepares a *Bridge List* of the state's bridges, which is published every two years, maintains the intranet-based Bridge Engineering Information System (BEIST), and prepares the annual Recommended Bridge Repair List (RBRL) based on the latest inspection reports for state owned structures.

BPO is responsible for the bridge load rating and scour programs. It provides damage assessments and emergency response services when bridges are damaged because of vehicle or ship collision or natural phenomenon such as: floods, wind, or earthquakes.

1.2.2.D Bridge Asset Management Engineer

The Bridge Asset Management Engineer is responsible for the program development, planning and monitoring of all statewide bridge program activities. These include Structures Preservation - P2 program funded bridge replacements and rehabilitation, bridge deck protection, major bridge repair, and bridge painting.

The Bridge Asset Management Engineer supervises the Bridge Deck Management Engineer, and also helps to program Seismic and Scour Remediation projects for WSDOT.

In addition, the Bridge Asset Management Engineer manages the bridge deck protection, deck testing and the bridge research programs. The Bridge Asset Management Engineer is responsible for the planning, development, coordination, and implementation of new programs (e.g., Seismic Retrofit and Preventative Maintenance), experimental feature projects, new product evaluation, and technology transfer.

1.2.2.E Staff Support

Staff Support is responsible for many support functions, such as: scanning, timekeeping, payroll, receptionist, vehicle management, mail, inventory management, and other duties requested by the Bridge and Structures Engineer. This unit also maintains office supplies and provides other services.

1.2.2.F Office Administrator

The Office Administrator is responsible for coordinating personnel actions, updating the organizational chart, out-of-state travel requests, and other duties requested by the Bridge and Structures Engineer. The Office Administrator also handles logistical support, office and building maintenance issues.

1.2.3 Unit Responsibilities and Expertise

The following is an updated summary of the structural design, review and plan preparation responsibilities/expertise within the Bridge Design Section. Contact the Unit Manager for the name of the appropriate staff expert for the needed specialty. The Bridge Design Office workflow is shown in Appendix 1.2-A1.

Unit Supervisor	Responsibility/Expertise
Brian Aldrich **Design Unit Manager**	Concrete Design Technical Support Bridge Paving Design Bridge Traffic Barriers and Rail Retrofits Bridge and Structures Design
Richard Zeldenrust **Design Unit Manager**	Overhead and Bridge-Mounted Sign Structures Light Standard & Traffic Signal Supports Repairs to Damaged Bridges Structural Steel Technical Support Seismic/Foundation Design Technical Support Emergency Slide Repairs Retaining Walls (including Structural Earth, Soldier Pile and Tie-Back, Geosynthetic, and Soil Nail) Pre-Approval of Retaining Wall Systems Noise Barrier Walls Bearing and Expansion Joint Technical Support Bridge and Structures Design
Michael Rosa **Bridge Projects Unit Manager**	Special Provisions, Bridge Preliminary Plans, Cost Estimates, *Bridge Design Manual*, Coast Guard Permits Bridge Scheduling Construction Support Consultant Liaison Architectural Guidance/Oversight for WSDOT Bridges Renderings/Graphics for Architectural Features Public Outreach Through Context-Sensitive Solutions framework
Craig Boone **Design Unit Manager**	Floating Bridge Design and Retrofit Anchor Cable Replacements Structural Rehab of Movable Bridges Support for Mega-Projects and Sound Transit Projects
Richard Brice **Bridge Design Technology Unit Supervisor**	Bridge Engineering Software, Bridge Design Office IT matters, and CAD

1.3 Roles, Responsibilities and Procedures

1.3.1 General

1.3.1.A Requirements for Engineering

A registered professional engineer licensed in the state of Washington or a registered structural engineer licensed in the state of Washington shall have responsible charge over all engineering. Section 1.3.2.D of this manual stipulates when a structural engineer is required as well as when a registered professional engineer can suffice.

1.3.2 General Design Procedures

1.3.2.A PS&E Prepared by WSDOT Bridge and Structures Office

1.3.2.A.1 *Design Team*

The design team usually consists of the Designer(s), Checker(s), Structural Detailer(s), Bridge & Structures Architect, and a Specification and Estimate Engineer, who are responsible for preparing a set of contract documents on or before the scheduled due date(s) and within the budget allocated for the project. On large projects, the Design Unit Manager may designate a designer to be a Project Coordinator with additional duties, such as: assisting the Design Unit Manager in communicating with the Region, coordinating and communicating with the State Geotechnical Office, and monitoring the activities of the design team.

In general, it is a good practice to have some experienced designers on every design team. All design team members should have the opportunity to provide input to maximize the quality of the design plans.

1.3.2.A.2 *Designer Responsibility*

The designer is responsible for the content of the contract plan sheets, including structural analysis, completeness and correctness. A good set of example plans, which is representative of the bridge type, is indispensable as an aid to less experienced designers and detailers.

During the design phase of a project, the designer will need to communicate frequently with the Design Unit Manager and other stakeholders. This includes acquiring, finalizing or revising roadway geometrics, soil reports, hydraulics recommendations, and utility requirements. Constructability issues may also require that the designer communicate with the Region or Construction Office. The designer may have to organize face-to-face meetings to resolve constructability issues early in the design phase. The bridge plans must be coordinated with the PS&E packages produced concurrently by the Region.

The designer shall advise the Design Unit Manager as soon as possible of any scope and project cost increases and the reasons for the increases. The Design Unit Manager will then notify the Region project office if the delivery schedule will have to be changed. If Region concurs with a change in the delivery date, the Design Unit Manager shall notify the Bridge Scheduling Engineer of the revised delivery dates.

The designer or Project Coordinator is responsible for project planning and development which involves the following:

1. Determines scope of work, identifies tasks and plans order of work.
2. Prepare design criteria that are included in the front of the design calculations. Compares tasks with BDM office practice and AASHTO *Bridge Design Specifications*.
   - A. Insures that design guidelines are sufficient.
     - i. Provides justification for any deviation from LRFD-BDS, LRFD-SGS, or the BDM.
     - ii. Provides justification for design approach.
     - iii. Provides justification for any deviation from office practices regarding design and details.
     - iv. Other differences.
   - B. Meet with the Region design staff and other project stakeholders early in the design process to resolve as many issues as possible before proceeding with final design and detailing.
   - C. Identify coordination needs with other designers, units, and offices.
   - D. Early in the project, the bridge sheet numbering system should be coordinated with the Region design staff. For projects with multiple bridges, each set of bridge sheets should have a unique set of bridge sheet numbers.
   - E. At least monthly or as directed by the Design Unit Manager:
     - i. Update Project Schedule and List of Sheets.
     - ii. Estimate percent complete.
     - iii. Estimate time to complete.
     - iv. Work with Design Unit Manager to adjust resources, if necessary.
   - F. Develop preliminary quantities for all cost estimates after the Preliminary Plan stage.
   - G. Near end of project:
     - i. Develop quantities, *Not Included in Bridge Quantity List, and Special Provisions Checklist* that are to be turned in with the plans. (See Section 12.4.4).
     - ii. Prepare the Bar List.
     - iii. Coordinate all final changes, including review comments received from the Bridge Specifications and Estimates Engineer.
     - iv. Meet with Region design staff and other project stakeholders at the constructability review/round table review meetings to address final project coordination issues.

The designer should inform the Design Unit Manager of any areas of the design, which should receive special attention during checking and review.

The design and check calculations are prepared by the designer and checker in accordance with Section 1.3.3 and become a very important record document. Design calculations will be a reference document during the construction of the structure and throughout the life of the structure. It is critical that the design calculations be user friendly. The design calculations shall be well organized, clear, properly referenced, and

include numbered pages along with a table of contents. The design and check calculation shall be assembled and archived in accordance with Section 1.3.3 and Section 1.3.8. The PDF calculations files shall be stamped, signed, and dated by a registered professional Engineer in the State of Washington. Computer data files shall be saved for use during construction, in the event that changed conditions arise.

The designer is also responsible for providing construction support and may be assigned to serve as a Bridge Technical Advisor. See Section 1.3.6.

The designer and Bridge Technical Advisor (BTA) shall review as-builts for accuracy prior to the Project Engineer submitting them to HQ Engineering Records in accordance with Section 1.3.6.B.3.

1.3.2.A.3 *Structural Detailer Responsibility*

The structural detailer is responsible for the quality and consistency of the contract plan sheets. The structural detailer shall ensure that the Bridge Office drafting standards as explained in Chapter 11 are upheld.

1. Refer to Chapter 11, for detailing practices.
2. Provide necessary and adequate information to ensure the contract plans are accurate, complete, and readable.
3. Detail plan sheets in a consistent manner and follow accepted detailing practices.
4. Check plans for geometry, reinforcing steel congestion, consistency, and verify control dimensions.
5. Check for proper grammar and spelling.
6. On multiple bridge contracts, work with the Designer/Project Coordinator to ensure that the structural detailing of all bridges within the contract shall be coordinated to maximize consistency of detailing from bridge to bridge. Extra effort will be required to ensure uniformity of details, particularly if multiple design units and/or consultants are involved in preparing bridge plans.
7. Maintain an ongoing understanding of bridge construction techniques and practices.

1.3.2.A.4 *Specialist Responsibility*

The primary responsibility of the specialist is to act as a knowledge resource for the Bridge and Structures Office, WSDOT, other governmental agencies and consultants. Designers are encouraged to consult specialists for complex projects early in the design process. Design Unit Managers overseeing a design project should actively identify any complex or unusual features, early in the design process, and encourage the designers involved to seek input from the suitable Specialist. The Specialists maintain an active knowledge of their specialty area, along with a current file of products and design procedures. The Specialists maintain industry contacts. Specialists provide training in their area of expertise.

Specialists are expected to remain engaged with the design efforts being carried out in the office related to their specialty. At the discretion of the Design Unit Manager, the Specialists may be requested to review, comment on and initial plans in their area of expertise prepared by other designers. Specialists are expected to review selected design work for consistency with other WSDOT projects, and for adherence to current office practice and current industry practice.

Specialists assist the Bridge and Structures Engineer in reviewing and voting on amendments to AASHTO specifications.

Specialists are responsible for keeping their respective chapters of the *Bridge Design Manual* up to date.

The Specialists act as Assistant Design Unit Managers within their unit. They are responsible for day-to-day supervision, including timesheet and evaluation responsibilities. The Specialists are also relied upon to assist the Design Unit Manager in allocating staff, and completing engineering and detailing staffing projections.

A secondary responsibility of the Bearings and Joints, Seismic/Substructure, Concrete and Steel Specialist is to serve as Design Unit Manager when the Design Unit Manager is absent.

Sign Structure design, Wall design, and Traffic Barrier & Rail design are three specialty areas where design and review work has traditionally been directed to dedicated staff in each of the two main design groups within the Bridge Design Office. Design guidance or review requests for unusual or unique projects involving these three specialty areas should be directed to the applicable Design Unit Manager for design or review.

1.3.2.A.5 *Specification and Estimating Engineer Responsibilities*

The S&E Engineer is responsible for compiling the PS&E package for bridge and/or related highway structural components. This PS&E package includes Special Provisions (Bridge Special Provisions or BSPs and General Special Provisions or GSPs as appropriate), construction cost estimate, construction working day schedule, test hole boring logs and other appendices as appropriate, and the design plan package.

The S&E Engineer is also responsible for soliciting, receiving, compiling and turning over to the designer all review comments received after the Bridge Plans turn-in. It is imperative that all review comments are channeled through the S&E Engineer to ensure consistency between the final bridge plans, specifications and estimate.

For a detailed description of the S&E Engineer's responsibilities, see Section 12.4.

1.3.2.A.6 *Design Unit Manager Responsibility*

1. The Design Unit Manager is responsible to the State Bridge Design Engineer for the timely completion and quality of the bridge plans.
2. The Design Unit Manager works closely with the Project Coordinator and the design team (designer, checker, and structural detailer) during the design and plan preparation phases to help avoid major changes late in the design process. Activities during the course of design include:
   A. Evaluate the complexity of the project and the designer's skill and classification level to deliver the project in a timely manner. Determine both the degree of supervision necessary for the designer and the amount of checking required by the checker.
   B. Assist the design team in defining the scope of work, identifying the tasks to be accomplished and developing a project work plan.
   C. Make suitable staffing assignments and develop a design team time estimate to ensure that the project can be completed on time and within budget.

D. Review and approve design criteria before start of design.

E. Help lead designer conduct face-to-face project meetings, such as: project "kick-off" and "wrap-up" meetings with Region, geotechnical staff, bridge construction, and consultants to resolve outstanding issues.

F. Participate in coordinating, scheduling, and communicating with stakeholders, customers, and outside agencies relating to major structural design issues.

G. Facilitate resolution of major project design issues.

H. Assist the design team with planning, anticipating possible problems, collectively identifying solutions, and facilitating timely delivery of needed information, such as geometrics, hydraulics, foundation information, etc.

I. Interact with design team regularly to discuss progress, problems, schedule and budget, analysis techniques, constructability and design issues. Always encourage forward thinking, innovative ideas and suggestions for quality improvement.

J. Arrange for and provide the necessary resources, time and tools for the design team to do the job right the first time. Offer assistance to help resolve questions or problems.

K. Help document and disseminate information on special features and lessons learned for the benefit of others and future projects.

L. Mentor and train designers and detailers through the assignment of a variety of structure types.

3. The Design Unit Manager works closely with the design team during the plan review phase. Review efforts should concentrate on reviewing the completed plan details and design calculations for completeness and for agreement with office criteria and office practices. Review the following periodically and at the end of the project:

   A. Design Criteria

      - Seismic design methodology, acceleration coefficient ("A" value), and any seismic analysis assumptions.
      - Foundation report recommendations, selection of alternates.
      - Deviations from AASHTO, this manual and proper consideration of any applicable Design Memorandums.

   B. Design Time and Budget

   C. Facilitates resolution of issues beyond the authority of WSDOT Reviewer or Coordinator.

   D. Estimate time to complete the project. Plan resource allocation for completing the project to meet the scheduled Ad Date and budget. Monitor monthly time spent on the project.

      Plan and assign workforce to ensure a timely delivery of the project within the estimated time and budget. At monthly Design Unit Managers' scheduling meetings, notify the Bridge Project Support Engineer if a project is behind schedule.

   E. Advise the Region of any project scope creep and construction cost increases. As a minimum, use quarterly status reports to update Region on project progress.

F. Use appropriate computer scheduling software or other means to monitor time usage, to allocate resources, and to plan projects.

G. Review constructability issues. Are there any problems unique to the project?

H. When submitting advertisement ready contract documents for distribution, identify a primary and secondary Bridge Technical Advisor (BTA) who will support the project in accordance with the WSDOT *Construction Manual* Section GEN 1-00.11 "Bridge and Structures Office Support on Design- Bid-Build Projects During Construction" to the Bridge Construction Support Engineer.

1.3.2.A.7 *State Bridge Design Engineer's Responsibilities*

The State Bridge Design Engineer is the coach, mentor, and facilitator for the WSDOT Bridge Design Procedure. The leadership and support provided by this position is a major influence in assuring quality for structural designs performed by both WSDOT and consultants. The following summarizes the key responsibilities of the State Bridge Design Engineer:

1. Prior to the State Bridge Design Engineer stamping and signing any plans, he/she shall perform a structural/constructability review of the plans. This action is consistent with the "responsible charge" requirements of state laws relating to Professional Engineers.
2. Review and approve the Preliminary Bridge Plans. The primary focus for this responsibility is to assure that the most cost-effective and appropriate structure type is selected for a particular bridge site.
3. Review unique project special provisions and *Standard Specifications* modifications relating to structures.
4. Facilitate partnerships between WSDOT, consultants, Local agencies, and the construction industry stakeholders.
5. Encourage designer creativity and innovation through forward thinking.
6. Exercise leadership and direction for maintaining a progressive and up to date *Bridge Design Manual*.
7. Create an open and supportive office environment in which Design Section staff are empowered to do high quality structural design work.
8. Create professional growth opportunities through an office culture where learning is emphasized.
9. Encourage continuing professional development through training opportunities, attendance at seminars and conferences, formal education opportunities, and technical writing.

1.3.2.A.8 *Bridge Scheduling Engineer Responsibilities*

1. Update/maintain the bridge design schedule.
2. Assign non-WSDOT structural design work to a Design Unit for review.

1.3.2.A.9 *WSDOT Design Reviewer's or Coordinator's Responsibilities*

1. Early in the project, review consultant's design criteria, and standard details for consistency with WSDOT practices and other bridge designs in project.
2. Review the Preliminary Plan files in the Project Folder as prepared by the Preliminary Plan Engineer.
3. Identify resources needed to complete work.
4. Initiate a project start-up meeting with the Consultant to discuss design criteria, submittal schedule and expectations, and also to familiarize himself/herself with the Consultant's designers.
5. Reach agreement early in the design process regarding structural concepts and design methods to be used.
6. Identify who is responsible for what and when all intermediate constructability, Bridge Plans, and Bridge PS&E review submittals are to be made.
7. Monitor progress.
8. Facilitate communication, including face-to-face meetings.
9. Resolve differences.

1.3.2.B Consultant PS&E — Projects on WSDOT Right of Way

1.3.2.B.1 *WSDOT Consultant Liaison Engineer Responsibility*

The Consultant Liaison's responsibilities are described using the term Area Consultant Liaison (ACL) in the current version of the WSDOT *Consultant Services Manual*. The Consultant Liaison facilitates agreement management and provides contract support to Project Managers.

1.3.2.B.2 *WSDOT Project Manager Responsibility*

The Project Manager's responsibilities are described in the current version of the WSDOT *Consultant Services Manual*. The Project Manager monitors and controls the consultant's scope, schedule, and budget and provides structural review of the consultant's deliverables.

1.3.2.C Consultant PS&E — Projects on County and City Right of Way

Counties and cities frequently hire Consultants to design bridges. WSDOT Local Programs Office determines which projects are to be reviewed by the Bridge and Structures Office.

WSDOT Local Programs Office sends the PS&E to the Bridge Project Support unit for assignment when a review is required. The Bridge and Structures Office's Consultant Liaison Engineer is not involved.

A WSDOT Bridge and Structures Office Design Reviewer or Coordinator will be assigned to the project and will review the project as outlined for Consultant PS&E Projects on WSDOT Right of Way.

Plans with the reviewers' comments marked in red should be returned to the Bridge Project Support Unit. One set of plans will be returned to Local Programs Office.

The first review should be made of the Preliminary Plan followed later by review of the PS&E and design calculations. Comments are treated as advisory, although major structural issues must be addressed and corrected. An engineer from the county, city, or consultant may contact the reviewer to discuss the comments.

1.3.2.D Structural Engineering and Significant Structures

Structural engineering is recognized as a specialized branch of professional engineering. An engineer must be registered as a structural engineer in order to provide structural engineering services for significant structures (see RCW 18.43.040(1)(a)(iii) & (iv)). Structural Engineering license requirement for WSDOT bridges and structures shall meet the requirement of Section 1.4.3 A-7.

The practice of engineering is defined in RCW 18.43.020(8)(a). Structural engineering services for significant structures include but are not limited to practice of engineering on:

- Vertical and lateral load-resisting components of significant structures including but not limited to foundations, columns, walls, abutments, girders, beams, diaphragms, cross-bracing, floors, decks, bearings and expansion joints.
- Retaining walls and other structures adjacent to a significant structure, when the failure of the structure would affect the structural adequacy of the significant structure.

Structural engineering services for significant structures do not include:

- Practice of engineering on other structural elements of significant structures including railings, barriers, approach slabs, utility supports, and supports for miscellaneous appurtenances such as signs and luminaires. The licensed structural engineer will be responsible for designing the vertical and lateral load resisting components of the significant structure to safely resist loads from these elements.
- Engineering services of other civil disciplines, including geotechnical and hydraulic engineering services.
- Creation of specifications and estimates

Supervision of construction on significant structures for the purpose of assuring compliance with the contract requirements (see RCW 18.43.020(5)(a)) may be performed by a registered professional engineer who is not also a registered structural engineer if all changes requiring structural engineering services are referred to a registered structural engineer (WAC 196-27A-020(2)(f)).

1.3.3 Design/Check Calculation File

1.3.3.A File Format and Naming

The official Design/Check Calculation File for a structure shall be in electronic PDF format and may consist of multiple PDF files. When a project consists of multiple structures, each structure shall have a unique Design/Check Calculation File. In special circumstances, the Design Unit Manager or Project Manager may allow multiple minor structures to be combined into a single Design/Check Calculation File.

The electronic PDF files that comprise the Design/Check Calculation File should be divided and organized in an orderly manner.

File sizes should not exceed 200 MB for each PDF file. The Design/Check Calculation File created during the design phase will eventually be electronically archived as described in Section 1.3.8, and reasonable PDF file sizes will support future download/retrieval of archive documents. Judgment should be used to determine the lowest resolution image appropriate to legibly portray the information. For example, a 200 dpi scan may save disk space and provide reasonable clarity as compared to a 600 dpi image.

The filename for each PDF file shall be rational and shall be clearly listed in the Index Sheets (or Table of Contents). Since the electronic archiving process will tag each PDF file with the contract number and Structure ID, the filenames need only be consistent with the naming and layout described in the Index Sheets. Example filenames:

- Volume 1.pdf, Volume 2.pdf, Volume 3.pdf, etc.
- SuperDesign.pdf, SuperCheck.pdf, SubDesign.pdf, SubCheck.pdf

The PDF files that comprise the Design/Check Calculation File are an electronic version of a traditional hard copy bound set of structural calculations. All PDF pages of calculation files shall be formatted to 8 ½" x 11" or to 11" x 17" sheet size so that they could be printed to hard copy without further formatting.

1.3.3.B File Inclusions

The following items shall be included in the Design/Check Calculation File:

1. **Cover Sheet**

   See Section 1.3.8.

2. **Index Sheets**

   Number all calculation sheets and prepare an Index (or Table of Contents) by subject with the corresponding sheet numbers.

   List the name of the project, SR Number, designer/checker initials, date (month, day, and year), and Design Unit Manager's initials.

   The filenames of each PDF file shall be clearly listed in the Index Sheets, and it shall be clear which PDF files contain which calculation content. The Index Sheets for the structure's entire Design/Check Calculation File shall be included at the beginning of each PDF file.

3. **Design Calculations**

   The design calculations should include design criteria, code and equation references, design assumptions, loadings, structural analysis, moment and shear diagrams and pertinent computer input and output data.

   The design criteria, design assumptions, and special design features should follow in that order behind the index.

   Computer-generated or hand written and scanned calculations are acceptable. The calculation sheets shall be formatted similar to WSDOT standard calculation sheets (WSDOT Form 232-007). The header for electronic calculation sheets shall carry WSDOT or Consultant logo along with project name, S.R. number, designer and checker's name, date, supervising engineer, and sheet numbers.

   All computer-generated or longhand design calculations shall be initialed by the designer and checker. Checker's initial are not necessary if separate check calculations are provided.

   Consultant submitted design calculations shall comply with the above requirements and shall be sealed and signed by the Engineer of Record.

Design calculations prepared by Consultants shall be sealed and signed by the Engineer of Record. Design calculations are considered engineering reports and part of the process that develops contract plans which are the final documents. Electronic signatures are acceptable.

See Appendix 1.3-A1 for an example calculation page with header. Code and other references used in developing calculations shall be specified. In general, when using Excel spreadsheet, enough information and equations shall be provided/shown in the spreadsheet so that an independent checker can follow the calculations.

4. **Special Design Features**

   Brief narrative of major design decisions or revisions and the reasons for them.

5. **Construction Problems or Revisions**

   Not all construction problems can be anticipated during the design of the structure. Calculations for revisions made during construction should be included in the design/check calculation file when construction is completed.

1.3.3.C File Exclusions

The following items should not be included in the file:

1. Irrelevant computer information.
2. Prints of Office Standard Sheets.
3. Irrelevant sketches.
4. Voided sheets.
5. Preliminary design calculations and drawings unless used in the final design.
6. Test hole logs.

1.3.4 PS&E Review Period

See Section 12.4.10 for PS&E Review Period and Turn-in for AD Copy activities.

1.3.5 Addenda

Plan or specification revisions during the advertising period require an addendum. The Specifications and Estimate Engineer will evaluate the need for the addendum after consultation with State Construction Office, and Region Plans Branch. The State Bridge Design Engineer or the Design Unit Manager must approve all addenda.

Use shading or clouding to mark all changes (except deletions) and place a revision note at the bottom of the sheet (Region and HQ Plans Branch jointly determine addendum date) and a description of the change. Return electronically-signed copies to the Specifications and Estimate Engineer who will submit the copy to the HQ Plans Branch for processing. See Chapter 12 for additional information.

For changes to specifications, submit a copy of the page with the change to the Specifications and Estimate Engineer for processing.

1.3.6 Construction Support

When submitting advertisement ready contract documents for distribution, the Design Unit Manager will identify a primary and secondary Bridge Technical Advisor (BTA) in accordance with Section 1.3.2.A.6. The Construction Support Engineer will maintain a list of all BTA assignments on the MS Team "HQ-Bridge-CN Support" providing access to all WSDOT Construction Offices.

The BTA coordinates structural support from the Bridge & Structures Office for the Project Engineer during contract work. The BTA may enlist the support of others within the Bridge Office as necessary including the original Engineer of Record or designer for the work.

Bridge Technical Advisors (BTAs) and others providing construction support shall follow the guidelines outlined in the WSDOT *Construction Manual* Section GEN 1-00.11 "Bridge and Structures Office Support on Design-Bid-Build Projects During Construction".

The Construction Support Supervisor, as the Bridge Office SME for Unifier, is responsible for ensuring the proper implementation and efficiency of reviews in Unifier.

1.3.6.A Shop Plans and Permanent Structure Construction Procedures

This section pertains to fabrication shop plans, weld procedures, electrical and mechanical items, geotechnical procedures, such as: drilled shafts and tieback walls, and other miscellaneous items related to permanent construction.

The following is a guide for checking shop plans and permanent structure construction procedures.

1.3.6.A.1 *Bridge Shop Plans and Procedures*

Shop Plans are typically marked up or revised electronically, using one of several available software packages for editing pdf files.

Mark each sheet with the following, near the title block, in red font, with the following information:

Contract number

Checker's initials and Date

Review Status

- No Exceptions Taken
- Make Corrections Noted
- Revise and Resubmit
- Rejected
- Structurally Acceptable
- Structurally Acceptable but does not conform to the Contract Requirements

Mark in red any errors or corrections. Comments should be “bubbled” so they stand out.

Items to be checked are typically as follows

Check against Contract Plans and Addenda, Special Provisions, Previously Approved Changes and *Standard Specifications*.

A. Material specifications (ASTM specifications, hardness, alloy and temper, etc.).

B. Size of member and fasteners.

C. Length dimensions, if shown on the Contract Plans.

D. Finish (surface finish, galvanizing, anodizing, painting, etc.).

E. Weld size and type and welding procedure if required.

F. Strand or rebar placement, jacking procedure, stress calculations, elongations, etc.

G. Fabrication — reaming, drilling, and assembly procedures.

H. Adequacy of details.

I. Erection procedures.

For prestressed girders and post-tensioning shop plan review see Sections 5.6.3.A and 5.8.6.C respectively.

Items Not Requiring Check

1. Quantities in bill of materials.
2. Length dimensions not shown on Contract Plans except for spot checking and is emphasized by stamping the plans: *Geometry Not Reviewed by the Bridge and Structures Office*.

Marking Categories

When finished, mark the sheets with one of six categories in red font, lower right corner.

1. **"No Exceptions Taken"** No Corrections required.
2. **“Make Corrections Noted”**
   Minor corrections only. Do not place written questions on a make corrections noted sheet. No resubmittal required if noted corrections are made.
3. **“Revise and Resubmit”**
   Major corrections are required which requires a complete resubmittal. Written questions may be included.
4. **“Rejected”**
   Not acceptable, or does not meet the contract requirements. Complete resubmittal required.

5. **"Structurally Acceptable"**
   This is appropriate for items that are not required to be reviewed per the contract, such as: work platforms, submittals from various local agencies or developers, and other items that are reviewed as a courtesy.

6. **"Structurally Acceptable But Does Not Conform to the Contract Requirements"**
   This is appropriate when a deviation from the contract is found but is determined to be structurally acceptable.

If in doubt between "Make Corrections Noted" and "Revise and Resubmit", check with the Design Unit Manager or Construction Support Engineer. An acceptable detail may be shown in red, in which case the Plans would be marked. "*Make Corrections Noted*".

Notify the Design Unit Manager and the Construction Support Engineer if problems are encountered which may cause a delay in the checking of the shop plans or completion of the contract. Typically, WSDOT administered contracts require reviews to be completed within 20 calendar days for Type 2 Working Drawings and 30 calendar days for Type 3 Working Drawings. The review time starts when the Project Engineer first receives the submittal from the Contractor and ends when the Contractor has received the submittal back from the Project Engineer. The Bridge Office does not have the entire review period to complete the review. Therefore, designers should give construction reviews high priority and complete reviews in a timely manner so costly construction delays are avoided. Time is also required for marking, mailing and other processing. It is the goal of the Bridge and Structures Office to return reviewed submittals back to the Project Engineer within 7 to 14 days of their receipt by the Bridge Office.

When checking is completed, return all shop drawings to the Construction Support Unit when Bridge Construction Support is listed as a WSDOT Review Group in Figure 1-1 of the WSDOT *Construction Manual*. Return all other shop drawings directly to the Project Engineering Office, and cc the Construction Support Unit for email submittals. Include a list of any deviations from the Contract Plans that are structurally acceptable and a list of any disagreements with the Project Engineer's comments (regardless of how minor they may be). Deviations from the Contract Plans may require engineering and a Change Order. Note that changes to the contract that are also practice of engineering will require a seal by a licensed professional in accordance with the WSDOT *Construction Manual* Section SS 1-04.4 Changes/ Responsibility of Licensed Professionals for Changes to Structural Engineered Drawings During Design-Bid-Build Construction Contracts.

Under no circumstances should the reviewer mark on the shop plans that a change order is required or notify the Project Engineer that a change order is required. The authority for determining whether a change order is required rests with State Construction Engineer assigned to the project.

1.3.6.A.2 *Sign Structure, Signal, and Illumination Shop Plans*

In addition to the instructions described under Section 1.3.6.A, the following instructions apply:

1. Review the shop plans to ensure that the pole sizes conform to the Contract Plans. Determine if the fabricator has supplied plans for each pole or type of pole called for in the contract.
2. Manufacturer's details may vary slightly from contract plan requirements, but must be structurally adequate to be acceptable.

1.3.6.A.3 *Geotechnical Submittals*

The Bridge Design Office and the State Geotechnical Office concurrently review these submittals which may include special design proprietary retaining walls, drilled shafts, ground anchors, and soldier piles. The State Construction Office is included for the review of drilled shaft installation plans. The Construction Support Unit combines these comments and prepares a unified reply that is returned to the Project Engineer.

1.3.6.B Contract Changes (Change Orders and As-Builts)

1.3.6.B.1 *Request for Changes*

During construction, changes to engineered drawings are often required to address field conditions, plan errors, contractor errors, repairs, differing site conditions, etc. Changes to engineered drawings for bridges and structures after contract award and execution shall be evaluated in accordance with WSDOT *Construction Manual* Section SS 1-04.4 Changes/Responsibility of Licensed Professionals for Changes to Structural Engineered Drawings during Design-Bid-Build Construction Contracts.

The WSDOT Assistant State Construction Engineer (ASCE) assigned to the project shall be notified of any administrative issues and potential changes to the contract since they provide approval for contractual changes affecting structures. The Construction Support Unit should also be informed of any changes.

Bridge office staff shall not discuss contract work directly with Contractors or Contractor suppliers, unless doing so at the request of the Project Engineer or ASCE. If contacted by a Contractor/supplier, refer them to the Project Engineer who is administering the contract.

1.3.6.B.2 *Processing Contract Revisions*

Changes to engineered drawings for bridges and structures after contract award and execution shall be prepared in accordance with WSDOT *Construction Manual* Section SS 1-04.4 "Changes/Responsibility of Licensed Professionals for Changes to Structural Engineered Drawings during Design-Bid-Build Construction Contracts".

The designer or BTA shall sign, date, and distribute any new plan sheets to the Region Project Engineer, the ASCE assigned to the project, and the Construction Support Unit. Signed sheets shall be given to the Specifications and Estimates Engineer for processing. Revisions shall include a written explanation describing the changes to the Contract, justification for the changes, and a list of material quantity additions or deletions.

This process applies to all contracts including HQ Ad and Award, Region Ad and Award, or Local Agency Ad and Award.

Whenever new plan sheets are required as part of a contract revision, the information in the title blocks of these sheets must be identical to the title blocks of the contract they are for (e.g., Job Number, Contract No., Approved by, and the Project Name). These title blocks shall also be initialed by the State Bridge Design Engineer, Design Unit Manager, designer, and checker before they are distributed. If the changes are modifications made to an existing sheet, the sheet number will remain the same. A new sheet shall be assigned the same number as the one in the originals that it most closely resembles and shall be given a letter after the number (e.g., if the new sheet applies to the original sheet 25 of 53, then it will have number 25A of 53).

Every revision will be assigned a number, which shall be enclosed inside a triangle. The assigned number shall be located both at the location of the change on the sheet and in the revision block of the plan sheet along with an explanation of the change.

This process applies to all contracts Including HQ Ad and Award, Regions Ad and Award, or Local Agency Ad and Award.

1.3.6.B.3 *As-Built Plan Process*

Region Project Engineers shall prepare and submit as-built plans to the HQ Engineering Records Office in accordance with *Construction Manual* 10-3.11.

Prior to submitting the as-built plans to HQ Engineering Records, the Region Project Engineer shall submit a draft version to the Bridge Office for review. The Bridge Office BTA and designer will compare the draft as-built plans with their construction support records, and will inform the Region Project Engineer if any discrepancies are noted. This review process must be completed within 30 days.

For more information on the as-built plan process for bridges, contact the Bridge Construction Support Supervisor.

1.3.7 Vacant

1.3.8 Archiving Design Calculations, Job Files, and S&E Files

1.3.8.A Upon Award of the Project

The designer and checker shall place a cover sheet on the Design/Check Calculation File (see Figure 1.3.8-1 for an example). The cover sheet shall include the contract number, the Project Title, SR Number, designer/checker names, date, and Design Unit Manager name. The designer shall then turn the File in to the Design Unit Manager or the assigned Project Coordinator.

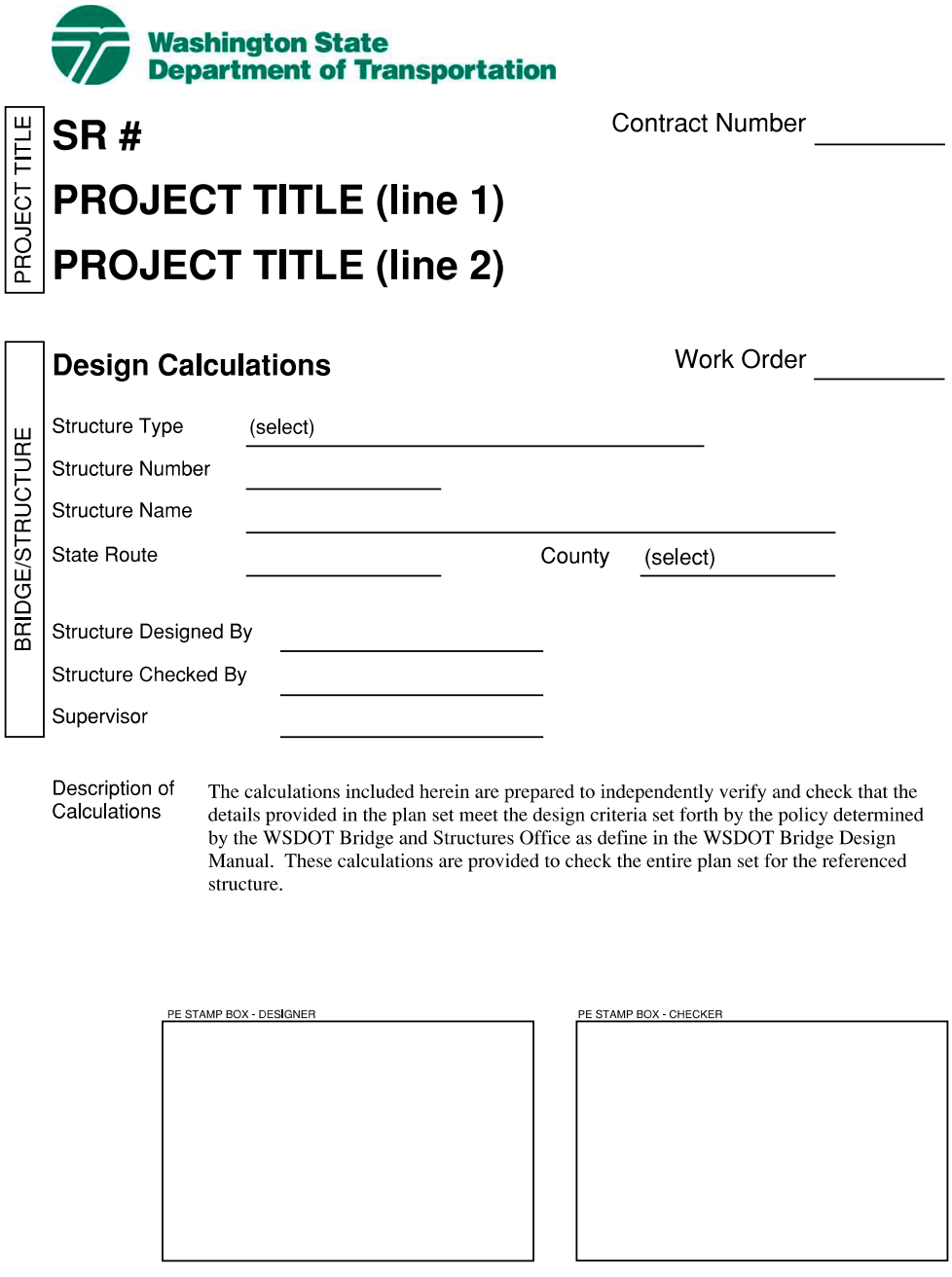
The Design Unit Manager or Project Coordinator shall verify that the content, PDF filenames, and Index Sheets of the Design/Check Calculation File meet the requirements of Section 1.3.3. The Design Unit Manager or Project Coordinator shall submit the Design/Check Calculations File to the Bridge Projects Unit Manager in PDF format.

The S&E Engineer shall save all files that are part of the Bridge Design Office deliverables to the Project Folders.

The Design/Check Calculation File shall be placed in a secure WSDOT digital storage location designated by the Bridge Projects Unit Manager.

Access to the Job Files, S&E Files and Design/Check Calculation Files shall be made available to Bridge and Structures staff members during construction for review. Design/ Check Calculations files developed during constriction shall be placed in the secure digital storage location.

Figure 1.3.8-1 Example Calculation Cover Sheet



1.3.8.B Upon Physical Contract Completion

The Scheduling Engineer shall notify the designer and supervisor when the contract is nearing physical completion. The designer shall finalize updates to the Design/Check Calculation File to reflect any contract plan changes that have occurred during construction. Revisions to the original design calculation file and any supplemental calculation volumes shall be signed and sealed by the Engineer of Record. If the original designer no longer works for WSDOT, the Design Unit Supervisor shall ensure the Engineer of Record responsibilities during construction are executed.

The Designer of Record shall upload the Design/Check Calculation File, consisting of all individual PDF files, using ILINX Capture (https://wsdotecm/capture/). The Contract Number is required to submit a Calculation File. If the Structure information is not populated, contact the Bridge Inventory group in Bridge Preservation. Uploads shall be limited to 200 MB per file and 1 GB per batch. Once the Calculation File is submitted, the Bridge Projects Unit Manager will be notified to review the files for general compliance with filename, index sheet, and cover sheet requirements and shall release the documents to the ECM archive.

Questions about using ILINX Capture should be directed to the Bridge Projects Unit Manager.

The Scheduling Engineer shall discard the Job Files and the S&E Files from the Project Folder. Load ratings are filed with the Bridge Load Rating Engineer.

1.3.8.C Consultant Designs

Prior to Ad, the Bridge and Structures Office Project Manager will receive the following from the design Consultant in PDF form:

1. The signed and stamped project design calculations.
2. The signed and stamped structural plan sheets.

All Consultant Ad Ready signed and stamped plan sheets, specifications, estimates and calculations need to be received by the Bridge Office prior to the Ad date in accordance with the Consultant Agreement and Scope of Work Agreement schedule. Plan sheets, specifications and estimates shall be submitted to the S&E Engineer for processing.

Bridge Design/Check Calculation Files created by consultant shall meet the requirements described in Sections 1.3.3 and 1.3.8 and shall be submitted to the Bridge Projects Unit Manager for secure storage during construction. Revisions to the calculations during construction shall be made as described above. The ECM archive process shall be as described except that the Bridge and Structures Office Project Manager will import the documents. It is therefore critical that the PDF files meet the format, content, filename, index sheet, and cover sheet requirements prior to completion of the consultant agreement.

1.3.8.D Design-Build and Progressive Design-Build Projects

The Design-Builder shall follow the requirements of the RFP for submission of the signed and stamped structural plan sheets and calculations. The Bridge and Structures Office's subject matter expert supporting the design-build project shall use the WSDOT ECM Document Importer to upload the PDF calculation files for archive.

1.3.9 Public Disclosure Policy Regarding Bridge Plans

The Bridge Information Technician in the BPO Information Group is the Bridge and Structures Office Public Disclosure contact and will coordinate with the WSDOT Headquarters Records Office for any release of calculations and/or reports.

Executive Order E 1023 *Public Disclosure* provides a specific procedure to follow when there is a request for public records. All external requests for WSDOT records are to follow the Public Disclosure Request process, and must be specific.

The Bridge and Structures Office is the "owner" of two types of records: (1) Design Calculations (until they are turned over to the State Records Center or ECM) and (2) Bridge Inspection Documents.

As-built plans available on the Bridge and Structures website are not "official" as-built plans. As-built plans are stored on WSDOT's ECM. Contact HQ Records for copies of these plans.

1.3.10 Use of Computer Software

1.3.10.A Policy on Open Source Software

It is the policy of the Bridge and Structures Office to license its own engineering software as open source, and to prefer and promote the use of open source software, within the bridge engineering community.

1.3.10.B Approved Software Tools

A list of approved software tools available for use by WSDOT bridge design engineers is available at www.wsdot.wa.gov/eesc/bridge/software/index.cfm. WSDOT does not require consulting engineers to use any specific software tools, so long as the use of the tools are in accordance with sound engineering practice, and does not violate software licensing agreements and Copyright law.

When using personal design tools created by others, such as a spreadsheet or MathCAD document, the designer is responsible for thoroughly checking the tool to ensure the integrity of the structural analysis and design.

1.4 Quality Control/Quality Assurance/Quality Verification (QC/QA/QV) Procedures

1.4.1 General

The purpose of the QC/QA/QV procedure is to improve the quality of the structural designs and plans. The key element to the success of this process is effective communication between all parties. The objectives of the QC/QA/QV procedure are to:

- Design structures that improve public safety and meet state regulations.
- Design structures which meet the requirements of the *Bridge Design Manual*, AASHTO LRFD *Bridge Specifications*, current structural engineering and architectural practices, and geometric criteria provided by the Region.
- Create contract documents that meet the customer's needs, schedule, budget, and construction staging requirements.
- Maximize plan quality.
- Produce an organized and indexed set of design calculations with the criteria and assumptions included in the front after the index.
- Minimize structural and architectural design costs.

The goals are listed in order of importance. If there is a conflict between goals, the more important goal takes precedence.

The Design Unit Manager determines project assignments and the QC/QA/QV process to be used in preparation of the structural design. The intent of the QC/QA/QV process is to facilitate plan production efficiency and cost-effectiveness while assuring the structural integrity of the design and to maximize the quality of the structural contract documents.

Professional Engineering license stamp is required for all proprietary Buried Structures as defined in Section 8.3.3. Deep foundations including shafts and piles shall be stamped by a Structural Engineer.

Structural Engineering license is required for all vehicular bridges, pedestrian bridges and nonproprietary Buried Structures with span lengths greater than 20 ft.

Structure repairs to be performed by WSDOT maintenance forces follow the guidance in Chapter 6 of the *Washington State Bridge Inspection Manual* (WSBIM). January 2022 revisions to the WSBIM will provide guidance on plan stamping.

The stamping requirement for all other structures shall be as specified in Section 1.4.3 for WSDOT Prepared PS&E, 1.4.4 for Consultant Prepared PS&E/Preliminary Plans on WSDOT Right of Way, 1.4.5 Structural Design Work Prepared Under Design-Build Method of Project Delivery, and 1.4.6 Structural Design Work Prepared Under Contractor Supplied Design Method of Project Delivery.

1.4.2 WSDOT Prepared Bridge (or Structure) Preliminary Plans

1.4.2.A Description of Terms

Quality Control (QC)

- A thorough and detail-oriented check of the engineering content of the Preliminary Plans is performed. A set of check prints is created and retained for QC documentation.
- Alignment, profile, super-elevation rates, vertical clearances, and geometry data shown on the Preliminary Plans are checked. Geometry checks may be performed by a Structural Detailer, using the appropriate CADD software.
- A set of check prints is created and retained for QC documentation.
- The Job Files shall be reviewed for key design decisions, and any hydraulic, geotechnical or environmental complications, etc.
- Confirm that the current design guidelines (BDM, AASHTO) and current WSDOT Bridge Office Design Policies have been followed.
- Particular attention shall be paid to documentation regarding justification for structure type selection.
- The QC task is traditionally carried out by the Preliminary Plan Checker of Record.

Quality Assurance (QA)

- A review of the Preliminary Plans is performed, based on knowledge, experience and judgment.
- Verification that the QC process has been properly followed. Verify the existence of the QC check prints.
- Confirm that the current WSDOT Bridge Office Policies and overall Preliminary Plan protocols have been followed.
- The QA task is traditionally carried out by the Bridge Projects Unit Manager.

Quality Verification (QV)

- Confirm that the QA process has been properly followed.
- A review of the Preliminary Plans is performed, based on knowledge, experience and judgment (this may also add QA value).
- The QV task is traditionally carried out by the State Bridge Design Engineer.

The QC/QA/QV procedures may vary depending on the type and complexity of the Preliminary Plan being created, and the experience level of the Engineers involved. More supervision, review, and checking may be required when the Engineers are less experienced.

1.4.3 WSDOT Prepared PS&E

1.4.3.A Plans, Calculations and Quantities Prepared by WSDOT Bridge and Structures Office

1.4.3.A.1 *Description of Terms*

Quality Control (QC)

- A thorough and detail-oriented check of the engineering content of the plans is performed. A set of check prints is created and retained for QC documentation.
- The Designer's calculations are also checked. A set of check calculations is created and retained for documentation.
- The QC task is traditionally carried out by the Checker of Record.

Quality Assurance (QA)

- A review of the plans is performed, based on knowledge, experience and judgment. A set of check prints is created and retained for QA documentation.
- The Designer's calculations are reviewed, based on knowledge, experience and judgment. Spot-checks may be included. Independent calculations are not typically produced.
- Verification that the QC process has been properly followed. Verify the existence of QC Check Prints and Check Calculations.
- Confirm that the current design guidelines (BDM, AASHTO) and current WSDOT Bridge Office Design Policies have been followed.
- The QA task is traditionally carried out by the Design Unit Manager.

Quality Verification (QV)

- Confirm that the QA process has been properly followed. Verify the existence of QA Check Prints.
- A review of the plans is performed, based on knowledge, experience and judgment (this may also add QA value).
- The QV task is traditionally carried out by the State Bridge Design Engineer.

The QC/QA/QV procedures may vary depending on the type and complexity of the structure being designed, and the experience level of the design team members. More supervision, review, and checking may be required when the design team members are less experienced.

1.4.3.A.2 *Designer Responsibility*

The Designer is responsible for the engineering content of the contract plan sheets, including structural analysis, completeness and correctness.

Upon completion of the QC/QA/QV process, the Designer shall prepare the QC/QA/QV Checklist, and obtain signatures/initials as required. This applies to all projects regardless of type or importance (bridges, retaining walls and noise barrier walls, overhead sign structures, bridge deck overlays, traffic barriers, etc.). Refer to Appendix 1.4-A1.

1.4.3.A.3 *Checker Responsibility*

The Checker is responsible to the Design Unit Manager for Quality Control of the structural design, which includes checking the design, plans, calculations and quantities to assure accuracy and constructability. The Design Unit Manager works with the Checker to establish the level of checking required. The checking procedure for assuring the quality of the design will vary from project to project. Following are some general checking guidelines:

1. **Job Files**

   Scan the Job Files for unconventional or project specific items relating to geometrics, hydraulics, geotechnical, environmental, etc.

2. **Design Calculations**

   The design calculations shall be checked by either of two methods:

   Design calculations may be checked with a line-by-line review and initialing by the Checker. If it is more efficient, the Checker may choose to perform his/her own independent calculations.

   Iterative design methods may be best checked by review of the Designer's calculations, while standard and straight-forward designs may be most efficiently checked with independent calculations. The Designer and Checker calculations shall both be retained for archiving.

   Revision of design calculations, if required, is the responsibility of the Designer.

3. **Structural Plans**

   The Checker's plan review comments are recorded on a set of check prints, including details and bar lists, and returned to the Designer for consideration. These check prints are a vital part of the checking process, and shall be preserved. If the Checker's comments are not incorporated, the Designer should provide justification for not doing so. If there is a difference of opinion that cannot be resolved between the Designer and Checker, the Design Unit Manager shall resolve any issues. Check prints shall be submitted to the Design Unit Manager at the time of 100 percent PS&E turn-in.

   If assigned by the Design Unit Manager, a structural detailer shall perform a complete check of the geometry using CADD or hand calculations.

   Revision of plans, if required, is the responsibility of the designer.

4. **Quantities and Barlist**

   The Checker shall provide an independent set of quantity calculations. These together with the Designer's quantity calculations shall be placed in the Project Folder.

   Resolution of differences between the Designer and Checker shall be completed before the Bridge PS&E submittal. See Section 12.2.2 for procedures and requirements. The Checker shall also check the barlist.

1.4.3.A.4 *Specialist/Bridge and Structures Architect Responsibility*

Specialist reviews are typically cursory in nature, are not intended to fulfill the role of the Checker, and should be considered as Quality Assurance (QA). Specialists shall perform reviews and initial the Project Turn-In QC/QA/QV Worksheet of Appendix 1.4-A1 at the 100 percent completion stage of certain projects including:

- **Bearing and Expansion Joint Specialist** – All expansion joint or bearing rehabilitation projects. All new bridges with modular expansion joints, unique strip seal joints (high skew, raised steel sliding plates at sidewalk, traffic islands, etc.), and bearings other than conventional elastomeric pads.
- **Concrete Specialist** – All post-tensioned super and substructures, and complex prestressed girder superstructures (long spans, large skews, tapered girders, etc.). All structures utilizing mass concrete, self-consolidating concrete (SCC), shotcrete or Grade 80 reinforcement.
- **Steel Specialist**– All new and retrofit steel superstructure projects or projects involving significant or complex welding.
- **Substructure/Seismic Specialist** – All drilled shaft foundations, and any foundations involving Concrete Filled Structural Tube (CFST) or Reinforced Concrete Filled Structural Tube (RCFST) technology. All retrofit projects, and new bridges with complex seismic design requirements.
- **Special Structures Specialist –** All floating, moveable, and special structure projects.
- **State Bridge and Structures Architect** – Responsible for review and approval of all Bridge & Structure projects for appropriate application of the Context Sensitive Design process and related architectural design. The Architect's involvement shall include, but not be limited to, TS&L studies, Preliminary Plans, and PS&E design-level plans.

1.4.3.A.5 *Design Unit Manager Responsibility*

The Design Unit Manager is responsible to the State Bridge Design Engineer for Quality Assurance (QA) of the structural design, which includes reviewing the design, plans and specifications for consistency and constructability. The Design Unit Manager shall review the plans for the following:

Review the Design Criteria.

Design Criteria

- Seismic design methodology, acceleration coefficient ("a" value), and any seismic analysis assumptions.
- Foundation report recommendations, selection of alternates.
- Deviations from AASHTO, this manual and proper consideration of any applicable Design Memorandums. Review constructability issues. Are there any problems unique to the project?
- The Design Unit Manager shall also review the following:
- Overall review of sheet #1, the bridge layout for:

A. Consistency — especially for multiple bridge project

B. Missing Information

- Review footing layout for conformance to Bridge Plan and for adequacy of information given. Generally, the field personnel shall be given enough information to "layout" the footings in the field without referring to any other sheets. Plan details shall be clear, precise, and dimensions tied to base references, such as a survey line or defined centerline of bridge. Any special circumstances regarding excavation quantities (structure exc. vs. roadway exc. delineation) shall also be detailed.
- Review the sequence of the plan sheets. The plan sheets should adhere to the following order: layout, footing layout, substructure, superstructure elements, miscellaneous details, barriers, railings, bridge approach slab, and barlist. Also check for appropriateness of the titles.
- Review overall dimensions and elevations, spot check for compatibility. For example, check compatibility between superstructures and substructure. Also spot check bar marks. Use common sense and experience to review structural dimensions and reinforcement for structural adequacy. When in doubt, question the Designer and Checker.

1.4.3.A.6 *State Bridge Design Engineer's Responsibilities*

The State Bridge Design Engineer is responsible for Quality Verification (QV) of the structural design process, and acts as the coach, mentor, and facilitator for the WSDOT QC/QA/QV Bridge Design process. The following summarizes the key responsibilities of the State Bridge Design Engineer related to QC/QA/QV.

- The State Bridge Design Engineer shall perform a structural/constructability review of the plans. This is a Quality Verification (QV) function as well as meeting the "responsible charge" requirements of state laws relating to Professional Engineers.
- Review unique project special provisions and *Standard Specifications*

1.4.3.A.7 *General Bridge Plan Stamping and Signature Policy*

The stamping and signing of bridge plans are the final step in the Bridge QC/QA/ QV procedure. It signifies a review of the plans and details by those in responsible charge for the bridge plans.

The revised bridge and structures plan stamping, and signature policy requires at least one licensed Structural Engineer, SE stamp and sign each contract plan sheet except for architectural detail sheets, bar list, and as specified herein:

A. Structural Engineering license, SE is required for all vehicular and pedestrian bridges with span lengths greater than 20 ft

B. Structural Engineering license, SE is required for non-proprietary Buried Structures with span lengths greater than 20 ft that are designed by the WSDOT Bridge Office or Consultants.

C. Structural Engineering, SE license is required for the foundation elements of proprietary Buried Structures placed on pile or shaft foundation. The non-foundation elements may be stamped by a Professional Engineer.

D. Structure repairs to be performed by WSDOT maintenance forces follow the guidance in Chapter 6 of the *Washington State Bridge Inspection Manual* (WSBIM). January 2022 revisions to the WSBIM will provide guidance on plan stamping.

For contract plans prepared by a licensed Civil or Structural Engineer, the Design Unit Manager and the licensed Civil or Structural Engineer co-stamp and sign the plans, except the bridge layout sheet. The bridge layout sheet is stamped and signed by the State Bridge Design Engineer.

As an exception to the requirements above, the State Bridge and Structures Engineer reserves the right to stamp and sign any plan sheet, while in conformance with and meeting the legal requirements of RCW 18.43.020.

For contract plans prepared by a designer who is not a licensed Civil or Structural Engineer, the Design Unit Manager and the State Bridge Design Engineer co-stamp and sign the plans except the bridge layout sheet. Alternatively, Design Unit Manager and the S.E. Licensed Engineer supervising the design work (if applicable) could co-stamp and sign the plans. The bridge layout sheet is stamped and signed by the State Bridge Design Engineer.

For Non-Standard Retaining Walls and Noise Barrier Walls, Sign Structures, Seismic Retrofits, Expansion Joint and Bearing Modifications, Traffic Barrier and Rail Retrofits, and other special projects, the Design Unit Manager with either the licensed designer or the State Bridge Design Engineer (if the designer is not licensed) co-seal and sign the plans except for the layout sheet. The layout sheets for these plans are sealed and signed by the State Bridge Design Engineer.

All plan sheets shall be signed electronically using the Certification Sheet Process established by WSDOT HQ Design Office, providing a locked PDF plan set for Advertisement.

1.4.3.B Specifications and Estimates (S&E) Prepared by WSDOT Bridge and Structures Office

1.4.3.B.1 *Description of Terms*

Quality Control (QC)

- A thorough and detail-oriented check of the Specifications Run List is performed. Special Provisions are reviewed for content, and for consistency with the Plans. Fill-in values in the Special Provisions are reviewed for accuracy.
- Transcription of the Designer-supplied quantities into the Engineers Estimate is checked. Unit bid prices assigned are reviewed.
- Project Duration calculations, and any required project scheduling assumptions are checked for accuracy and consistency.
- A set of QC Review Comments is created, and retained for documentation.
- The QC task is traditionally carried out by the Specification and Estimate Engineer assigned to the Project.

Quality Assurance (QA)

- A review of the Specifications and Estimate is performed, based on knowledge, experience and judgment.
- Consistency with the Plans shall be emphasized.
- Verification that the QC process has been properly followed. Verify the existence of QC Review Comments.

- Confirm that the current WSDOT Bridge Office Policies and overall S&E organization protocols have been followed.
- Responsibility for the QA task belongs with the Bridge Projects Unit Manager.

Quality Verification (QV)

- Confirm that the QA process has been properly followed.
- A review of the Specifications and Estimate is performed, based on knowledge, experience and judgment (this may also add QA value).
- The QV task is traditionally carried out by the State Bridge Design Engineer.

1.4.3.B.2 *General Specification and Estimate Stamping and Signature Policy*

The stamping and signing of the Certified Bridge Specifications and Estimate is the final step in the S&E QC/QA/QV procedure. It signifies a completed review of the Specifications and Estimate by those in responsible charge. The Specifications and Estimate Engineer responsible for S&E for the project shall stamp and sign the Specifications and Estimate Cover Sheet. The Certified Bridge Specifications and Estimate document is sent to the Project Engineer of the Region PE Office responsible for the overall design of the project for the retention in the Project Design File.

The Specifications and Estimate Cover Sheet shall be signed using an electric signature in accordance with the HQ electronic signature policy.

1.4.4 Consultant Prepared PS&E/Preliminary Plans on WSDOT Right of Way

Plans, Quantities and Calculations, or Specifications and Estimates, or Preliminary Plans prepared by Consultants shall follow the individual Consultant's own QC/QA procedures. Also, as a minimum, the Consultant's QC/QA procedures shall include the features described above for similar WSDOT prepared work.

Preliminary Plans prepared by Consultants shall be reviewed and approved by WSDOT Bridge Office and Regional Engineering Manager (or Project Development Engineer) for the project.

The Consultant Prepared PS&E/Preliminary Plans on WSDOT Right of Way shall follow the General Bridge Plan Stamping and Signature Policy of Section 1.4.1.

WSDOT's role in Consultant-prepared engineering work will be Quality Verification only. The Consultant shall be relied upon to provide their own QC/QA effort and oversight. WSDOT'S QV task is traditionally carried out by the designated WSDOT Bridge Design Reviewer or Coordinator for the project. The WSDOT Bridge Design Reviewer/ Coordinator's QV responsibilities shall include:

1. Review Consultant's Preliminary Plans. Upon resolution of all review comments, the Preliminary Plan Reviewer shall submit the Preliminary Plans to the State Bridge Design Engineer and to the Regional Engineering Manager (or Project Development Engineer) for their review and signature.
2. Review Consultant's design calculations and plans for completeness and conformance to Bridge Office design practice. The plans shall be checked for constructability, consistency, clarity and compliance. Also, selectively check dimensions and elevations.
3. At the 100 percent turn-in milestone, verify that the Consultant's own QC/ QA processes have been followed, and, as a minimum, that WSDOT's QC/QA requirements for similar work have been met.

1.4.5 Structural Design Work Prepared Under Design-Build Method of Project Delivery

Structural design work prepared by others under a Design-Build contract shall follow the QC/QA procedures outlined in the approved project-specific Quality Management Plan (QMP). As a minimum, the QMP procedures shall include the features described above for similar WSDOT prepared work.

The Structural Design Work Prepared Under Design-Build Method of Project delivery shall follow the plan stamping and signature policy of RFP Section 2.13.

WSDOT's role in Design-Build engineering work will be Quality Verification only. The outside designers shall be relied upon to provide their own QC/QA effort and oversight, per the project's approved QMP. WSDOT'S QV task is traditionally carried out by the designated WSDOT Bridge Design Reviewer or Coordinator for the project. The WSDOT Bridge Design Reviewer/Coordinator's QV responsibilities shall include:

1. Review Design-Build design calculations and plans for completeness and conformance to Bridge Office design practice and applicable RFP requirements. The plans shall be checked for constructability, consistency, clarity and compliance. Also, selectively check dimensions and elevations.
2. At the Release For Construction (RFC) turn-in milestone, verify that the Design-Build QC/QA processes have been followed (as outlined in the approved QMP), and, as a minimum, that WSDOT's QC/QA requirements for similar work have been met.

1.4.6 Structural Design Work Prepared Under Contractor Supplied Design Method of Project Delivery

The Structural Design Work Prepared Under a Contractor Design Method of Project delivery shall follow the General Bridge Plan Stamping and Signature Policy described in Section 1.4.3.A.7 A, B and C above.

WSDOT's role in Contractor Supplied Design engineering work will be Quality Verification only. The Contractor shall provide their own QC/QA effort and oversight. WSDOT'S QV task is traditionally carried out by the designated WSDOT Bridge Technical Advisor or Coordinator for the project.

As a minimum, the QC/QA procedures shall include the features described above for similar WSDOT prepared work. For Contractor Supplied design work for Buried Structures, the Contractor shall be responsible for carrying out a thorough check of the plans and calculations, meeting or exceeding the requirements described in Appendix 1.4-A2.

The WSDOT Bridge Technical Advisor or Coordinator's QV responsibilities shall include: Review Contractor Supplied Design calculations and plans for completeness and conformance to Bridge Office design practice. The plans shall be reviewed for constructability, consistency, clarity and compliance. Dimensions and elevations shall also be selectively reviewed.

1.5 Bridge Design Scheduling

1.5.1 General

The Bridge Projects Unit Manager is responsible for workforce projections, scheduling, receiving new work requests coming into the Bridge Design office, and monitoring progress of projects. The *Bridge Design Schedule (BDS)* is used to track the progress of a project and is updated monthly by the Bridge Scheduling Engineer. A typical project would involve the following steps:

1. Regions advise Bridge and Structures Office of an upcoming project.
2. The Bridge Project Support Unit determines the scope of work, estimates design time and cost to prepare preliminary plans, design, and S&E (see Section 1.5.2). The Design Unit Manager may also do this and notify the Bridge Project Support Engineer.
3. The project is entered into the BDS with start and due dates for site data preliminary plan, project design, PS&E, and the Ad Date.
4. Bridge site data received.
5. Preliminary design started.
6. Final Design Started – Designer estimates time required for final plans (see Section 1.5.3).
7. Geotechnical information received
8. Hydraulic information received
9. Monthly Schedule Update – Each Design Unit Manager is responsible for maintaining a workforce projection, monitoring monthly progress for assigned projects, and reporting progress or any changes to the scope of work or schedule to the Bridge Scheduling Engineer.
10. Project turned in to S&E unit.

1.5.2 Preliminary Design Schedule

The preliminary design estimate done by the Bridge Project Support Unit is based on historical records from past projects taking into consideration the unique features of each project, the efficiencies of designing similar and multiple bridges on the same project, designer's experience, and other appropriate factors.

1.5.3 Final Design Schedule

1.5.3.A Breakdown of Project Staff-Hours Required

Using a spreadsheet, list each item of work required to complete the project and the staff-hours required to accomplish them. Certain items of work may have been partially completed during the preliminary design.

The designer or design team leader should research several sources when making the final design time estimate. The following are possible sources that may be used:

The "Bridge Design Summary" contains records of design time and costs for past projects. This summary is kept in the Bridge Project Support Unit. The times given include preliminary plan, design, check, drafting, and supervision.

The Bridge Project Support Unit has "Bridge Construction Cost Summary" books. These are grouped according to bridge types and have records of design time, number of drawings, and bridge cost.

1.5.3.B Estimate Design Time Required

The design team leader or the Design Unit Manager shall determine an estimate of design time required to complete the project. The use of a spreadsheet, or other means is encouraged to ensure timely completion and adherence to the schedule. Use 150 hours for one staff month.

The following percentages should be used for the following activities:

Activity No.	Percentage
1 Design	40
2 Design Check	20
3 Drawings	20
4 Revisions	5
5 Quantities	5
6 S&E	5
7 Project Review	5
Total	100%

The individual activities include the specific items as follows under each major activity.

Activity No. 1 Design — See Section 1.3.2.A.2 — Includes:

1. Project coordination and maintaining the Design File.
2. Geometric computations.
3. Design calculations.
4. Complete check of all plan sheets by the designer.
5. Compute quantities and prepare barlist.
6. Preparing special provisions checklist.
7. Assemble backup data covering any unusual feature in the Design File.

Activity No. 2 Design Check — See Section 1.3.2.A.3 — Includes:

1. Checking design at maximum stress locations.
2. Checking major items on the drawings, including geometrics.
3. Additional checking required.

Activity No. 3 Drawings — See Section 1.3.2.A.4 — Includes:

1. Preparation of all drawings.

Activity No. 4 Revisions — Includes:

1. Revisions resulting from the checker's check.
2. Revisions resulting from the Design Unit Manager's review.
3. Revisions from S&E Engineer's review.
4. Revisions from Region's review.

Activity No. 5 Quantities — Includes:

1. Compute quantities including barlist.
2. Check quantities and barlist.

Activity No. 6 S&E — See Section 12.4 — Includes:

1. Prepare S&E.
2. Prepare working day schedule.

Activity No. 7 Project Review — Includes:

1. Design Unit Manager and Specialist's review.

1.5.3.C Monthly Project Progress Report

The designer or design team leader is responsible for determining monthly project progress and reporting the results to the Design Unit Manager. The Design Unit Manager is responsible for monthly progress reports using information from the designer or design team leader. Any discrepancies between actual progress and the project schedule must be addressed. Report any revisions to the workforce assigned to the project, hours assigned to activities, or project schedule revisions to the State Bridge Design Engineer and Region.

The designer may use a spreadsheet, to track the progress of the project and as an aid in evaluating the percent complete. Other tools include using a spreadsheet listing bridge sheet plans by title, bridge sheet number, percent design complete, percent design check, percent plan details completed, and percent plan details checked. This data allows the designer or design team leader to rapidly determine percent of project completion and where resources need to be allocated to complete the project on schedule.

1.6 Guidelines for Bridge Site Visits

When conducting site visits, the design team shall conform to the safety requirements of WSDOT and the Contractor. WSDOT safety requirements are included in the Secretary of Transportation's Executive Order E 1033, the WSDOT *Safety Procedures and Guidelines Manual* and other policy documents. Contractor safety requirements are included in the safety plan for the site (see *Standard Specifications* Section 1-07.1 and the WSDOT *Construction Manual* Section SS 1-07.1). Personal protective equipment shall be used as appropriate. A pre-activity safety plan is required prior to any site visit.

When visiting sites that are not under construction, it is recommended to consult Region personnel beforehand. They are typically familiar with the site and can provide escort and traffic control if necessary. Traffic control may require significant advance notice.

In some cases, an in-depth inspection with experienced BPO inspectors is appropriate. The decision to perform an in-depth inspection should include the Design Unit Manager, Region, the State Bridge Design Engineer, and the State Bridge Preservation Engineer.

It may be necessary to use inspection equipment such as BPO's Under Bridge Inspection Trucks (UBIT) to access details and obtain measurements during a site visit. Advance planning and coordination with BPO and the Region project office will be necessary if inspection equipment is required because of BPO's heavy workload and the need to provide traffic control well in advance of the site visit.

When visiting construction sites, Region personnel shall be consulted beforehand. They will be familiar with the safety plan for the site and will be able to educate the design team on the safety plan. They will also be able to provide escort and arrange for traffic control if necessary.

1.6.1 Existing Structure Modifications

It is critical that the design team know as much as possible about the existing structure. Recent inspection reports, prepared by inspectors from the Bridge Preservation Office (BPO), contain useful information on the condition of existing structures. The inspection reports, as well as as-built plans, are available on the Intranet through Bridge Engineering Information System (BEIST). As-built plans are also available from the Regions through the Enterprise Content Management (ECM) Portal. The WSDOT Maintenance Operations Division documents maintenance work on existing structures in the MPET and HATS systems, which can be another source of information for the design team. As-built plans, inspection documentation and maintenance documentation are helpful, but may not necessarily be accurate or complete.

Site visits are recommended when modifying existing bridges. However, if there is any doubt about the adequacy of the available information or concern about accelerated deterioration of the structural elements, a site visit is required. Region personnel or others may perform the site visit to obtain the information needed to detail existing conditions, especially for remote or difficult to access locations.

Site visits are especially important for expansion joint rehabilitation projects. On many recent expansion joint rehabilitation projects, field conditions during construction have not matched as-built and contract plan details. This can cause large impacts in construction since new steel joint components are typically prefabricated and typically must be installed in a short time frame or closure. Consideration should be given to exposing portions of existing expansion joints to confirm as-built or plan details either during design or by the Contractor during construction. When done by the Contractor:

- The plans should include new expansion joint details based upon the information available to the design team
- Adequate time should be given in the Contract between the investigation and the installation of the new joint assembly (typically at least four weeks) to allow for possible redesign and fabrication
- A materials procurement suspension should be considered.

1.6.2 New Structures

Generally, photographs and site data from the Region are adequate for most new structure designs. However, if the new structure is a replacement for an existing structure, a site visit is recommended, particularly if the project requires staged removal of the existing structure and/or staged construction of the new structure.

1.6.3 Structure Demolition

If structure demolition is required as part of a project, a site visit is recommended for the design team to determine if there are unique site restrictions that could affect the demolition. If unique site restrictions are observed, they should be documented, included in the Job Files, and noted on the special provisions checklist.

1.7 Appendices

Appendix 1.1-A1	Vacant
Appendix 1.2-A1	Bridge & Structures Design Office Workflow
Appendix 1.3-A1	Bridge & Structures Design Calculations
Appendix 1.4-A1	QC/QA Signature Sheet
Appendix 1.4-A2	Min. Requirements for Check of Contractor-Design Buried Structure

Appendix 1.1-A1 Vacant

Appendix 1.2-A1 Bridge & Structures Design Office Workflow

REGION/SPECIALTY PROVIDED DATA	BRIDGE & STRUCTURES DESIGN OFFICE WORK FLOW		
	WORK PHASE	WORK ITEMS	PRIMARY CONTACT
	SCHEDULING	• BRIDGES • BURIED STRUCTURES • WALLS • RAILINGS • DECK REPAIR • EXPANSION JOINTS	BRIDGE PROJECTS UNIT MANAGER
STRUCTURE SITE DATA →	PRELIMINARY DESIGN	• PRELIMINARY DESIGN • PRELIMINARY ESTIMATE	PRELIMINARY PLAN ENGINEER OR BRIDGE DESIGN UNIT MANAGER/LEAD with QV by PRELIMINARY DESIGN ENGINEER
GEOTECH/HYDRAULIC REPORT →	STRUCTURAL DESIGN	• STRUCTURAL DESIGN • INTERMEDIATE REVIEW	BRIDGE DESIGN UNIT MANAGER
	SPECIFICATIONS & COST ESTIMATES	• PRE-SUBMITTAL REVIEW • FINAL PS&E • AD COPY	BRIDGE PROJECT SUPPORT ENGINEER OR BRIDGE DESIGN UNIT MANAGER/LEAD with QV by SPECIFICATION & COST ESTIMATE ENGINEER
	CONSTRUCTION SUPPORT	• REVIEW FALSEWORK • REVIEW DEMO PLAN • REVIEW EXCAVATION • REVIEW SHORING • REVIEW RFIS • REVIEW SHOP DRAWING • REVIEW REPAIR PROCEDURES	CONSTRUCTION SUPPORT SUPERVISOR OR BRIDGE TECHNICAL ADVISOR

Appendix 1.3-A1 Bridge & Structures Design Calculations

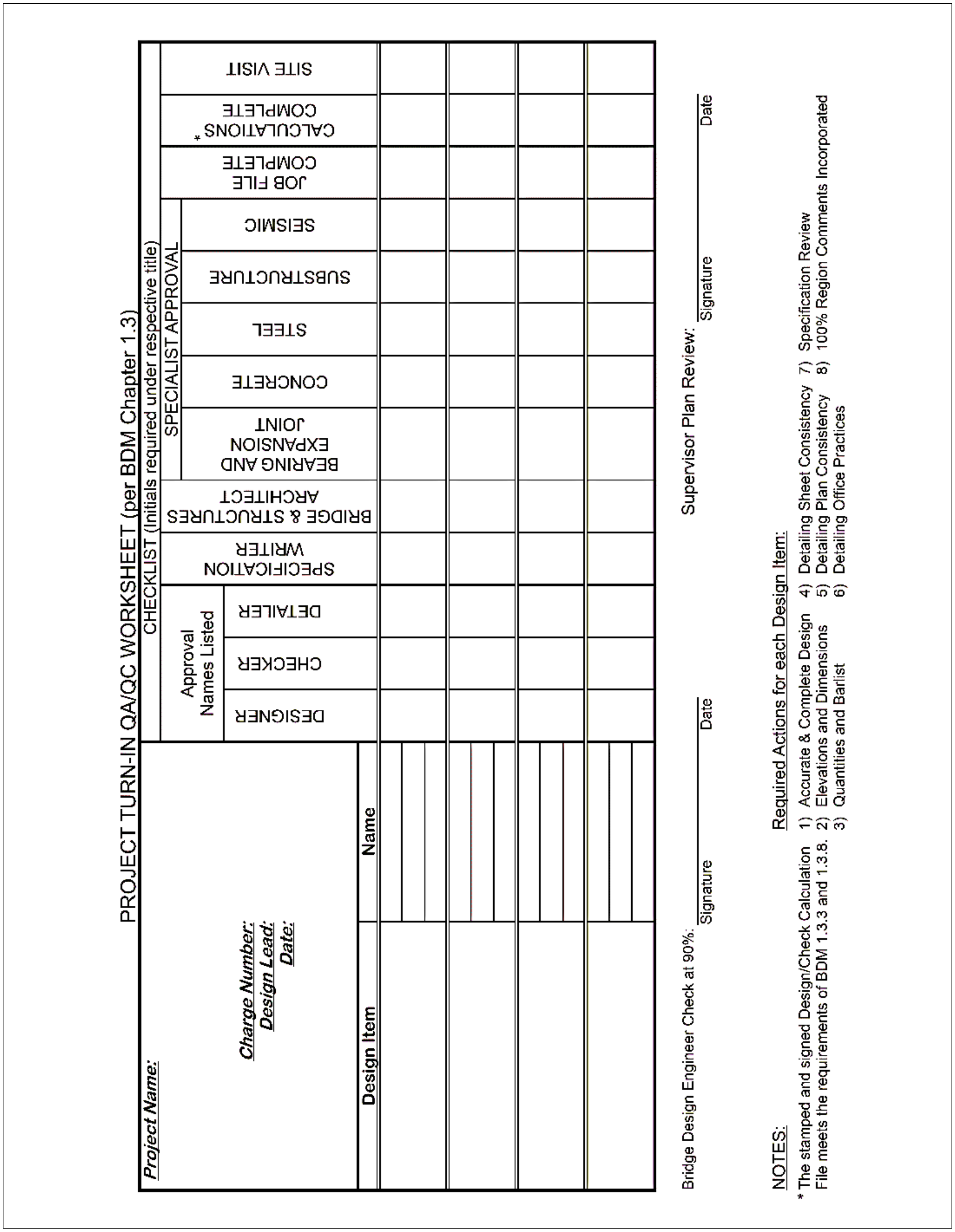
Washington State Department of Transportation

Bridge & Structures Design Calculations

Project			Sheet No. 1 of 1 Sheets		Code Reference
S.R.	Made By	Check By	Date 7/7/10	Supv	

C:\AAWork\Bridge Template.xlsx Sheet1

Appendix 1.4-A1 QC/QA Signature Sheet



PROJECT TURN-IN QA/QC WORKSHEET (per BDM Chapter 1.3)

Project Name:

Charge Number:
Design Lead:
Date:

		CHECKLIST (Initials required under respective title)												
		Approval Names Listed					SPECIALIST APPROVAL							
Design Item	**Name**	DESIGNER	CHECKER	DETAILER	SPECIFICATION WRITER	BRIDGE & STRUCTURES ARCHITECT	BEARING AND EXPANSION JOINT	CONCRETE	STEEL	SUBSTRUCTURE	SEISMIC	JOB FILE COMPLETE	CALCULATIONS * COMPLETE	SITE VISIT

Bridge Design Engineer Check at 90%: ______________________ Signature Date

Supervisor Plan Review: ______________________ Signature Date

NOTES:

* The stamped and signed Design/Check Calculation File meets the requirements of BDM 1.3.3 and 1.3.8.

Required Actions for each Design Item:

1) Accurate & Complete Design
2) Elevations and Dimensions
3) Quantities and Barlist
4) Detailing Sheet Consistency
5) Detailing Plan Consistency
6) Detailing Office Practices
7) Specification Review
8) 100% Region Comments Incorporated

Appendix 1.4-A2 Min. Requirements for Check of Contractor-Design Buried Structure

The following items shall be reviewed and verified by the Checker:

1. Conformance with alignment, profile, and dimensions as required in the Contract Documents.
2. Traffic Staging and Maintenance of Traffic requirements satisfied.
3. Conformance with AASHTO LRFD and WSDOT BDM requirements.
4. Conformance with Hydraulic Report requirements.
5. Scour and Stream Migration parameters accounted for.
6. Conformance with Geotechnical Report requirements.
7. Depth and extent of any Over-Excavation/Backfill or Ground Improvement requirements satisfied.
8. Seventy Five (75) Year Design Life requirement met or exceeded.
9. Strength, Service, and Extreme Limit State design requirements satisfied.

The calculations may be checked by either of two methods:

- A line-by-line review and initialing by the Checker.
- Independent calculations created by the Checker.

1.99 References

1. AASHTO *LRFD Bridge Design Specifications*, 10th Edition. American Association of State Highway and Transportation Officials (LRFD-BDS), Washington, D.C., December 2024
2. WSDOT *Design Manual* M 22-01, September 2024
3. WSDOT *Construction Manual* M 41-01, February 2025
4. WSDOT *Geotechnical Design Manual* M 46-03, February 2022
5. WSDOT *Hydraulics Manual* M 23-03, April 2024
6. *AASHTO Guide Specifications for LRFD Seismic Bridge Design*, 3rd Edition. American Association of State Highway and Transportation Officials (LRFD-SGS), Washington, D.C., October 2023