



Washington State Ferries

Terminal Engineering Quality Management Plan

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Quality – The degree to which a set of inherent characteristic fulfills requirements. PMBOK 6th Edition 2018

The WSF Quality Management Plan (QMP) is intended to assure consistent standard of quality for the development of final plans and design deliverables on design-bid-build projects. This QMP outlines the roles and responsibilities of all involved in the delivery of quality design products, which results in delivery of quality transportation improvement projects.

Quality is achieved by adequate planning, scoping, communications and coordination, supervision, and technical direction; by providing adequate time in the schedule for thorough reviews; by proper definition of job requirements and procedures; by the use of appropriately skilled personnel; and by individuals performing their work functions carefully. Implementing quality processes early and throughout the development of final plans ultimately saves time and helps avoid costly change orders, or scheduling delays. This QMP establishes WSDOT- Ferries Division's policy to support these measures.

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Acronyms

AOR	Architect of Record
ASCE	Assistant State Construction Engineer
ASDE	Assistant State Design Engineer
CE	Construction Engineer
CEM	Construction Engineering Manager
CR	Constructability Review
DBB	Design-Bid-Build
DC	Design Clarification
DEM	Design Engineering Manager
DOR	Designer of Record
EIS	Environmental Impact Statement
EOR	Engineer of Record
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impacts
FTA	Federal Transit Administration
GEC	General Engineering Consultants
HQ	Headquarters (Project Development Support)
IR	Interdisciplinary Review
ISOWA	Internal Scope of Work Agreement
OSR	Over-the-Shoulder Review
PE	Project Engineer
PM	Project Manager
PMP	Project Management Plan
PS&E	Plans, Special Provisions and Estimate
TDM	Terminal Design Manual
TE	Terminal Engineering
QA	Quality Assurance
QC	Quality Control
QM	Quality Manager
QMP	Quality Management Plan
QV	Quality Verification
TS&L	Type, Size and Location
WSDOT	Washington State Department of Transportation
WSF	Washington State Ferries

Definitions

Checker	The person with the necessary expertise assigned to perform detailed checks of a study, report, calculation, or drawing.
Constructability Review (~60% Design)	Previously called “60% Design”, this level of design addressed all Geometric Design Review (~30% Design) comments, design has progressed per internal scope of work agreement and discipline specific QA/QC documented. Smaller and less complex projects may skip this design milestone based upon the project team’s discretion. When the 60% design milestone review is skipped, a constructability meeting shall be scheduled at the 90% milestone.
Contract Documents Ready (100% Design)	Previously called “Ad ready”, this level of design has all Pre-contract Review (~90% Review) comments addressed, discipline specific QA/QC documented, stamped plans, stamped specifications, and the final estimate entered into e-Base. Construction schedule comments have been addressed and the total number construction working days have been identified.
Design Milestones	Typical design milestones are the following in sequential order: Site Data as applicable (~5%), TS&L(~15%), Permit Submittal (~20%), Geometric Design- basic footprint and horizontal /vertical geometry (~30%), Constructability Review (~60%), Pre-contract Review (~90%) and Contract Documents Ready (100%). A design milestone is achieved only after an interdisciplinary review has been performed and comments documented. Designers addressing interdisciplinary review comments initiates the beginning of the next design milestone.
Environmental Reviews	Environmental Reviews are performed for environmental documents produced during all phases of the Program including design. These consist of a series of programmed and scheduled work steps that ensure satisfactory and timely completion of the projects. Each document will have at least one primary QC Reviewer. Other reviewers may review each document, as determined by the Environmental Manager.
Geometric Design (~30% Design)	Previously called “30% Design”, this level of design refined the initial TS&L design, incorporated other discipline’s design based upon the TS&L and discipline specific QA/QC documented. Typically only plans are submitted during this review period. Geometric design has progressed to the point of finalizing the initial TS&L design and environmental permit applications can be submitted.
Interdisciplinary Reviews (IR)	IRs are used to help coordinate design responsibility and design details between and within various disciplines. IRs are typically performed at major review milestones (Geometric Design, Constructability Review and Pre-contract Review) to check for potential interferences and to ensure compatibility between design disciplines. Performing and documenting interdisciplinary review comments formally ends that design milestone.
Originator	Initiated a deliverable as an author, designer or other qualified person.
Over-the-Shoulder Reviews (OSR)	OSRs are performed throughout the development stage of work and provide informal input. Individuals from outside the Project Team or team members who are not directly involved in the production of the work conduct the OSRs.
Pre-contract Review (~90% Design)	Previously called “90% Design”. Prior to distributing the Pre-Contract Review plans, specifications and estimate package for interdisciplinary review, all previous review comments shall be addressed. At this review milestone, all applicable engineering discipline’s design plans, specifications and estimates must be complete and near advertisement ready with discipline specific QA/QC documented. Only minor interdisciplinary coordination and minor plan, specification and estimate updates should be needed after the pre-contract review period.

Project Team	The entire project development team comprised of all applicable disciplines responsible for developing or reviewing bid documents, including civil, electrical, mechanical and structural engineering, environmental, communications, operations, maintenance, construction, traffic, and information technology, from WSF, WSDOT, and consultants.
Type, Size and Location or TS&L (~15% Design)	Typically a conservative structural design to be used for long-lead environmental documentation or permitting applications. This design is also often referred to as a 15% Design and includes the following: pile type, pile size, pile quantity, temporary structures, benthic area footprint, over water coverage area, and anticipated construction methods. Other design disciplines not impacting environmental documentation or permitting applications are optional at this level of design.
Quality	Quality – The degree to which a set of inherent characteristic fulfills requirements. PMBOK 6th Edition 2018
Quality Assurance	Quality Assurance (QA) –actions at management levels under the jurisdiction of the Project Engineer, to observe project processes and ensure prudent quality control procedures are in place and are being carried out in accordance with the QMP.
Quality Assurance Audit	Quality Assurance Audits are performed after each QC Review to ensure and document that all QC requirements were performed. QA Audits are not limited to only the deliverable or scheduled reviews. The Project Manager/Quality Manager may choose to conduct periodic reviews to ensure the process is being followed and that proper documentation supports the product.
Quality Control	Actions at the production and administrative levels, under the jurisdiction of the Project Engineer or Discipline Manager, to produce deliverables that meet the specified performance requirements <u>Quality Control is a production tool.</u>
Reviews	Reviews are performed on all deliverables and supporting documentation, to verify they are complete and understandable, conform to project standards, are numerically accurate, and meet the projects expectations. Project team members perform these reviews. These Checkers or Reviewers will have similar experience or maintain more experience with design discipline knowledge and professional qualifications, in comparison to the Originator of the work element under review. A set of checklists have been included in this manual to provide guidelines, to minimize discrepancies, and to facilitate with the verification and coordination efforts.
Quality Verification (QV)	Actions employed at HQ Project Development Division and Region, under the jurisdiction of the State Design Engineer, or designee, to selectively review final products to ensure a QMP was implemented; the appropriate project development process was followed and reflected in the final contract document.

1.0 INTRODUCTION

This document is the WSF Terminal Engineering Quality Management Plan (QMP) for design. It provides the framework to design quality management practices, procedures and expectations associated with quality during a project's design phase. The QMP improves project quality by verifying the engineering behind the design and by ensuring the Plans, Special Provisions and Estimates packages are comprehensive, clear and enforceable.

1.1 Purpose

The purpose of this QMP is to provide Quality Assurance (QA) and Quality Control (QC) procedures that will help to achieve high-quality products and services from the WSF design team and ensure that the design deliverables are in compliance with the following project compliance documents.

- Scoping Documents
- WSF Terminal Design Manual (TDM) – in effect at the time of the Design Approval.
- Project Design Approval Document
- WSDOT Standard Specifications – edition in effect at time of construction including Amendments to the Standard Specification, General Special Provisions (GSPs), and Regional General Special Provisions (RGSPs)
- AASHTO LRFD Bridge Design Specifications – in effect at the time of the Design Approval.
- International and local Building Codes – in effect at the time of the Design Approval.
- Basis of Design (BOD) Document when developed by design team and approved by WSF
- Responses to Design Clarifications
- Approved Design Analyses to Criteria Above

The design deliverables will also comply with any modifications to the project contract. Such modifications will be recognized in the QMP by reference to the contract amendment date. If required by the content of the amendment, a revision to the QMP will be made. Modifications may additionally be introduced into the project by the Design Clarification (DC) process explained below.

1.2 Background

On November 20, 2018, the Washington State Department of Transportation (WSDOT) Headquarters Design Office approved a memorandum emphasizing the importance of quality during the design phase. The memorandum stated, "WSDOT has determined that it is a priority to provide for improvements to the process used in providing quality on each phase of Project Delivery. WSDOT has successfully been performing quality control (QC) in various ways from region to region, specialty office to specialty office, and program to program for many years. However, at this time there is no single policy or centralized process guiding the conduct of this function statewide."

2.0 DESIGN TEAM PROJECT QUALITY RESPONSIBILITIES

The design of the project is broken down into individual areas of responsibilities by discipline. For each discipline and for each portion of the work, a designer-of-record (DOR) is responsible for the quality of the design. Where the designation engineer of record (EOR) or architect of record (AOR) is used it shall be the same as DOR. The QA responsibilities are organized to include a QC/QA manager for the project and a QA manager for each discipline. The project manager will serve as a reviewer of the work products.

Each discipline's DOR(s) will be responsible for key elements of the design which will include the following:

- Assuring their work products have been fully checked and coordinated prior to passing on these work products to the project team for the coordination check

- Reviewing comments by the project team after the team-wide coordination check is completed
- Resolving any differences between review comments from team members and documenting the results
- Assuring the necessary comments are addressed in the finished work

The responsibilities of each QA manager will include the following.

- Verifying that their discipline has provided the necessary resources for quality control, including adequately experienced staff assigned to checking their discipline's work products
- Assuring their discipline is following project requirements (current versions) described below and any QC/QA plan requirements specific to their discipline
- Acting as an independent reviewer when needed, checking portions of the work products for their discipline as well as checking coordination with the work products of other disciplines on the design team
- Maintaining work documents used for checking and coordination
- Providing a completed submittal sign-off sheet for their discipline's work to the Project Manager at each submittal

The procedures described herein shall be the minimum quality control/quality assurance protocol. Since each designer is responsible for the quality of their deliverable, it is their responsibility to determine if these minimum requirements are sufficient or if additional QC/QA procedures need to be implemented through their own internal QC plans.

3.0 QUALITY REVIEW PROCEDURES

3.1 Quality Control Checks

The fundamental principle of the project organization is that the DOR is responsible for the design of the portions of the project under their discipline's control. The project manager will coordinate with each discipline's manager to provide the necessary resources to perform the appropriate quality control activities. If quality control resources are not available, that discipline's manager shall notify the project manager to coordinate identifying appropriate resources. Staff assigned review sign-off responsibilities will have adequate experience to evaluate the items they are assigned.

3.2 Detailed Procedures for Checking Project Documents

This section provides clarification for the checking of drawings, calculations, computer inputs, specifications, and quantities. The level of checking will be performed during the interdisciplinary review period. Although schedule should not dictate the performance of QC/QA reviews, the project schedule does have an influence since certain deadlines are inflexible. For example, at the constructability review level (~60% Design), the thoroughness of the checking will be sufficient to verify that the direction of the project is complying with requirements but not to the level that each piece of information is fully checked. As the first level of checking, the originator of the document will perform necessary checks to verify their product, when delivered to the checker, is correct and coordinated appropriately for the level of design. The checker will then perform their review, highlighting in yellow all items checked that are correct or marking necessary corrections or clarifications in red. It will be the responsibility of the originator/designer to make the corrections as noted by the checker or to gain agreement with the checker on an acceptable resolution to the correction or comment. When the document is updated, the checker will verify that the correction has been satisfactorily incorporated.

At the "Pre-Contract Review" submittal level (~90% Design), the above procedure will be repeated but the review will be in greater detail.

A rigorous review will be performed prior to “Contract Documents Ready” (100% percent). This submittal will be the basis for the construction documents. This review is expected to take between 2 to 4 weeks to complete depending on the complexity of the project. The thoroughness of the review will be consistent with the level required by typical Department of Transportation projects. The Terminal Design Manual contains excerpts from the State of Utah QC plan that provides guidelines for the level of detail and process for performing and documenting the QC checking that is expected by WSF.

3.3 Sign-Off Sheets and Checklists

After completing the procedure described in the previous section, a sign-off sheet will be generated by each discipline performing design services on this project. The submittal sample sign-off sheets are provided in the appendices within the Terminal Design Manual. Blank forms of the sheets for each submittal are available from the Project Manager or Discipline Engineering Manager. Each submittal item will have a sign-off for originator of the document, who will either be the DOR or his/her designee. The submittal items will also be signed by the reviewer, who will be either the discipline’s QA manager or his/her designee. Signatures indicate that the submittal products comply, to the best of the individual’s knowledge, with the project requirements as listed in the reference documents in Section 1.1, and additionally with the modifications introduced into the project formally by the Design Clarification (DC) process.

The DCs will be tracked by the project manager and included into the design submittals when returned within the required time frame identified in the project schedule. A sample DC form can be found within the appendices of the Terminal Design Manual.

In addition to the submittal item sign-offs required of the submittal originator and reviewer, there will be sign-offs required from the QA manager or his/her designee. These include assurance that all documents including DCs relevant to the discipline’s submittal have been complied with, assurance that the drawings and specifications are consistent with one another, assurance that interdisciplinary interfaces and areas of coordination have been reviewed, and that construction requirements have been addressed in the submittal.

If a sign-off is not relevant, then NA (not applicable) will be substituted on the sign-off line. If a submittal item is not included, for whatever reason, NI (not included) will be on the sign-off line. If separate submittals are made for items that are not included, for whatever reason, in one of the required submittals, then a sign-off sheet will accompany the separate submittal.

There are no mandatory checklists that must be included with this plan, beyond those on the forms identified above. Because the documents referenced in Section 1.1 are the basis of the overall design, these documents themselves should also be used a reference to check if a design’s progress is in line with the project’s objective. It is permissible for any discipline to develop additional checklists to aid their production of project compliant submittals. However, such checklists are not part of the formal QMP.

4.0 QUALITY MANAGEMENT PLANS AND SCALABILITY

Each project must have a formal QC/QA process for both contract plan development. The plan can be contained within the Project Management Plan if the project is small and less complex, or a standalone project specific quality management plan can be developed if the project is complicated and/or multi-phased.

FIGURE 4 – QMP SCALABILITY

Project Type	Project Complexity	Operational Impacts	Project Budget (PE+CN+RW)	CN Duration	Documentation
Berthing Structures, ADA projects, Illumination projects, Security	1 or 2 Design Disciplines	Low – short duration operational impacts	<\$10M	1 CN Season	PMP QMP or WSF TE QMP
Project contains 1 or 2 of the following: Buildings, Trestles, Passenger Overhead Loading, or Vehicle Transfer Spans.	2 or 3 Design Disciplines	Medium	≥\$10M and < \$30 M	2 CN Seasons	WSF TE QMP
New Terminal or Project contains 3 or more of the following: Berthing Structures, Buildings, Trestles, Passenger Overhead Loading, or Vehicle Transfer Spans.	3 or More Design Disciplines	High-long term operational impacts or closures.	≥\$30M	2 or more CN Seasons	Project Specific QMP

5.0 Design Milestone Review Cycles, Review Durations & Deliverable Requirements

All projects need to receive a reasonable level of interdisciplinary reviews (IRs) in order to achieve a Design Milestone. The following review cycles, review durations and deliverable requirements are identified for project delivery based on project type, complexity and budget.

FIGURE 5 – INTERDISCIPLINARY REVIEW REQUIREMENTS

Project Type	Project Complexity	Approximate Project Budget (PE+CN+RW)	Review Cycle	Review Duration	Review Requirements
Berthing Structures, ADA projects, Illumination projects, Security	1 or 2 Engineering Disciplines	<\$10M	Geometric Review (~30% Design)	1 week min	Plans and Estimate
			Pre-contract Review (~90% Design)	2 weeks	Plans, Specs, Estimate, and CN Schedule
Project contains 1 or 2 of the following: Buildings, Trestles, Passenger Overhead Loading, or Vehicle Transfer Spans.	2 or 3 Engineering Disciplines	≥\$10M and <\$30M	Geometric Review (~30% Design)	2 weeks	Plans and Estimate
			Constructability Review (~60% Design)	3 weeks	Plans, Estimate, and Draft CN Schedule
			Pre-contract Review (~90% Design)	3 weeks	Plans, Specs, Estimate, and Final CN Schedule
New Terminal or Project contains 3 or more of the following: Berthing Structures, Buildings, Trestles, Passenger Overhead Loading, or Vehicle Transfer Spans.	3 or More Engineering Disciplines	≥\$30M	Geometric Review (~30% Design)	2 weeks	Plans and Estimate
			Constructability Review (~60% Design)	4 weeks	Plans, Estimate, and Draft CN Schedule
			Pre-contract Review (~90% Design)	4 weeks	Plans, Specs, Estimate, and Final CN Schedule

6.0 QMP Performance Metrics

The WSF Terminal Engineering Design Quality Management Plan establishes the following performance metrics, in Figure 6 below, to track the quality performance from design through contract completion.

FIGURE 6 – QUALITY METRICS

Performance Metric	Performance Target (per contract)	5 Year Historical Average (Jan 2013 to Dec 2017)	Last Year's Average (Jan 2016 to Dec 2016)
Number of Addenda	Reduce 25% from the 5 year average/program	W1 – xx < \$10M – xx ≥\$10M & <\$30M-xx ≥ \$30M - xx	W1 – xx < \$10M – xx ≥\$10M & <\$30M-xx ≥ \$30M - xx
Over/Under Engineer's Estimate	All Other +/-10%	W1 – xx% within +/-10% < \$10M – xx% within +/-10% ≥\$10M & <\$30M - xx% within +/-10% ≥ \$30M - xx% within +/-10%	W1 – xx% within +/-10% < \$10M – xx% within +/-10% ≥\$10M & <\$30M - xx% within +/-10% ≥ \$30M - xx% within +/-10%
Plan Error Change Orders	Reduce 25%	W1 – xx < \$10M – xx ≥\$10M & <\$30M-xx ≥ \$30M - xx	W1 – xx < \$10M – xx ≥\$10M & <\$30M-xx ≥ \$30M - xx
Contract Changes exceeding 4% contingency	Reduce 25%	Percentage exceeding 4% contingency (all contracts) W1 – xx% < \$10M – xx ≥\$10M & <\$30M-xx ≥ \$30M - xx	Percentage exceeding 4% contingency (all contracts) W1 – xx < \$10M – xx ≥\$10M & <\$30M-xx ≥ \$30M - xx

7.0 Lessons Learned/Post Construction Evaluations

Once a project is built, the emphasis moves to documenting lessons for the benefit of future projects. This could simply include a list of problems encountered during design and construction and how those problems were resolved. It could also include meeting with the contractor to review the project, or meeting with the design team to convey what went well during construction, or what may be improved. Lessons learned may be used to revise existing templates, initiate writing a new RGSP, or require a revision the WSF Terminal Design Manual. These are principles of continuous quality improvement and include learning and understanding requirements and expectations, using quality improvement tools, involving all personnel in the process.

A periodic “Lessons Learned” meeting has been established at WSF Terminal Engineering to review existing design and construction projects. Discussion will cover what may or may not have worked, and how to continually improve upon and continue to produce successful contracts for bid. Maintenance, design, construction, and environmental managers are invited to this meeting.

Additionally, all lessons learned may be placed on the WSDOT Lessons Learned website at <http://wwwi.wsdot.wa.gov/Projects/Delivery/LessonsLearned/>. It is an on-line, automated database designed to capture, present, and track lessons learned from the department’s project delivery program. The intent of this system is to share lessons learned and best practices to avoid repeating past issues.

8.0 WSDOT Best Quality Practices Library

WSDOT HQ Quality Office has established and will maintain a Best Quality Practices (BQP) library. This library is a repository of tools from all WSDOT regions that will be helpful in producing quality deliverables. The library will provide a baseline set of tools from which offices or regions can choose to insure quality goals are met.