

VERMONT AGENCY OF TRANSPORTATION

# Highway Safety & Design Quality Control Plan

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12/18/2015

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## INTRODUCTION

### **PURPOSE:**

The VTrans Highway Division is responsible for maintaining Vermont's highway system and consists of multiple Bureaus, each of which has unique responsibilities associated with Vermont's highways. One of those Bureaus is the Project Delivery Bureau, this Bureau responsible for producing project plans for a wide range of highway projects. The Project Delivery Bureau consists of multiple Sections, each of which has unique design elements, plan development techniques, and review procedures. Due to these differences, it was not feasible to develop a single Quality Control Plan (QCP) that would meet the needs of all of the individual Sections. Highway Safety & Design has recognized these differences and has developed a QCP that is tailored to their specific design and development procedures.

The intent of the Quality Control Plan is to improve quality, clarity, consistency and constructability of the Highway Safety & Design Section's plans, estimates and documents, through increased communication and feedback between design and field personnel.

### **OBJECTIVE:**

The main objective is to provide a document that clearly outlines and identifies the elements of the Highway Safety & Design Section (HSD) QCP. This document will serve as a reference to designers and managers alike, and will detail processes, along with corresponding roles and responsibilities, that shall be employed throughout a project's design to ensure systematic and consistent project design, documentation, development, and review.

This document is intended to be a living document. HSD recognizes that there will always be new, innovative tools and information available that may improve efficiency and quality. HSD will review and update this document periodically to incorporate new concepts obtained from research and feedback provided by design, review, and field personnel.

### **DEFINITION OF TERMS:**

**Quality Control (QC):** Quality Control refers to those actions, procedures, methods, and goals/targets that are routinely employed, as described in the Quality Control Plan, at the production and administrative levels under the jurisdiction of the Project Manager, to produce a quality project.

**Quality Control Review (QCR):** The Quality Control Review (QCR) is the review conducted by the Design Team prior to any other reviews. This is an internal review for the design team, to be conducted under their procedures and methods. The QCR is intended to help provide a quality and as error-free as possible submittal to reviewers.

**Quality Assurance (QA):** Quality Assurance refers to those actions, procedures, and methods employed at the management and senior technical levels to ensure that practical quality control procedures are available, implemented, and utilized, resulting in the production of a quality project.

**Quality Assurance Review (QAR):** The Quality Assurance Review (QAR) is the review which allows the Highway Safety & Design, Technical Development Unit to review and comment on the plans.

**Online Shared Review (OLSR):** The Online Shared Review (OLSR) is the review which allows other sections and divisions within the Agency, as well as other interested parties outside the Agency, to review and comment on the plans as applicable. This review is administered, upon request, by the Technical Development's Online Shared Review Coordinator.

### STAFF AND RESPONSIBILITIES:

**Program Manager:** The Program Manager is ultimately responsible for the accuracy and quality of projects produced by HSD. The Program Manager will ensure the development, implementation, and performance of the QCP and will work in coordination with the Project Managers and Design Teams to ensure that adequate resources are provided.

**Project Manager:** The Project Manager has primary management responsibility throughout a project's development and is responsible for allocating resources to specific project components based on schedule and budget, and identifying and resolving problems or conflicts that arise. The Project Manager or Project Supervisor is responsible for technical review and approval of project documents and maintains frequent communication with other Divisions/Sections within VTrans, local governments, other state agencies, and the general public.

In order to efficiently perform the duties described above, it is critical that the Project Manager instructs designers to utilize the QCP throughout a project's design and development. A project's cost, schedule, and scope are constraining factors, and the Project Manager will need to consider the work associated with the QCP in order to develop accurate cost estimates, plans, specifications, and project schedules. The Project Manager will be responsible for conveying project status and review requirements to members of HSD. It shall be the Project Manager's responsibility to ensure that Quality Control processes, practices and reviews are implemented on all projects.

**Project Supervisor:** The Project Supervisor shall be responsible for working with the Design Team to ensure a project's design progresses in accordance with the Project Manager's project schedule. The Project Supervisor shall work with the Project Manager to ensure he/she is aware of any issues that may need to be brought to the attention of the Project Team.

**Technical Development Engineer:** The Technical Development Engineer is responsible for periodically reviewing and updating the QCP. He/she will have frequent communication with the Performance Unit as well as other Divisions/Sections to gauge the QCPs effectiveness and any potential areas of improvement.

The Technical Development Engineer shall be available to assist Project Managers, Design Teams, and Review Teams with interpretation and implementation of the QCP, and assist or participate in project reviews. The Technical Development Engineer is responsible for gathering and distributing any and all new or modified information related to project design, plan development, cost estimating, performance objectives, etc.

**Design Team:** The Design Team shall include all designers involved with the project's design, including consulting engineers, and will be responsible for all aspects of a project's design, including detailed design documentation. The Design Team shall consider and implement aspects of the QCP throughout a project's design. The Design Team shall be available to address questions or concerns as they arise during project reviews as described in the QCP. The Project Manager, and if applicable, the Technical Development Engineer shall provide immediate and constant feedback to Design Team engineers or consultant designers regarding the accuracy, completeness, consistency, and attention to detail of completed design activities, plans, specifications, and cost-estimates.

**Project Team:** The Project Team will consist of the Project Manager, Design Team, and technical support staff including but not limited to, representatives from: Environmental Section, Right-Of-Way Section, Materials and Research Section, Traffic Research Section, etc. The Project Team shall be utilized as a resource throughout a project's development as well as during project reviews. The Project Team's main purpose is to assist the Project Manager with developing and advancing the project design and resolving delaying issues. To facilitate this assistance, the Project Manager is encouraged to meet regularly with the Project Team to review project scope issues, discuss and resolve design-related issues, assign project deadlines, resolve scheduling conflicts, and to monitor progress. The Project Manager then develops the necessary "Action Plan" to resolve any design-related issues or delays and proposes these recommendations to the Program Manager so any resource (staffing support or project funding) issues may be resolved.

**Review Team:** The Review Team shall consist of a minimum of two peer level engineers or technicians who are not members of the Design Team and a one member from the Design Team. The remainder of the Review Team will be independent from the Design Team, and will not be actively involved in a project's design. The Review Team will be responsible for detailed review of a project's design documentation, plans, estimate, etc. The Review Team will not be assembled for every project but only those projects where it is deemed necessary by the Project Manager.

## QUALITY CONTROL PLAN

### INTRODUCTION:

Quality Control is the processes, practices, reviews, and quality targets that ensure systematic and consistent project design, documentation, and development. HSD shall adopt this document as their QCP and shall implement the corresponding processes and practices on all projects produced by the Section. These processes and practices should be utilized and considered on a daily basis by the Design Teams and their Consultants.

### REVIEW ELEMENTS:

The following are required elements for reviews; all elements listed below may not be needed, or applicable, for all reviews, see Appendix A for specific submittal requirements. Additional materials may be submitted for review as necessary, based on individual project characteristics.

**Project Plans:** Project plans are prepared by the Design Team under the supervision of a Project Manager or Project Supervisor. A project's design and plans are developed using numerous sources of information, including, but not limited to: project site characteristics and constraints survey data, reports, and record drawings. Project plans are prepared in conformance with applicable design standards and guidelines.

**Project Estimates:** Project estimates are prepared by the Design Team under the supervision of a Project Manager or Project Supervisor. A project's estimate is typically developed using the *Estimator* software or when applicable research on specific items or bid histories.

**Permit Conditions:** Applicable project permits may have specific conditions and/or restrictions associated with them. These conditions and/or restrictions may influence how the Design Team designs specific project elements and should be provided to the Review Team.

**Design Calculations:** Design calculations are prepared by the Design Team under the supervision of a Project Manager or Project Supervisor. Design calculations shall be prepared to

clearly identify the subject and shall be organized to facilitate a review. All supporting material such as graphs, tables, and data sheets, as well as references to relevant sources, shall be included.

**Quantity Calculations:** A list of applicable pay items and a corresponding quantity calculation book shall be prepared by the Design Team under the supervision of a Project Manager or Project Supervisor. Quantity calculations shall be neatly prepared and organized to facilitate a review.

**Project Correspondence:** Project correspondence submitted for review shall be limited to that which justifies design assumptions, design decisions, or material that is deemed relevant by the Project Manager for a complete and accurate review. The submittal of applicable project correspondence should reduce the number of comments provided by the Review Team. Submittal of all project related emails and correspondence is not required.

## REVIEW PROCESS:

During a project's initial schedule development, the Project Manager shall review the project scope and identify which stages of plan development shall be reviewed. The Project Manager will then have a defined review schedule, knowing specifically which stages of plan development will require an OLSR. The Project Manager shall utilize this information and provide, at least, the minimum amount of review time (see Appendix A for minimum review times) required in the Artemis project schedule for each OLSR. By default, QARs shall occur concurrently with the OLSR, requiring no additional time to be built into the Artemis project schedule. However, when deemed necessary by the Project Manager, QARs can be conducted prior to the OLSR. When this occurs the Project Manager shall account for the additional time requirements associated with an independent QAR. It will be the responsibility of the Project Manager to maintain updated Artemis project schedules and for the Technical Development Engineer to be prepared for all OLSRs and QARs based on those schedules.

Although all projects will be reviewed at certain stages it is important that the Design Team review their own work, to ensure quality and as error-free as possible submittals are being sent out for review the Design Team shall complete a QCR prior to any submittal, the QCR shall include all elements required at the applicable plan development stage. For projects of complex scope, the Project Manager may assemble a Review Team with an assigned lead reviewer to conduct the QCR.

Throughout a project's development the Design Team, supervised by the Project Manager or Project Supervisor shall maintain a detailed, organized, and properly named project file. All project plans, project estimates, design calculations, design decisions, design assumptions and quantity calculations should be properly documented and saved as part of the project file. These documents are essential to a comprehensive review and shall be complete and up to date at each review submission. After a project's Preliminary Plans have been developed, reviewed, and comments addressed, the Design Team shall maintain a Design Change Order Worksheet. Minimal changes should occur between this project stage and a project's advertisement, and a Design Change Order Worksheet will help to track these changes. This sheet will also assist the Technical Development Unit or Review Team to identify modifications that have occurred since the previous submittal. The intention of the Design Change Order Worksheet is to document significant changes on projects with a complex scope, Right Of Way requirements, or Utilities requirements, projects of less complex scope may omit the Design Change Order Worksheet.

The Technical Development Engineer shall be notified of all reviews, for OLSRs this shall be done by selecting Highway Safety & Design as a reviewer in the OLSR. When independent QARs are required prior to the OLSR the Technical Development Engineer shall be notified in writing. The Project Manager, Project Supervisor, or Lead Designer shall review all material identified in Appendix A prior to submittal for an OLSR, or QAR when applicable. All materials identified in Appendix A shall be submitted for each review submittal. For independent QARs the submittal should occur a minimum of four weeks in advance of the OLSR start dates, allowing approximately 2 weeks for the QAR and 2 weeks for addressing comments from the QAR.

The Technical Development Engineer should complete QARs within the timeframe identified in the OLSR, for independent QARs the Technical Development Engineer should complete the reviews by the deadline identified in the Artemis project schedule. If no activity exists for a QAR in the project schedule the review should be completed by the deadline included in the submittal. When scheduling conflicts arise the Technical Development Engineer shall coordinate with Project Managers to adjust deadlines as needed. The Technical Development Engineer shall perform detailed reviews ensuring conformance with applicable design/CADD standards and guidance, and other related design resources.

The OLSR process automatically compiles all comments, questions, and suggested modifications. However, when an independent QAR is conducted the Technical Development Engineer shall compile all comments and submit electronically to the Project Manager. The Technical Development Engineer shall provide these comments by the scheduled deadline in Artemis. The Project Manager shall acknowledge receipt of the comments, and upon receipt of comments, he/she in coordination with the Design Team shall review all comments and evaluate and make modifications as necessary. The Design Team shall have a minimum of two weeks to complete this work; additional time should be scheduled by the Project Manager based on project complexity.

It is recognized that the OLSR process provides valuable feedback on a project's overall development and aides in the development of a quality product, in order to ensure that continued and quality feedback is received on all projects it is important to respond to all reviewers, notifying them that their feedback is taken into consideration. The Project Manager, or designated staff, shall make every effort to provide a response that outlines and provides justification for all significant modifications that were or were not implemented by the Design Team. Note that "significant" describes those comments that are directly related to design and/or constructability and do not include spelling errors, drafting preferences, etc. Those comments that are addressed do not require individual responses; however, a general response shall be submitted explaining that they were addressed and/or corrected. The decision of the Project Manager may be appealed through the management of the commenting section to the HSD Program Manager as necessary. Communication between the Project Manager and external reviewers for comments and responses will primarily be through the use of OLSR. In the event that comments are received through meetings with reviewers, there shall be minutes prepared that summarize the comments received. The Project Manager shall respond to all significant comments. The response shall be made in the OLSR or in memo form if appropriate. The Project Manager will be responsible for submittal of comment/responses to the reviewing entity. All projects, Consultant or In-House, shall following this process with the exception that the Project Manager may designate the Consultant to prepare responses to review comments.

The Design Team, or Review Team when applicable, should also document any inconsistencies, errors, or questions related to design standards, including, but not limited to: standard drawings, state standards, CADD standards, project checklists, etc. These inconsistencies, errors, or questions should be described in an email to the Technical Development Engineer.

QARs should occur at all plan development stages that are submitted for review, with the exception of Pre-Contract Plans. The intent of the Pre-Contract Plans review is to allow interested parties the opportunity to review the draft special provisions and Pre-Contract Estimate. Project plans are considered complete at this stage and should be used for reference only.

During a project's advertisement and construction periods the Project Manager, in coordination with the Contract Administration and Construction Sections, shall maintain a detailed account of significant questions from external parties relating to the project's design or plan development. This shall also include any significant modifications that were made to the design while under construction. Once construction on a project has been completed, the Project Manager shall provide the Technical Development Engineer with a memorandum describing/listing the significant questions raised, change orders, and lessons learned.

The presence of a defined Review Schedule is in place to ensure that projects produced by HSD are consistent, accurate, and constructible. The Design Team should not rely solely on these reviews, and must

implement consistent quality control actions, procedures, and methods on a daily basis throughout a project's design.

### REVIEW SCHEDULE:

The following review schedule outlines plan development stages within a typical project's life and details the complexity of the review that shall occur at each stage. Please note that this review schedule is intended for a typical project and not all projects will require review submittals for all stages. While all reviewers associated with an OLSR are expected to review aspects of project plans relative to their expertise the QARs shall review the elements of a submittal as outlined below.

**Conceptual Plans:** The key elements of Conceptual Plans typically include defined horizontal/vertical alignments as well as typical sections. The QAR will focus on these elements and ensure that the Conceptual Plans meets applicable design standards, design guidelines, the "VAOT CADD Standards and Procedure Manual" and any other applicable guidance. Although Conceptual Plans do not contain detailed design work such as drainage design, operational/construction stormwater, and traffic control all elements included in the Conceptual Plans should be reviewed to ensure they are complete and as error free as possible as described in the HSD Conceptual Plan Checklist. The Technical Development Engineer will provide recommendations for the Design Team to consider as they progress through the design through the QAR.

**Preliminary Plans:** Preliminary Plans typically show all design elements associated with a construction project including the preliminary estimate. The QAR will ensure that the Preliminary Plans meet applicable design standards, design guidelines, the "VAOT CADD Standards and Procedure Manual" and any other applicable guidance. In addition to this the QAR shall ensure all design calculations, quantity calculations, estimates and other design documentation are consistent throughout the project files, Preliminary Plans and estimate. The QAR should ensure the Preliminary Plans are complete and as error free as possible as described in the HSD Preliminary Plan Checklist. The Technical Development Engineer will provide comments on any elements of the Preliminary Plans where errors, omissions and ambiguity are identified.

**Final Plans:** Final Plans show all design elements associated with a construction project and are considered substantially complete, including the estimate and proposed special provisions. The QAR will ensure that the Final Plans meet applicable design standards, design guidelines, the "VAOT CADD Standards and Procedure Manual" and any other applicable guidance. In addition to this the QAR shall ensure all design calculations, quantity calculations, estimates and other design documentation are consistent throughout the project files. The QAR should ensure the Final Plans are complete and as error free as possible as described in the HSD Final Plan Checklist. The Technical Development Engineer will provide comments on any elements of the Final Plans where errors, omission and ambiguity are identified. Because this will be the only review that will allow reviewers to comment on the special provisions and project plans at the same time all projects shall undergo a Final Plan Review.

**Pre-Contract Plans:** Pre-Contract Plans are considered complete and a detailed review of the plans is not required. Pre-Contract Plans shall include Draft Special Provisions and the Pre-Contract Estimate. The QAR will ensure accuracy and consistency between the Draft Special Provisions, Pre-Contract Estimate and Pre-Contract Plans. A detailed review of Pre-Contract Plans should only occur if it is identified on the Design Change Order Worksheet that a modification has been made between Final Plan and Pre-Contract Plan submittals.

**Contract Plans:** Contract Plans are considered complete and no review is required at this stage.

## QUALITY CONTROL PLAN PRESERVATION

### COMMUNICATION:

Communication is critical to the success of the HSD QCP. Throughout a project's life the Technical Development Engineer shall be available to all parties, providing assistance and guidance, as well as answering questions. The Technical Development Engineer shall work in coordination with the Performance Unit, Project Managers, and field personnel to compile and reviews received comments and identify common errors and omissions that occurred during project development and construction. It shall be the responsibility of the Technical Development Engineer to maintain an open line of communication to the Project Managers, Design Teams, and Review Teams specifically providing guidance regarding areas for improvement.

This document is intended to be a living document, meaning that HSD recognizes that there will always be new, innovative tools and information available that may improve efficiency and quality. All members of HSD are encouraged to provide comments, suggestions for improvement, or general feedback to the Technical Development Engineer in an effort to produce a better product.

### DESIGN GUIDANCE DOCUMENTS:

There are numerous design guidance documents and resources available to members of HSD. One of the most important duties of the Technical Development Engineer will be to review these documents and develop an organized list for use by the Design Teams and Review Teams. The Technical Development Engineer shall work towards developing sample plan sets and corresponding project review guidance and checklists.

### TRAINING:

The Technical Development Engineer shall review comments received during all reviews. Based on these comments the Technical Development Engineer shall identify specific training needs of HSD to improve future performance and plans. The intent of these training opportunities is to allow HSD staff to maintain their technical skills and acquire additional knowledge regarding design elements and plan preparation. Some of the topics may include CADD elements, erosion prevention and sediment control, hydraulics and hydrology, pavement design, work zone design, etc. The identified training needs will be included in the Annual HSD Quality Control Report. The Technical Development Engineer shall work in coordination with the Program Manager to develop HSD attendee lists that would best support the Section.

## QUALITY CONTROL PLAN PERFORMANCE

### SUMMARY:

All Project Managers are expected to follow and implement the HSD QCP. Compliance, by all Project Managers, at all applicable plan stages is expected. A formal submittal for an OLSR, that meets the schedule and requirements described in Appendix A is defined as compliant. Note that schedule and resources may not allow for a complete review, advance coordination and agreement between the Project Manager and the Technical Development Engineer in these instances will be considered compliant.

### TRACKING:

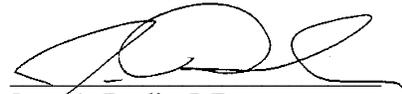
By January 31<sup>st</sup> of each year, the Technical Development Engineer shall deliver to the Highway Division Chief Engineer and Highway Safety & Design Program Manager a report that documents the effectiveness

of the HSD QCP over the past year. This report shall summarize the following Key Performance Indicators:

- Percent of projects adhering to the HSD QCP
- Percent of projects with PS&E estimates within 10% of the low bid
- Percent of projects with a final construction (at substantial completion) costs within 5% of the low bid
- Percent of projects with a substantial completion on or before the original Contract Completion Date.
- Estimated Construction Engineering Costs Vs. Actual Construction Engineering Costs (There is currently no baseline for this, all projects will be considered, by project type, until criteria is developed).

In addition to these Key Performance Indicators the report shall also contain information related to addenda sent and questions received on advertised projects, project estimates, bid result analysis as well as analysis of recorded mistakes/comments. The report shall identify areas that need improvement, layout definitive goals for the upcoming year, document any corrective actions taken, and recommend modifications to the HSD QCP. This report shall be utilized as a learning mechanism, used to ensure that HSD is producing accurate and quality projects.

## SIGNATORIES



Jesse A. Devlin, P.E.  
Highway Safety & Design Program Manager

12/18/2015

Date

APPENDIX A

**Project Review Requirements**

In order to ensure consistent review submittals, the following matrix has been developed to identify what elements shall be included or available at each phase of review and how much time shall be scheduled for each review. All elements denoted with an **X** shall be provided to the QCU as a PDF, and all elements noted with an **O** shall be complete and available in the project files at the corresponding review phase.

Plan Set	Estimate	Design Calculation Sheets	Quantity Calculation Sheets	Proposed Special Provisions*	Draft Special Provisions**	Plan Checklist***
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**Conceptual Plans: 2 Week Minimum**

X	X	O				O
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**Preliminary Plans: 3 Week Minimum**

X	X	O	O			O
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**Final Plans: 3 Week Minimum**

X	X	O	O	X		O
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**Pre-Contract Plans: 1 Week Minimum**

X	X				X	
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\* Proposed special provisions are those special provisions developed for the project prior to Contract Administration developing special provisions. These shall be for specific items associated with the project, they may be newly developed special provisions, previously used special provisions, or construction items that have been modified. All proposed special provisions that have not previously been used shall be drafted prior to Final Plan reviews and shall include all pertinent information and special provisions that require modification of existing items shall also be drafted prior to Final Plan reviews.

\*\* Draft special provisions are those special provisions developed by Contract Administration and provided via the Pre-Contract Plan Submittal Response Form.

\*\*\* Plan checklist shall be the current version available as provided by the Technical Development Engineer and shall be available in the project file before OLSR will commence.