

# **Construction Quality Management Toolkit**

Prepared for:  
Wisconsin Department of Transportation

Prepared by:  
Walling Consulting Services, LLC

October 2017

# Table of Contents

<a href="#">Introduction.....</a>	<a href="#">1</a>
<a href="#">Approach.....</a>	<a href="#">2</a>
<a href="#">What is Quality.....</a>	<a href="#">3</a>
Construction Quality Management Toolbox	
<a href="#">Toolbox Preface.....</a>	<a href="#">5</a>
<a href="#">Roles and Responsibilities.....</a>	<a href="#">5</a>
<a href="#">List of Acronyms.....</a>	<a href="#">7</a>
<a href="#">Documentation Focus Area.....</a>	<a href="#">8</a>
<a href="#">Communications and Relationships Focus Area.....</a>	<a href="#">20</a>
<a href="#">Contract Management Focus Area.....</a>	<a href="#">29</a>
<a href="#">Resources Focus Area.....</a>	<a href="#">38</a>
<a href="#">Testing of Focus Areas.....</a>	<a href="#">41</a>
<a href="#">Roundtable Feedback on Improving Quality.....</a>	<a href="#">44</a>
<a href="#">Bibliography.....</a>	<a href="#">48</a>

## Introduction

**Background.** In 2016, the Wisconsin Department of Transportation developed and implemented a project to obtain and evaluate data related to construction quality management.

Walling Consulting Services, LLC (WCS) assisted Department staff with the development of a scalable construction quality management (CQM) process.

The Department conducted a scan of current practices. The effort included a literature search from agencies and construction organizations across North America, as well gathering information from a series of roundtable sessions across Wisconsin (see details in the Approach section).

**Context.** The project is an example of the Department's focus on continuous improvement, cost savings, and efficiencies.

The project also builds upon the efforts of related initiatives undertaken by the Department:

In addition, a meeting was held with Mortenson Construction to obtain their perspective regarding CQM from having worked on major projects in both horizontal (i.e. road and bridge) and vertical (i.e. building) construction.

- In 2013 and 2015, the Department created the **Timely Decision Making Manual (TDM)**. Additional guidance and tools were developed to assist the project staff and contractors in their communication efforts.

Finally, the project leverages and reinforces the value of typical construction documentation resources including:

- Construction & Materials Manual
- Standard Specifications
- Supplemental Specifications
- Region-specific documentation
- Project-specific documentation (i.e. plans, specifications, and other construction documents)

**Objective.** The objective of the project was to develop a scalable construction quality management process for the Department. Much like the PCEE and TDM initiatives, the end product is a toolbox; a compilation of tools designed to provide guidance and direction for project staff, consultants, and contractors in the successful delivery of WisDOT construction projects.

## Approach

A review of current and best practices in CQM was conducted among the following entities:

1. WisDOT practices (Southeast Region, Northeast Region, Southwest Region)
2. Literature review, including prior best practice summaries
3. Practices of other state DOT's in the Upper Midwest
4. Practices in the vertical construction industry

To address 1) above, WisDOT's Brian Roper and Heather Sackman, together with WCS's Van Walling, conducted focused interviews (i.e. roundtable sessions) with the following transportation entities:

- Federal Highway Administration – Wisconsin Division (FHWA)
- Wisconsin Transportation Builders Association (WTBA)
- WisDOT
  - Bureau of Project Development
  - Bureau of Structures
  - Bureau of Technical Services
  - Northeast Region
  - Southeast Freeways (Construction Team)
  - Southeast Region
  - Southwest Region (I-39/90 Team)

Initially, three focus areas were identified:

- **Project Documentation**
- **Project Communication**
- **Contract Management Efficiencies**

**These focus areas were used to categorize input from the** review of current and best practices as well as the various roundtables could be categorized. As expected, the focus area descriptions evolved throughout the process into the following:

- Documentation
- Communications and Relationships
- Contract Management
- Resources

Individual elements and details were identified for each of the four focus areas. A tabular format utilizing a “What, When, Who, How, and Why” approach was developed. A High/Medium priority of the various elements was applied.

The four focus areas were then tested on a recently completed WisDOT construction project with input from the project team. The object was to identify to what extent the CQM elements were utilized or if other elements should be added to the CQM toolbox.

Research was conducted to address items 2) and 3); the resulting list of sources can be found in the Bibliography. For the most part, these documents concentrated on the design process or had a strong emphasis on construction materials testing rather than addressing the “big picture” of CQM; i.e. “did the project conform to industry and stakeholder requirements”? Those documents providing the greatest value with respect to WisDOT's CQM effort included those from Virginia DOT and the Federal Transit Administration.

For item 4), a meeting was held with Mortenson Construction to obtain their perspective regarding CQM from having worked on major projects in both horizontal (i.e. road and bridge) and vertical (i.e. building) construction.

## What is Quality?

In the conduct of the literature search for this project, many definitions were found for the terms “quality”, “quality assurance” and “quality control”. Fortunately, the vast majority of the definitions were similar, given that the emphasis of their respective reports were the construction of transportation infrastructure. Here are some representative examples:

*Quality. (1) The degree of excellence of a product or service. (2) The degree to which a product or service satisfies the needs of a specific customer. (3) The degree to which a product or service conforms with a given requirement.*

Transportation Research Circular, Number E-C173, June 2013

*AASHTO defines QA as “(1) All those planned and systematic actions necessary to provide confidence that a product or facility will perform satisfactorily in service, or (2) making sure the quality of a product is what it should be.”*

*FHWA’s Transportation Construction Quality Assurance Reference Manual defines QC as “The system used by a contractor party to monitor, assess, and adjust their production or placement processes to ensure that the final product will meet the specified level of quality.”*

Construction Quality Assurance for Design-Build Highway Project,  
FHWA Publication No. FHWA-HRT-12-039, April 2012

In the conduct of the roundtable discussions used to gather input from various entities involved in the construction of transportation infrastructure in Wisconsin, the response (as shown below) were quite varied. It should be noted that the meeting facilitators were not asking for definitions, but more of word association, or “what comes to mind when you hear the word quality?”

## What is Quality?

- Good decision making
- Requires consensus between contractor and WisDOT staff
- Relationships
- Very good product for reasonable cost
- Meets specifications
- Not just materials but workmanship as well; it's a manufacturing process
- When work effort is integrated between WisDOT, contractor, etc... shared responsibilities
- Getting both sides to buy in and understand benefits to them
- Importance of crew; same company can perform drastically different work on different projects
- Quality of product
- Cost (value)
- Meeting what is in specs
- Happy owner
- On time, on budget
- Testing assures quality
- Weekly meetings
- Different definitions for WisDOT and contractor
- Need to have good plans
- Engaged reviews; not just checking boxes
- Budget
- Product
- Schedule
- Staff
- Safety
- Public perception
- Acceptable to WisDOT
- Completed in safe manner
- And for some, "how does it look?"
- Have to balance consistency and reasoning
- Durable, long lasting product
- Consistency in administration and product
- Meeting intent of plan (even if plan is not specific in a given area)
- Schedule
- Budget integrity; on budget or rationale for exceeding
- Don't do the wrong thing just to stay within budget (i.e. avoiding EBS)
- Meet stakeholder expectations
- Prudent use of change order budget
- Safety; culture change as a result of Owner Controlled Insurance Program
- Minimize surprises for management; provide problems and proposed or actual solutions
- How did contractor perform in face of incomplete plan, bad weather, etc.
- Compliance with contract documents
- Customer success factors
- People, process, tools put in place to ensure an expected outcome is met in an expedited, repeatable way

In some of the roundtables, the facilitators asked for the participants to respond to “how do we build quality into construction projects?” Their response are shown below,

- Processes
- Communication
- Clear expectations between team and contractor
- Need to know plans and specifications thoroughly
- Need to be in right place at the right time
- Be in rhythm with the contractor
- Have knowledge about what contractor intends to do... and the consequences

The questions and subsequent discussion allowed the roundtable participants 1) to express their interpretation of quality on WisDOT construction projects, 2) to hear others interpretations and most importantly, 3) to establish the context for the specific focus area questions that followed.

## Toolbox Preface

The project team reviewed and assigned all the feedback received at the roundtable sessions.

Individual elements were identified for each of the four focus areas:

- Documentation
- Communications and Relationships
- Contract Management
- Resources

Details were added for each element. A tabular format utilizing a “What, When, Who, How, and Why” approach was developed to provide a tool that is easy to understand and use. Prioritization of the various elements was addressed on a **High (depicted with green highlighting)** and **Medium (depicted with blue highlighting)** basis.

A guiding principle throughout the project was to provide a CQM toolbox that would be scalable to the type, size, and complexity of all WisDOT construction projects all across the state. While many of the focus area elements were used on mega and major projects, these elements are scalable so that the toolbox has value to all users.

## Roles and Responsibilities

Throughout the roundtable sessions, there were many discussions regarding the relationships among various entities. Accordingly, “Communications and Relationships” and “Roles and Responsibilities” were originally seen as two of the focus areas to be addressed the CQM toolbox. After further discussion, it was determined that “Roles”, and more specifically, “Roles and Responsibilities” was more of a foundational component underlying the four other focus areas.

In those cases where differences of opinion or conflict develop between the various entities, it is often the result of a misunderstanding of the role and responsibility of one's own entity, or that of the role and responsibility of other entities. Clarification of roles and responsibilities at the beginning of a project, and reinforcement throughout the project, will go a long way to optimize partnering.

Presented here is an overview of the "Roles and Responsibilities" for four different entities involved in the construction of WisDOT's transportation infrastructure.

<p>FHWA Wisconsin Division Office</p> <ul style="list-style-type: none"> <li>• Review and approve main processes (specifications, FDM, CMM)</li> <li>• Review construction</li> <li>• Review contract status</li> <li>• Identify program-wide quality issues for federal compliance</li> <li>• Review construction inspection report</li> <li>• Prepare annual construction inspection report</li> <li>• Report out at WTBA, ACEC, and Region conferences</li> </ul>	<p>WisDOT Statewide Bureaus</p> <ul style="list-style-type: none"> <li>• Review and approve plans and specs</li> <li>• Review construction</li> <li>• Review contract status</li> <li>• Identify quality issues</li> <li>• Review construction inspection report</li> <li>• Prepare annual construction inspection report</li> <li>• Report out at WTBA, ACEC, and Region conferences</li> <li>• Oversee EEO, prevailing wage and DBE commitment status</li> </ul>
<p>WisDOT Region</p> <ul style="list-style-type: none"> <li>• Oversee contractor work in progress and overall project schedule</li> <li>• Inspect and review construction</li> <li>• Review submittals</li> <li>• Manage RFI's</li> <li>• Document and resolve issues and disputes</li> <li>• Measure quantities, prepare estimates, process payments</li> <li>• Develop and oversee work zone safety measures for traveling public</li> <li>• Oversee public relations</li> <li>• Administer contract documents</li> <li>• Identify quality issues</li> <li>• Obtain required permits and coordinate with state and local agencies</li> <li>• Coordinate with local businesses, residents, and other stakeholders as appropriate</li> </ul>	<p>Contractor</p> <ul style="list-style-type: none"> <li>• Perform construction per plans, special provisions, standard specifications, CMM, and other industry standards as appropriate</li> <li>• Develop and implement QC processes and procedures</li> <li>• Develop and implement safety measures for contractor operations</li> <li>• Implement work zone traffic control for traveling public</li> <li>• Develop and manage project schedule</li> <li>• Develop RFI's</li> <li>• Identify project issues (e.g. quality, safety, schedule, constructability, staging, etc.) and develop potential solutions</li> <li>• Coordinate with subcontractors</li> <li>• Coordinate with local businesses, residents, and other stakeholders as appropriate</li> <li>• Obtain required permits and coordinate with state and local agencies as required in contract</li> <li>• Coordinate with FHWA and WisDOT</li> <li>• Maintain EEO, prevailing wage and DBE documentation</li> </ul>



## List of Acronyms

BOS – Bureau of Structures	RFI - Request for Information
BPD – Bureau of Project Development	RFP – Request for Price
BTS – Bureau of Technical Services	ROM – Rough Order of Magnitude
CMJ – Contract Modification Justification	TDM - Timely Decision Making (Manual)
CMM – Construction & Materials Manual	WAF - Work Authorization Form
CPM – Critical Path Method	WTBA – Wisconsin Transportation Builders Association
CQI – Construction Quality Index	
CQM – Construction Quality Management	
CRI – Cost Reduction Incentive	
DIN – Design Issue Notice	
FDM – Facilities Development Manual	
FHWA – Federal Highway Administration	
IDR – Inspector’s Daily Report	
MUTCD – Manual on Uniform Traffic Control Devices	
PCEE – Project Communication Enhancement Effort	
PCL – Project Construction Leader	
PEPED - Performance, Evaluation, Planning and Employee Development	
PI – Public Involvement	
PL – Project Leader	
PM – Project Manager	
PMP – Project Management Plan	
QA – Quality Assurance	
QC – Quality Control	
QV – Quality Verification	
RCM – Region Communications Manager	

**Construction Quality Toolbox - Documentation**

ID	Element	Details
DOC-01	Project Management Plan	<p><i>What</i> Providing formal documentation of project management approach</p> <p><i>When</i> Initial version completed prior to pre-construction meeting (usually as a carryover from the design phase) Updated as needed throughout construction</p> <p><i>Who</i> PM or designee</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Compile documents and recorded information for each of the following components (Note that the quantity of information is scalable to the type, size and complexity of the project, and not all projects require documentation of all components):             <ul style="list-style-type: none"> <li>○ Change Management</li> <li>○ Scope</li> <li>○ Schedule</li> <li>○ Budget</li> <li>○ Quality</li> <li>○ Resources (In House Staff)</li> <li>○ Procurement (Consultant Services)</li> <li>○ Communication</li> <li>○ Risk Management</li> <li>○ Scope Baseline</li> <li>○ Budget Baseline</li> <li>○ Schedule Baseline</li> <li>○ Stakeholders</li> </ul> </li> </ul> <p><i>Why</i> To ensure that project management activities are appropriately engaged during the initiating, planning, executing, monitoring and controlling, and closeout phases of the project</p>

**Construction Quality Toolbox - Documentation**

<i>ID</i>	<i>Element</i>	<i>Details</i>
DOC-02	Inspection guide	<p><i>What</i> Using document that supplements CMM to provide project-specific guidance for new construction staff</p> <p><i>When</i> Throughout project</p> <p><i>Who</i> All project staff</p> <p><i>How</i> Specifically designed for use by student and new staff</p> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• To supplement CMM and shorten the learning curve for new personnel on project</li> <li>• To provide a consistent communication flow between all parties</li> </ul>
DOC-03	Schedule	<p><i>What</i> Assisting the contractor in the development and maintenance of the project schedule</p> <p><i>When</i> From pre-construction through project closeout</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• Designated by PM (typically PL)</li> <li>• Contractor representative</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Develop original schedule for pre-construction meeting</li> <li>• Measure progress every day; revise schedule for weekly meetings</li> <li>• Document actual start and end dates to compare with planned dates</li> <li>• Provide complete schedule, but concentrate on 3-week look-ahead</li> </ul> <p><i>Why</i> To pro-actively manage project schedule</p>

**Construction Quality Toolbox - Documentation**

<i>ID</i>	<i>Element</i>	<i>Details</i>
DOC-04	Cost to complete analysis	<p><i>What</i> Developing periodic cost to complete analysis and to take necessary corrective and/or pro-active steps (i.e. monitoring and controlling)</p> <p><i>When</i> Throughout project</p> <p><i>Who</i> Designated by PM</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Track progress on designated items (usually large items) at regular intervals and/or at milestones</li> <li>• Use statistical analysis, similar project experience and expert judgment to project end values for these items</li> <li>• Forward analysis to PM, project controls team, management team, etc.</li> </ul> <p><i>Why</i> Monitoring of current trends allows proactive management to revise (reduce) projected end costs</p>
DOC-05	Project performance metrics	<p><i>What</i> Developing and sharing project performance metrics</p> <p><i>When</i> Throughout project</p> <p><i>Who</i> Designated by PM</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Regularly track project cost savings/efficiencies</li> <li>• Post on a highly visible whiteboard or a virtual dashboard</li> <li>• Cascade information to other delivery teams</li> </ul> <p><i>Why</i> To promote transparency, incentivization, and teamwork by public sharing of project performance metrics</p>

**Construction Quality Toolbox - Documentation**

ID	Element	Details
DOC-06	Photos and videos	<p><i>What</i> Taking, using, filing, retrieving of project photos and videos</p> <p><i>When</i> Throughout project</p> <p><i>Who</i> Designated by PM</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Take a large number of photos</li> <li>• Photos are particularly important to document non-visible (underground) work</li> <li>• Digital photo technology evolving to include geo-spatial tags</li> <li>• Consider rule of thumb of “10 photos a day”</li> <li>• Consider using video logs to document before, during, and post construction conditions</li> <li>• Consider using video logs to document traffic shifts</li> <li>• Post photos and videos for access by all staff</li> </ul> <p><i>Why</i> To provide visual documentation of project construction</p>
DOC-07	Shop drawings	<p><i>What</i> Providing timely and consistent review, processing, and filing of shop drawings received from contractors</p> <p><i>When</i> Prior to and throughout construction</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• Designated by PM</li> <li>• Appropriate party within appropriate statewide bureau</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Helpful to have list of submittals at beginning of project</li> <li>• Establish and agree upon project-specific approach to deal with process flow , including timeframes for turnaround of reviews</li> <li>• Review in field</li> <li>• Forward to appropriate party within appropriate statewide bureau</li> </ul> <p><i>Why</i> To ensure compliance with plans and specifications</p>

**Construction Quality Toolbox - Documentation**

<i>ID</i>	<i>Element</i>	<i>Details</i>
DOC-08	Shop inspection documentation	<p><i>What</i> Providing timely and consistent review, processing, and filing of shop inspection documentation received from contractors</p> <p><i>When</i> Prior to and throughout construction</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• Designated by PM</li> <li>• Appropriate party within appropriate statewide bureau</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Helpful to have list of submittals at beginning of project</li> <li>• Establish and agree upon project-specific approach to deal with process flow , including timeframes for turnaround of reviews</li> <li>• Review in field</li> <li>• Forward to appropriate party within appropriate statewide bureau</li> </ul> <p><i>Why</i> To ensure compliance with plans and specifications</p>
DOC-09	Pay Estimates	<p><i>What</i> Developing periodic pay estimates</p> <p><i>When</i> Throughout project</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• Designated by PM (typically PL)</li> <li>• Beneficial for one person to have sole or primary responsibility for this task</li> </ul> <p><i>How</i> Per CMM and Standard Specifications</p> <p><i>Why</i> To provide</p> <ul style="list-style-type: none"> <li>• Accurate and timely project record keeping</li> <li>• Information needed for timely and accurate payments</li> </ul>

**Construction Quality Toolbox - Documentation**

<i>ID</i>	<i>Element</i>	<i>Details</i>
DOC-10	General project documentation	<p><i>What</i></p> <ul style="list-style-type: none"> <li>• Maintain diaries and Inspector Daily Records (IDR's) per CMM</li> <li>• Produce weekly reports on working day contracts</li> <li>• Document conversations held on the grade in an email</li> <li>• Document communications with public – use email like the old phone logs; forward to RCM and project inbox</li> </ul> <p><i>When</i> Daily</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• All engineers and inspection staff</li> <li>• PM or designee to check diaries and IDR's on a regular basis (frequency TBD by type, size, and complexity of project)</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Scalable to the type, size and complexity of the project</li> <li>• Recognize that project documentation requirements may affect staffing levels</li> <li>• Per CMM</li> <li>• Document on a timely basis; same day whenever possible</li> <li>• Include source documentation (e.g. weight tickets)</li> <li>• If in doubt, document it... “if it wasn't documented, it didn't happen”</li> <li>• Need to coordinate documentation efforts between multiple mid-level staff on large projects to avoid gaps and redundancies</li> <li>• Use best available e-construction tools</li> <li>• Diaries require facts; not opinions</li> <li>• PM to spot check diaries on a regular basis</li> <li>• Diaries should be kept forever; particularly important to document non-visible (underground) work</li> </ul> <p><i>Why</i> To ensure compliance with plans and specifications and provide a permanent record for the project</p>

**Construction Quality Toolbox - Documentation**

<i>ID</i>	<i>Element</i>	<i>Details</i>
DOC-11	Specific project documentation	<p><i>What</i> Utilizing available forms/processes; e.g.</p> <ul style="list-style-type: none"> <li>• CMJ - Contract Mod Justification</li> <li>• CRI – Cost Reduction Incentive</li> <li>• DIN - Design Issue Notice</li> <li>• RFI – Request for Information</li> <li>• RFP – Request for Price</li> <li>• WAF – Work Authorization Form</li> </ul> <p><i>When</i> Throughout project</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• PM</li> <li>• Designated by PM</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Per CMM, PCEE Manual, TDM Manual</li> <li>• Need to determine by the preconstruction meeting what role, and to what degree, FHWA and each statewide bureau will be involved in each of these processes (e.g. courtesy copy all issues, courtesy copy pertinent issues, action or approval required, etc.)</li> <li>• Document and share agreed upon processes with all affected parties</li> <li>• Log all processes; e.g. <ul style="list-style-type: none"> <li>○ CRI's – reasons for acceptance or denial</li> <li>○ RFI's/DIN's – used to consider pursuit of E&amp;O's</li> </ul> </li> <li>• Where regions use CMJ's they should precede WAF</li> <li>• Consider using transparency contracts – means of accessing designers after design contract is closed; helps with RFI and DIN process</li> <li>• RFIs/DINs not always used on a lot of SHR projects; instead, issues are tracked in weekly meetings</li> </ul> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• To... <ul style="list-style-type: none"> <li>○ Identify issues</li> <li>○ Improve documentation</li> </ul> </li> <li>• Ensure compliance with plans and specifications and provide a permanent record for the project</li> </ul>



**Construction Quality Toolbox - Documentation**

<i>ID</i>	<i>Element</i>	<i>Details</i>
DOC-12	Change orders	<p><i>What</i> Processing of change orders</p> <p><i>When</i></p> <ul style="list-style-type: none"> <li>• In general, throughout the project</li> <li>• Specifically, after CMJ is approved and WAF is sent out</li> </ul> <p><i>Who</i> Designated by PM (typically PM)</p> <p><i>How</i> Per CMM</p> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• To provide accurate and timely project record keeping and payments</li> <li>• To provide detailed information for consideration on future projects</li> </ul>

**Construction Quality Toolbox - Documentation**

ID	Element	Details
DOC-13	Issue log and issue closure	<p><i>What</i></p> <ul style="list-style-type: none"> <li>• Maintain log of ongoing project issues, schedule, responsible parties, status</li> <li>• More detailed info in issues log than in diaries; need to balance and understand what's in each</li> </ul> <p><i>When</i></p> <ul style="list-style-type: none"> <li>• Continuously from project kickoff through closeout</li> <li>• Be timely; set aggressive project-specific goals for ongoing completion of project documentation and meet them</li> </ul> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• PM</li> <li>• Project controls leader</li> <li>• Other as designated by PM</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Identify issue...               <ul style="list-style-type: none"> <li>○ What needs to be done</li> <li>○ Who needs to do it</li> <li>○ By when</li> </ul> </li> <li>• Track project issues, schedule, responsible parties, status, path to closure</li> <li>• Close issue...               <ul style="list-style-type: none"> <li>○ Responsible party(s) address issue within agreed upon timeframe</li> <li>○ Provide appropriate documentation</li> <li>○ Indicate closed status on issue log</li> </ul> </li> <li>• Share with team and others as lessons learned</li> <li>• Share with management team with agreed upon frequency</li> </ul> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• To ensure all issues are logged, appropriate action is taken, and entire process is documented</li> <li>• To ensure compliance with plans and specifications</li> <li>• To provide a consistent communication flow between all parties</li> <li>• To compile documentation for potential errors and omissions</li> </ul>

**Construction Quality Toolbox - Documentation**

<i>ID</i>	<i>Element</i>	<i>Details</i>
DOC-14	Explanation of variance report	<p><i>What</i>    Gathering data and creating report about actual versus planned quantities and costs</p> <p><i>When</i>    Throughout project</p> <p><i>Who</i>      Designated by PM</p> <p><i>How</i>      • Maintain log of original quantities and costs                      • Track actual quantities and costs                      • Document data providing explanations for significant variances                      • On megas, this report provides input for equalization mods</p> <p><i>Why</i>      To provide an accurate record for project and guidance for future projects</p>
DOC-15	Non-conforming and non-performance materials	<p><i>What</i>    Gathering data and creating report about non-conforming and non-performance materials</p> <p><i>When</i>    Upon becoming aware of non-conforming and non-performance materials</p> <p><i>Who</i>      Designated by PM</p> <p><i>How</i>      • Document materials that do not conform to specifications and/or do not perform in accordance with specifications                      • Forward to PM, statewide bureaus, FHWA, contractor, and others as appropriate</p> <p><i>Why</i>      To ensure compliance with plans and specifications</p>

**Construction Quality Toolbox - Documentation**

<i>ID</i>	<i>Element</i>	<i>Details</i>
DOC-16	Project closeout documentation	<p><i>What</i> Providing project closeout documentation per CMM</p> <p><i>When</i> Continuously from project kickoff through closeout (i.e. close as you go)</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• PM</li> <li>• Other as designated by PM</li> <li>• Whoever does inspection does that part of finals</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Follow final closeout process flowchart</li> <li>• Use checklist</li> <li>• Capture lessons learned and best practices (see DOC-20)</li> </ul> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• To ensure all project closeout components (e.g. administrative, technical, logistical, human resource, etc.) are completed and documented correctly, completely, and efficiently</li> </ul>
DOC-17	As-builts	<p><i>What</i> Preparing as-built drawings</p> <p><i>When</i> Throughout project (develop as project progresses, do not wait until the end of the project)</p> <p><i>Who</i> Designated by PM</p> <p><i>How</i> Per CMM</p> <p><i>Why</i> To provide accurate and timely project record keeping</p>

**Construction Quality Toolbox - Documentation**

<i>ID</i>	<i>Element</i>	<i>Details</i>
DOC-18	Lessons learned and best practices	<p><i>What</i> Capturing and sharing lessons learned and best practices from project</p> <p><i>When</i> Throughout project</p> <p><i>Who</i> All delivery staff (i.e. construction, design, ad-hocs, etc.)</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Informal or formal meetings               <ul style="list-style-type: none"> <li>○ Teams decide topics</li> <li>○ Assemble photos, SDDs, specs, etc.</li> <li>○ Everything goes into an e-folder with person's name</li> </ul> </li> <li>• Many different types of meetings can be used to gather this information, including:               <ul style="list-style-type: none"> <li>○ Monthly region-wide PM meetings</li> <li>○ Annual construction feedback meetings</li> <li>○ Lessons learned meetings</li> <li>○ Formal post-construction meetings with design staff</li> <li>○ Annual construction training</li> </ul> </li> </ul> <p><i>Why</i> To provide an accurate record for project and guidance for future projects</p>

**Construction Quality Toolbox – Communications/Relationships**

<i>ID</i>	<i>Element</i>	<i>Details</i>
COM-01	Pre-Bid Meeting	<p><i>What</i> Meeting to review plans and specs</p> <p><i>When</i> Prior to bid opening</p> <p><i>Who</i> Prospective bidders and WisDOT and consultant design and construction staff</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Typically mandatory for megaprojects and major interstate bridge projects</li> <li>• Use standard agenda; circulate prior to meeting</li> <li>• Define outcome and process for each topic</li> <li>• Invite appropriate parties; no more, no less</li> <li>• Follow steps to run an efficient meeting:               <ul style="list-style-type: none"> <li>○ Set ground rules</li> <li>○ Assign a time keeper, topic checker, and parking lot attendant</li> <li>○ Start and end on time</li> <li>○ Stick to the agenda – defer to parking lot or future meetings</li> <li>○ Identify potential addenda</li> <li>○ Summarize action items and responsible parties and timeframes</li> </ul> </li> </ul> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• To provide a greater understanding of the scope, schedule, and special considerations associated with the project</li> <li>• To provide a high level overview of the plans and specs</li> </ul>

**Construction Quality Toolbox – Communications/Relationships**

ID	Element	Details
COM-02	Pre-Construction Meeting	<p><i>What</i> Meeting to formally kick off the project</p> <p><i>When</i> As soon as possible after contract award</p> <p><i>Who</i> Contractor, subs, local officials, utilities, law enforcement, etc. and construction staff to formally kick off the project</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Mandatory</li> <li>• Use standard agenda; circulate prior to meeting</li> <li>• Define outcome and process for each topic</li> <li>• Invite appropriate parties; no more, no less</li> <li>• Follow steps to run an efficient meeting:               <ul style="list-style-type: none"> <li>○ Set ground rules</li> <li>○ Assign a time keeper, topic checker, and parking lot attendant</li> <li>○ Start and end on time</li> <li>○ Stick to the agenda – defer to parking lot or future meetings</li> <li>○ Summarize action items and responsible parties and timeframes</li> </ul> </li> </ul> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• To introduce the key players</li> <li>• To provide a greater understanding of the scope, schedule, and special considerations associated with the project</li> <li>• To provide a high level overview of the plans and specs</li> </ul>
COM-03	Partnering meetings	<p><i>What</i> Partnering meetings between construction staff and contractor</p> <p><i>When</i> Begin early in the project; preferably before 25% completion, and continue throughout the project</p> <p><i>Who</i> Key project staff from both sides identified by PM and construction superintendent</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Scalable to the type, size and complexity of the project</li> <li>• Content, format, and areas of emphasis agreed upon by both parties</li> </ul> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• To establish the overall framework and tone for the successful execution of the project</li> <li>• To set consistent expectations</li> </ul>

**Construction Quality Toolbox – Communications/Relationships**

<i>ID</i>	<i>Element</i>	<i>Details</i>
COM-04	Progress meetings	<p><i>What</i> Regularly scheduled meetings to discuss project progress</p> <p><i>When</i> PM to determine frequency</p> <p><i>Who</i> PM to determine (can include PM, PCL, PI, supervisor, other team members as appropriate, contractor, law enforcement, local officials (on non megas))</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Use standard agenda; circulate prior to meeting</li> <li>• Invite appropriate parties; no more, no less</li> <li>• Follow steps to run an efficient meeting</li> <li>• Follow steps to run an efficient meeting:               <ul style="list-style-type: none"> <li>○ Set ground rules</li> <li>○ Assign a time keeper, topic checker, and parking lot attendant</li> <li>○ Start and end on time</li> <li>○ Stick to the agenda – defer to parking lot or future meetings</li> <li>○ Summarize action items and responsible parties and timeframes</li> </ul> </li> <li>• Prepare and circulate meeting minutes; typically within one week</li> </ul> <p><i>Why</i> To ensure compliance with plans and specifications and provide a consistent communication flow between all parties</p>



**Construction Quality Toolbox – Communications/Relationships**

<i>ID</i>	<i>Element</i>	<i>Details</i>
COM-05	Communication between design and construction staff	<p><i>What</i></p> <ul style="list-style-type: none"> <li>• Develop regular communication opportunities</li> <li>• Develop, implement and maintain project-specific communication plan</li> </ul> <p><i>When</i></p> <p>Continuously from 60% to 90% design phase through pre-construction planning through project closeout</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• Design lead(s)</li> <li>• Construction lead(s)</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Regularly scheduled staff level meetings within the region</li> <li>• Emails</li> <li>• Phone calls</li> <li>• Notes to construction</li> <li>• Construction to provide feedback to design on annual basis (if not more frequently)</li> <li>• Conduct meeting between design and construction to review plans and specs and recommend revisions               <ul style="list-style-type: none"> <li>○ If in-house design, meet with region design team</li> <li>○ If consultant design, develop small contract to meet with consultant and region design team</li> </ul> </li> </ul> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• Quality construction begins with quality design; take steps to decrease knowledge loss from design to construction by bringing groups together earlier</li> <li>• To ensure compliance with plans and specifications</li> <li>• To provide mutual insight (e.g. designers to share design intent; construction staff to share reasons for revisions or adjustments done in the field for future consideration by designers)</li> </ul>

**Construction Quality Toolbox – Communications/Relationships**

<i>ID</i>	<i>Element</i>	<i>Details</i>
COM-06	Communication between construction staff and contractor	<p><i>What</i></p> <ul style="list-style-type: none"> <li>• Develop regular communication opportunities</li> <li>• Develop, implement and maintain project-specific communication plan</li> <li>• Primary discussion items include schedule, planned operations, issues, safety, weather, payment, major activities, etc.</li> </ul> <p><i>When</i> Throughout project</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• PM or designee</li> <li>• Contractor</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Set agreed upon, project-specific critical success factor at kickoff</li> <li>• Align expectations in pre-con phase..."what is the goal of this project?"</li> <li>• Pre-con meeting should set communications expectations</li> <li>• Progress meetings</li> <li>• Other meetings</li> <li>• Phone calls</li> <li>• Emails</li> <li>• Conversation on grade</li> <li>• All construction operations should be preceded by a 2-3 minute conversation</li> <li>• Seek agreement on quantities at the end of every day</li> <li>• Seek agreement on personnel and equipment every day</li> <li>• Talk in advance of an issue (i.e. "pre-RFI")</li> </ul> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• To ensure compliance with plans and specifications and provide a consistent communication flow between all parties</li> <li>• Consistent expectations</li> </ul>

**Construction Quality Toolbox – Communications/Relationships**

<i>ID</i>	<i>Element</i>	<i>Details</i>
COM-07	Communication between task leads and inspectors	<p><i>What</i></p> <ul style="list-style-type: none"> <li>• Develop regular communication opportunities</li> <li>• Develop, implement and maintain project-specific communication plan</li> </ul> <p><i>When</i></p> <p>Continuously from project kickoff through closeout</p> <p><i>Who</i></p> <p>All staff assigned to project</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Set agreed upon, project-specific critical success factor at kickoff</li> <li>• Align expectations in pre-con phase...“what is the goal of this project?”</li> <li>• Encourage lower level staff to approach upper level staff with questions and concerns</li> <li>• Encourage upper level staff to check in with lower level staff on regular basis in addition to regularly scheduled meetings and/or when there is a problem... make sure they don’t feel helpless or overwhelmed</li> <li>• Stress importance of communication to all staff; ensure everyone knows that it is better to err on the side of over-communicating</li> <li>• Document meetings</li> <li>• Minutes (including action items) prepared within agreed upon timeframe</li> <li>• Minutes shared with all staff assigned to project</li> <li>• Work schedule</li> </ul> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• Improve...             <ul style="list-style-type: none"> <li>○ Project understanding</li> <li>○ Team morale</li> </ul> </li> <li>• Consistent expectations</li> </ul>

**Construction Quality Toolbox – Communications/Relationships**

<i>ID</i>	<i>Element</i>	<i>Details</i>
COM-08	Communication between construction staff and statewide bureaus and FHWA	<p><i>What</i></p> <ul style="list-style-type: none"> <li>• Take pro-active steps to provide seamless and appropriate interaction between bureaus and construction teams in the administration and delivery of the project</li> <li>• Develop regular communication opportunities</li> <li>• Develop, implement and maintain project-specific communication plan</li> </ul> <p><i>When</i></p> <p>Continuously from project kickoff through closeout</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• PM</li> <li>• Project leads</li> <li>• Statewide bureau oversight engineers</li> <li>• FHWA assigned representative</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Develop, implement, maintain, and abide by project-specific Roles and Responsibilities Matrix</li> <li>• Construction staff to initiate early involvement by statewide bureaus when project issues arise in the field</li> <li>• Seek bureau input for answers re: statewide consistency</li> <li>• Consider project-specific partnering efforts</li> <li>• Set agreed upon, project-specific communications expectations at kickoff, including               <ul style="list-style-type: none"> <li>○ the meetings to which should statewide bureaus and FHWA should be invited</li> <li>○ the issues on which statewide bureaus and FHWA should be copied on emails</li> </ul> </li> <li>• Set agreed upon, project-specific critical success factor at kickoff</li> <li>• Align expectations in pre-con phase...”what is the goal of this project?”</li> <li>• Statewide bureaus - assign and maintain consistent project-specific staff</li> <li>• Meetings - invite statewide bureaus to meetings, send agenda in advance, and share all meeting minutes with bureau within agreed upon timeframe</li> <li>• Emails - include statewide bureaus on emails and all parties to reply to emails within 24 hours</li> <li>• Phone calls               <ul style="list-style-type: none"> <li>○ generally preferred over emails when quick turnaround is needed</li> <li>○ all parties to reply to phone calls within 24 hours</li> <li>○ follow up with formal documentation immediately after call</li> </ul> </li> <li>• Follow chain of command to resolve issues with statewide bureaus and FHWA</li> </ul> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• Develop consistent expectations</li> <li>• Improve project understanding, mutual respect, team morale</li> </ul>

**Construction Quality Toolbox – Communications/Relationships**

<i>ID</i>	<i>Element</i>	<i>Details</i>
COM-09	Communication between construction staff and general public	<p><i>What</i></p> <ul style="list-style-type: none"> <li>• Develop regular communication opportunities (pro-active approach mitigate negative scenarios)</li> <li>• Develop, implement and maintain project-specific communication plan</li> </ul> <p><i>When</i> From pre-construction activities to project closeout</p> <p><i>Who</i> PM or designee</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Align expectations in pre-con phase..."what is the goal of this project?"</li> <li>• Meetings as needed</li> <li>• Phone calls</li> <li>• Emails</li> <li>• Public involvement               <ul style="list-style-type: none"> <li>○ Letters</li> <li>○ Newsletters</li> <li>○ Social media</li> <li>○ Workshops</li> </ul> </li> </ul> <p><i>Why</i> To provide a consistent communication flow between all parties</p>

**Construction Quality Toolbox – Communications/Relationships**

<i>ID</i>	<i>Element</i>	<i>Details</i>
COM-10	Quarterly coordination meetings between megaproject team in different regions	<p><i>What</i> Meetings to coordinate efforts and share respective experiences</p> <p><i>When</i> Quarterly</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• PM's</li> <li>• Project leads</li> <li>• Others as designated by PM</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Use standard agenda; circulate prior to meeting</li> <li>• Invite appropriate parties; no more, no less</li> <li>• Follow steps to run an efficient meeting</li> <li>• Address high level scope, schedule, budget, risk, safety, quality, resource, technology, etc. issues</li> <li>• Identify best practices and lessons learned</li> <li>• Document items, responsible parties, and timeframes in action item or issues log</li> <li>• Prepare and circulate meeting minutes prior to next quarterly meeting</li> </ul> <p><i>Why</i> Information sharing</p>

**Construction Quality Toolbox – Contract Management**

<i>ID</i>	<i>Element</i>	<i>Details</i>
MGT-01	Project Management	<p><i>What</i> Represent WisDOT in all project-related matters with contractors, consultants, utilities, agencies, law enforcement, general public, media, etc.</p> <p><i>When</i> From pre-construction activities through project closeout</p> <p><i>Who</i> PM, as supported by PL, Projects Controls Leader, and others as appropriate</p> <p><i>How</i> Be responsible for management of scope, schedule, budget, communications, stakeholders, resources, procurements, risk, quality, and safety</p> <p><i>Why</i> To provide management and leadership on behalf of WisDOT in the execution of the construction contract</p>
MGT-02	Plan & Specification Reviews	<p><i>What</i> Review of plans and specifications by construction and maintenance staff before plans are finalized by design staff</p> <p><i>When</i> Between 60% and 90% design</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• Construction lead(s)</li> <li>• Maintenance lead(s)</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Use checklist to ensure consistency</li> <li>• Develop function-specific checklist if one does not exist</li> <li>• Make sure Contract Time for Completion is practical; consider utilities, concrete pavement cure time, pavement marking cure times, planting periods, etc.</li> </ul> <p><i>Why</i> To identify potential construction and/or maintenance concerns and recommend revisions before bidding</p>

**Construction Quality Toolbox – Contract Management**

<i>ID</i>	<i>Element</i>	<i>Details</i>
MGT-03	Constructability reviews	<p><i>What</i></p> <ul style="list-style-type: none"> <li>• Efforts to review plans and specs, to identify bid-ability and constructability issues, and to provide recommendations to address before finalizing design, including:               <ul style="list-style-type: none"> <li>○ Scope, budget and schedule</li> <li>○ Staging</li> <li>○ Risk and quality</li> </ul> </li> </ul> <p><i>When</i></p> <ul style="list-style-type: none"> <li>• Between 60% and 90% design</li> <li>• 75% constructability reviews created in NER; 60% plans didn't have enough detail with respect to staging, temp drainage, etc</li> </ul> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• WisDOT construction staff</li> <li>• Specialty consultant</li> <li>• Contractors</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Prepare for constructability reviews (i.e. study plans and specs, bring recommendations and project-specific questions for contractors to the meeting)</li> <li>• Offsite and field (i.e. plan-in-hand) reviews</li> <li>• Meetings</li> <li>• Phone calls</li> <li>• Emails</li> </ul> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• To address potential constructability issues during design phase</li> <li>• Reduces bid costs by minimizing conflicts and ambiguities</li> <li>• Potential to increase number of bidders</li> </ul>



**Construction Quality Toolbox – Contract Management**

<i>ID</i>	<i>Element</i>	<i>Details</i>
MGT-04	Pre-construction activities	<p><i>What</i> Pre-construction activities</p> <p><i>When</i> Between bid opening and pre-construction meeting</p> <p><i>Who</i> All construction staff</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Have staff review               <ul style="list-style-type: none"> <li>○ plans and specs</li> <li>○ CMM, FDM, MUTCD, bridge manual, and/or other reference material pertaining to their functional role on the project</li> <li>○ utilities</li> <li>○ drainage</li> <li>○ traffic control and staging</li> <li>○ layout survey</li> <li>○ R/W</li> <li>○ railroads</li> <li>○ erosion control</li> <li>○ haul routes</li> <li>○ quarries and pits</li> <li>○ PI plan</li> <li>○ etc.</li> </ul> </li> <li>• Photo and/or video document pre-construction condition</li> </ul> <p><i>Why</i> To adequately prepare for construction project</p>

**Construction Quality Toolbox – Contract Management**

<i>ID</i>	<i>Element</i>	<i>Details</i>
MGT-05	Utility coordination	<p><i>What</i> Coordination with public and private utility owners re: relationship between construction project and utility facilities (existing and relocated)</p> <p><i>When</i> Pre-construction (utility adjustments) through project closeout</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• Designated by PM</li> <li>• Region utility engineer</li> <li>• Megaproject utility engineer</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Physically verify utility relocations, or minimally, verify schedule</li> <li>• Realize that utility companies use outside contractors to construct utility relocations; check to make sure that details of agreements between utility companies and WisDOT are met</li> </ul> <p><i>Why</i> To ensure utility adjustments are completed in compliance with</p> <ul style="list-style-type: none"> <li>• project schedule</li> <li>• plans and specifications</li> <li>• utility agreements</li> <li>• environmental commitments</li> <li>• real estate commitments</li> </ul>

**Construction Quality Toolbox – Contract Management**

<i>ID</i>	<i>Element</i>	<i>Details</i>
MGT-06	Inspection	<p><i>What</i> Inspect construction work performed by contractor</p> <p><i>When</i> Throughout construction</p> <p><i>Who</i> WisDOT and/or consultant inspectors</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Per CMM</li> <li>• Use inspection checklist</li> <li>• Be thoroughly familiar with plans, specifications, and special provisions</li> <li>• Interpret specs as written</li> <li>• Have an owner controlled mentality</li> <li>• Own every decision; don't blame other individuals, departments, agencies, etc.</li> <li>• Notify contractors of non-conforming work</li> </ul> <p><i>Why</i> To ensure compliance with plans and specifications</p>
MGT-07	Materials	<p><i>What</i> Make time to visit materials trailer, quarries, pits, etc.</p> <p><i>When</i> Throughout project</p> <p><i>Who</i> Project leader or designee</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Make visit</li> <li>• Review documents</li> <li>• Talk to staff</li> </ul> <p><i>Why</i> Ensure compliance with plans and specifications</p>

**Construction Quality Toolbox – Contract Management**

<i>ID</i>	<i>Element</i>	<i>Details</i>
MGT-08	Materials Testing	<p><i>What</i></p> <ul style="list-style-type: none"> <li>• QC testing of materials by contractor</li> <li>• QV testing of materials by WisDOT and/or consultants</li> </ul> <p><i>When</i></p> <ul style="list-style-type: none"> <li>• Frequency of testing, number of tests, etc. to be determined on a project-specific basis per CMM</li> <li>• Ensure aggregate pits and quarries are tested in accordance with CMM</li> </ul> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• QC testing               <ul style="list-style-type: none"> <li>○ Contractor QC technicians</li> </ul> </li> <li>• QV testing               <ul style="list-style-type: none"> <li>○ Materials technicians</li> <li>○ Lab technicians</li> <li>○ Inspectors</li> <li>○ Consider having a regional materials PM to help PMs be more consistent with respect to testing</li> </ul> </li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Per CMM</li> <li>• All grading, base, paving, etc. testing efforts need to conform to CMM with the same diligence as typically employed on bridge deck pour</li> <li>• Maintain “big picture” view of materials testing; just because a test was taken does not necessarily mean quality has been achieved</li> <li>• Send samples to lab ASAP; withholding samples will cause lab to miss 48 hour turnaround</li> </ul> <p><i>Why</i></p> <p>To ensure compliance with plans and specifications</p>

**Construction Quality Toolbox – Contract Management**

<i>ID</i>	<i>Element</i>	<i>Details</i>
MGT-09	Payment	<p><i>What</i> Accurate, prompt payment to contractors</p> <p><i>When</i> Frequency per CMM</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• PM</li> <li>• PM designee</li> </ul> <p><i>How</i> Testing, estimates, measurements, etc. per CMM</p> <p><i>Why</i> To ensure compliance with specifications</p>
MGT-10	Punch List Review	<p><i>What</i> Opportunity for all functional areas to provide input on punch list</p> <p><i>When</i> At end of project</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• WisDOT functional areas from region and statewide bureaus (e.g. design, maintenance, lighting, signals, signing, marking, structures, materials, etc.)</li> <li>• FHWA</li> <li>• Local agencies that will assume jurisdiction</li> <li>• Contractors</li> </ul> <p><i>How</i> Detailed field review</p> <p><i>Why</i> To provide opportunity for construction staff to share reasons for revisions or adjustments done in the field</p>

**Construction Quality Toolbox – Contract Management**

<i>ID</i>	<i>Element</i>	<i>Details</i>
MGT-11	Traffic Management	<p><i>What</i> Work with contractor to develop, implement, revise and continually improve project traffic control plan</p> <p><i>When</i> Throughout the project</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• PM</li> <li>• PM designee</li> <li>• Contractor rep</li> <li>• Sub-contractor specializing in traffic operations</li> <li>• Law enforcement</li> <li>• Local officials</li> <li>• WisDOT STOC</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Develop plan</li> <li>• Regularly revise plan as needed due to severe weather, incidents, changed conditions, etc.</li> <li>• Photo and video documentation</li> <li>• Daily observation and feedback</li> <li>• Meetings</li> </ul> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• To achieve safe and optimal traffic operations for all; i.e. motorists, pedestrians, bicyclists, and all construction traffic (e.g. heavy equipment, trucks, cranes, workers vehicles, delivery vehicles, etc.)</li> </ul>

**Construction Quality Toolbox – Contract Management**

<i>ID</i>	<i>Element</i>	<i>Details</i>
MGT-12	Safety	<p><i>What</i> Work with contractor to develop, implement, revise and continually improve project safety plan</p> <p><i>When</i> Throughout the project</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• PM</li> <li>• All WisDOT and consultant staff</li> <li>• All contractor, sub-contractor, supplier, materials staff</li> <li>• All site visitors</li> <li>• Law enforcement</li> <li>• Local officials</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Develop plan</li> <li>• Regularly revise plan as needed due to changed conditions and/or continuous improvement</li> <li>• Photo and video documentation</li> <li>• Daily observation and feedback</li> <li>• Meetings/tailgate talks prior to work beginning</li> <li>• Project may or may not utilize Owner Controlled Insurance Program (OCIP)</li> </ul> <p><i>Why</i> To achieve safe work zone for all; i.e. workers, site visitors, motorists, pedestrians, bicyclists, etc.</p>

**Construction Quality Toolbox - Resources**

<i>ID</i>	<i>Element</i>	<i>Details</i>
RES-01	Knowledge and experience of inspectors	<p><i>What</i> Take pro-active steps to improve knowledge and experience of inspectors</p> <p><i>When</i> Pre-project through project kickoff</p> <p><i>Who</i> All staff to undergo a skills inventory assessment on an annual basis</p> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Develop and implement certification process and/or 2-week training similar to MnDOT – require initial training and refresher training by all WisDOT and consultant staff assigned to construction projects</li> <li>• Develop, implement and maintain project-specific Roles and Responsibilities Matrix</li> <li>• PM to show up, observe, talk to staff, ask questions, etc.</li> <li>• Make sure all staff has tools needed to do the job and know to communicate their findings</li> <li>• Put people in correct roles; take advantage of different levels of expertise</li> <li>• Have all staff think in terms of “What is your job? and “Why are you here?” To measure, pay, and enforce compliance with contract</li> <li>• Require annual assessment of WisDOT and consultant staff assigned to construction projects</li> </ul> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• Improve...             <ul style="list-style-type: none"> <li>○ Project quality</li> <li>○ Documentation of skills sets and gaps</li> <li>○ Development of training to address gaps</li> </ul> </li> <li>• Employee development</li> </ul>



**Construction Quality Toolbox - Resources**

ID	Element	Details
RES-02	Appropriate construction staffing levels	<p><i>What</i> Selection of construction staff (WisDOT and consultant)</p> <p><i>When</i> As early as possible (scaled to type, size and complexity of project)</p> <p><i>Who</i></p> <ul style="list-style-type: none"> <li>• PM</li> <li>• Region PDS</li> <li>• Others as required</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• Match available resources (considering number of staff, experience, and expertise required) to all construction project needs on region-wide basis</li> <li>• Consider utilizing design staff on construction projects;               <ul style="list-style-type: none"> <li>○ expands their horizons</li> <li>○ improves their design skills by exposing them to practical considerations</li> <li>○ adds value to construction team with their skill sets (e.g. Civil3D)</li> </ul> </li> <li>• “A good inspector is worth 2 weeks on the schedule”</li> <li>• Determine consultant need, if any</li> <li>• Mega projects do not usually have a staffing problem, but need to effectively manage staff to avoid “too many cooks in the kitchen”</li> <li>• Be prepared to deal with more turnover on mega projects</li> <li>• Need to provide initial training of staff coming onto project – general construction then project-specific</li> <li>• Make sure staff don’t get bogged down with unchallenging assignment; rotate if possible</li> <li>• Make deliberate effort to get newer staff on construction projects early in their career</li> </ul> <p><i>Why</i> Assembling the best possible team as early as possible improves quality by allowing staff to become familiar with plans and specs, coordinate with design staff, etc.</p>

**Construction Quality Toolbox - Resources**

<i>ID</i>	<i>Element</i>	<i>Details</i>
RES-03	Mentoring	<p><i>What</i>    Actively seek and leverage mentoring opportunities on construction project</p> <p><i>When</i>    Throughout construction</p> <p><i>Who</i>      • Potential mentors -- all staff; especially those with experience in industry and/or with WisDOT          • Potential protégés -- all staff; especially less experienced staff</p> <p><i>How</i>      • Develop mentoring plan and include it as part of Resources chapter in Project Management Plan                      ○ Develop plan for formal or informal mentoring as part of PEPED                      ○ Identify and then leverage mentoring opportunities on project to achieve goals included in mentoring plan          • Take design staff into field to expose them to construction, especially if it is a project they worked on in design          • Consider using mentoring as part of selection criteria when hiring consultants          • Proper mentoring takes time; be sure to build into project budget</p> <p><i>Why</i>      Providing mentoring to staff as part of their professional development is beneficial to industry, WisDOT, mentor, and protégé – both now and going forward</p>

## Testing of Focus Areas

The four focus areas were tested on a recently completed project. The construction leader and support staff for the Center Street project (part of the Zoo Interchange) were interviewed to see to what extent the CQM elements were utilized. They were also asked if other elements were used that should be added to the CQM toolbox.

The Center Street project was seen as a good candidate for this testing role in that it was part of a mega project and therefore the staff were familiar with some of the more detailed processes associated with mega projects. At the same time, it was a smaller contract, with a scope, schedule, and budget comparable to projects across the state.

The following is an element-by-element summary of the Center Street construction team’s comments on the four focus areas:

### Documentation

<i>ID</i>	<i>Element</i>	<i>Feedback from Center Street construction team</i>
DOC-01	Project Management Plan	PMP was followed
DOC-02	Inspection guide	Geared toward structures and concrete pavement
DOC-03	Schedule	Used fully detailed CPM schedule per Zoo Interchange process; this would not typically be done on a project of this type, size, and complexity
DOC-04	Cost to complete analysis	Not familiar with this terminology, but did perform cost projections based on ROM
DOC-05	Project performance metrics	Project metrics not posted, but shared verbally with staff at weekly meetings
DOC-06	Photos and videos	Took lots of photos
DOC-07	Shop drawings	Utilized Bureau of Structures SharePoint site
DOC-08	Shop inspection documentation	Prompt turnaround
DOC-09	Pay Estimates	Biweekly; burn rate did not warrant weekly payments
DOC-10	General project documentation	Documentation was completed
DOC-11	Specific project documentation	Followed Zoo Interchange process; no CRI's
DOC-12	Change orders	Followed Zoo Interchange process; no federal oversight
DOC-13	Issue log	Used issue log; provided opinion that these two elements should be combined (Note: This was done post-meeting. New element DOC-13 includes issue log and issue closure; subsequent elements re-numbered)
DOC-14	Issue closure	
DOC-15	Explanation of variance report	Team utilized “Equalizing modification”

<i>ID</i>	<i>Element</i>	<i>Feedback from Center Street construction team</i>
DOC-16	Non-conforming materials	Followed Zoo Interchange process; provided opinion that these two elements should be combined (Note: This was done post-meeting. New element DOC-15 includes non-conforming and non-performance materials; subsequent elements re-numbered)
DOC-17	Non-performance materials	
DOC-18	Project closeout documentation	Completed
DOC-19	As-builts	Completed
DOC-20	Lessons learned and best practices	Lessons learned were addressed at weekly meetings; not documented

### **Communications and Relationships**

<i>ID</i>	<i>Element</i>	<i>Feedback from Center Street construction team</i>
COM-01	Pre-Bid Meeting	Did not have a pre-bid meeting
COM-02	Pre-Construction Meeting	Completed
COM-03	Partnering meetings	Did not have formal partnering meetings on this project
COM-04	Progress meetings	Weekly progress meetings; 20-45 minutes; contractor provided 3-week look-ahead schedule
COM-05	Communication between design and construction staff	Identified a design liaison; had formal and informal conversations throughout construction
COM-06	Communication between construction staff and contractor	Daily dialogue with contractor re: immediate upcoming work
COM-07	Communication between task leads and inspectors	Daily dialogue with 3-4 inspectors; lots of communication, maybe even over-communication
COM-08	Communication between construction staff and statewide bureaus and FHWA	Good communication with Bureau of Structures; no involvement with other bureaus or FHWA
COM-09	Communication between construction staff and general public	Had several concerned residents; utilized Zoo Interchange PI team
COM-10	Quarterly coordination meetings between megaproject team in different regions	Not applicable

## Contract Management

<i>ID</i>	<i>Element</i>	<i>Feedback from Center Street construction team</i>
MGT-01	Project Management	Per Zoo Interchange process
MGT-02	Plan & Specification Reviews	Reviewed plans at Draft PS&E; used old Southeast Region spreadsheet
MGT-03	Constructability reviews	Do not know if there was a formal constructability review
MGT-04	Pre-construction activities	Per Zoo Interchange process
MGT-05	Utility coordination	Utilized Region expertise; no issues
MGT-06	Inspection	Per Zoo Interchange process
MGT-07	Materials	Per Zoo Interchange process
MGT-08	Materials Testing	Per Zoo Interchange process
MGT-09	Payment	Per Zoo Interchange process
MGT-10	Punch List Review	Occasionally sent punch list out with estimate

NOTE: MGT-11 Traffic Management and MGT-12 Safety were added to this focus area after the testing meeting.

## Resources

<i>ID</i>	<i>Element</i>	<i>Feedback from Center Street construction team</i>
RES-01	Knowledge and experience of inspectors	Had right mix of skills on project
RES-02	Appropriate construction staffing levels	Overall, staffing level was appropriate; all staff worked at least 40 hours per week and never exceed 60 hours per week; having resources from Zoo Interchange team reduced need for project-specific resources
RES-03	Mentoring	Not formalized

## Roundtable Feedback on Improving Quality

At each roundtable discussion, the facilitators documented and categorized the participant responses. Some of that feedback provided the participants' "definition of quality" and their view on "how do we build quality into construction projects?". The majority of their feedback became part of the focus area elements.

Another component of the roundtable feedback was what the Department could do to improve construction quality. These are captured below; categorized by the four focus areas, plus a category for miscellaneous feedback not directly tied to one of the focus areas.

Some are questions directed to Department leadership. Others lend themselves to further study by committees, task forces, etc. It is indicative of the passion that WisDOT and contractors have for the work they do, and the products and services for which they are responsible. It is also further proof that quality is a journey, and continuous improvement is just that.

### Documentation

There were comments at every roundtable regarding WisDOT's **CQI process**. Many questioned the value of how the current process is being performed and suggested that it be revised or replaced. Some suggested that rather than being completed with Maintenance staff - which is sometimes difficult to schedule - independent quality reviews should be completed with different disciplines, thereby providing a broader quality focus. Alternative methods of judging construction quality were mentioned, including change order percentage.

Other questioned the timing of the CQI process and had various suggestions including 1) beginning at punch list time, 2) creating a draft CQI at end of project to identify what to look at 6 months later, and 3) postponing entirely until 2-3 years later.

WisDOT's **CRI process** also generated considerable discussion. Those with negative experiences cited that the money saved often did not justify the time spent by contractors or WisDOT. However at another roundtable, the opposite view was taken... be sure to look at small CRI's as they all add up.

Others noted that contractors were simply eliminating items or otherwise coming up with savings that the Department would have implemented even without the process. Still others thought that the process takes too long. Others noted that CRI's could and should be more widely used but experience has turned a lot of contractors off, and that there is not much motivation for contractors.

Feedback was received on other WisDOT documentation including: addressing the shop drawing approval process, developing process for preparing as-builts, developing a SharePoint site for easier access to shop drawings and shop inspection documentation for both construction staff and statewide bureaus, developing an approved list of suppliers, reviewing what other state DOT's are doing with e-construction tools, providing training for construction management documentation requirements, and consolidating WisDOT's reference materials into a single location to which project-specific information can be added.

## Communications/Relationships

It was suggested that WisDOT review **communication** issues related to specific institutional barriers and develop specific actions needed to overcome these barriers. Barriers identified included those between: design and construction, consultants and WisDOT, region and region, region and statewide bureau, megas and conventional projects, and region units and other region units.

External communications; develop a scalable, statewide model to explain “bad” news to public and elected officials.

It was suggested that WisDOT review and address **relationships** with contractors. Some of the issues identified included 1) some contractors don't want to do evaluations because of potential retribution, 2) some contractors have gotten a poor evaluation from WisDOT and then have that project be submitted for an award; sending a mixed message, and 3) In spite of improved communication and documentation, there continues to be instances of contractors looking for extras at the end of projects.

## Contract Management

There were several comments regarding **materials testing**. One suggested that WisDOT review and address optimal percentage of owner testing; e.g. could quality be improved by going to 100% owner testing?. Another suggestion was to review and address the appropriateness of materials tests; some tests are out of date.

WisDOT should consider putting an emphasis on training of **CPM scheduling** for WisDOT construction staff... contractors are much more familiar with this tool as it migrated from vertical construction. It would be beneficial for WisDOT to have its staff have a similar level of expertise.

**Contractor concerns** included: more layers of authority are being added; slowing turnaround time for decisions, need more timely decision making on all projects... not just megas, not enough experience in the field to make day-to-day decisions, WisDOT not giving guidance in the field, errors in plans, and the perception that there used to be better results when engineers staked projects and had responsibility for materials as it forced them to understand the project better.

There were suggestions to review and address **credits** including 1) how to determine when to pursue credits; do credits relate to the delta between target quality and actual quality?, 2) process takes too long; can spend \$10,000 to credit \$1,000, and 3) do schedule credits take user delays into consideration... if not, they should.

## Resources

There were many general suggestions regarding **resources**. These included consideration of the following positions: 1) functional experts in regions assigned to specific programs/projects; e.g. HMA, structures, etc., 2) a Quality Manager position similar to that employed by the Illinois Tollway, 3) a BPD-based QC person for all aspects of project (not just materials), and more trained technicians, or rotating entry level engineers through various functional roles.

Questions to consider when addressing resource issues in the **field** include: 1) do we have enough staff on construction projects?, 2) does our staff have appropriate skills?, and 3) what steps should be taken when paired with the range of contractor crew experience levels?

Questions to consider when addressing resource issues in the **materials lab** include: 1) do we have enough lab staff?, 2) does our lab staff have appropriate training and skills?, 3) is our lab staff tied up with research to the detriment of their construction testing responsibilities?, and 4) what would it take to bring central office lab facilities and equipment up to par with other state DOT's?

There were many suggestions regarding **consultants**. Review and address perceptions regarding 1) performance of consultant inspectors, 2) training of consultants, 3) adequacy of competencies in the following areas - specs, hierarchy between plans, specials, etc.

## **Miscellaneous**

The roundtables generated many comments for areas not specifically included in one of the four focus areas. The first sub-category under Miscellaneous includes areas that participants thought should be **reviewed and addressed** by WisDOT in an attempt to improve construction quality.

- “Big picture” quality or individual components, i.e. did project achieve objectives versus did materials comply?
- Design quality directly impacts construction quality
- Construction quality on megas can be adversely affected by having too much scope and/or not enough time
- Contractors may be a source of construction quality issues
- Risk management on WisDOT construction projects
- Execution of “responsible charge” on WisDOT construction projects
- Long term ramifications of cold weather construction
- Estimating and payment practices
- Consider packaging smaller projects to achieve efficiencies of scale on non megas
- Factors that favorably affect CQM (road closures providing contractor with more room, additional time, and greater access)
- Factors that adversely affect CQM (political influence, utility issues)
- WisDOT’s self-imposed limitations (e.g. time, R/W, etc.) can adversely affect quality
- Need to balance competing project constraints; e.g. scope, schedule, cost, traffic staging, quality, etc. on all projects, but especially on megas
- Need more staffing on many WisDOT construction projects; staffing affects quality
- Should WisDOT be more aggressive in shutting down a project or removing materials versus pursuing credits?
- Should WisDOT do more to keep contractors accountable?
- Should WisDOT do more to keep itself accountable?
- Does WisDOT take too much ownership of contractor problems?
- Why can’t QA/QC be applied to workmanship and not just materials?
- WisDOT used to be a bigger part of solving problems in the field than we are today; contractors are still adjusting to it
- Is WisDOT spending too much on project controls and issues tracking?



- Are too many contracts split up for the benefit of construction industry causing coordination issues and thus affecting quality?

The roundtable held with Mortenson Construction highlighted the **differences between horizontal** construction (highway and bridge) projects **and vertical construction** (buildings) projects. It is acknowledged that the industries and associated work types are fundamentally different. However, specific vertical approach strategies should be reviewed and considered for adoption by WisDOT as appropriate.

<i>Component</i>	<i>Horizontal</i>	<i>Vertical</i>
Detail in plans and specs	More	Less
Quantity takeoffs	Engineer	Contractor
Warranty	Seldom	Always
Engineering staff	More	Less
Level of inspection	More	Less
Owner (or representative) onsite during construction	Always	Seldom

## Bibliography

<i>Title</i>	<i>Document</i>	<i>Date</i>	<i>Author(s)</i>
Analysis of Construction Quality Assurance Procedures on Federally Funded Local Public Agency Projects	Publication No. FHWA-HRT-15-008	July 2016	Linda Karen Konrath, Leslie Ann McCarthy, Sidney Scott
Applying AQS In the Highway Industry	Publication No. FHWA-HRT-08-006; Issue No: Vol. 72 No. 2	Sept/Oct 2008	Alberto Miron, Richard B. Rogers, and Peter A. Kopac
Construction Quality Assurance for Design-Build Highway Projects	Publication No. FHWA-HRT-12-039	April 2012	Michael Rafalowski
Construction Quality Improvement Program (CQIP) Checklist Distribution	Virginia DOT	2014	
Construction Resource Guide	Virginia DOT website	2017	
Construction Resource Guidebook	Virginia DOT	2012	
External Inspector Trainee Job Book	Virginia DOT		
Field Guide for Partnering	Virginia DOT	2005	
Glossary of Transportation Construction Quality Assurance Terms	Transportation Research Circular Number E-C173	June 2013	
Guidebook on Alternative Quality Management Systems for Highway Construction	NCHRP Report 808	2015	Keith R. Molenaar, Douglas D. Gransberg, David N. Sillars
I-4 Ultimate Project, FDOT Risk Based Inspection System Using Risk Based Audit Plan (RBAP)	FHWA Webinar	November 2016	Loreen Bobo, Michael Gwynne
Quality Assurance and Quality Control Guidelines	Federal Transit Administration, FT-IT-90-5001-02.1	February 2002	Rick Carter, Dr. Osama Tomeh, Georges Darido, Donald Schneck, Frank Waesche III
Quality Assurance and Quality Control Process Guide for Project Managers; MDOT Trunkline Projects	MDOT	January 2005	
Quality Assurance Procedures for Construction	Federal Aid Policy Guide, 23 CFR 637B	October 1995	
Quality Management Practice in Highway Construction	International Journal of Quality & Reliability Management, Vol. 20 Issue 5		Mireille G. Battikha
Quality Management Process for Design-Bid-Build Final Plan Development	Minnesota Department of Transportation	April 2012	
Quality Management System for a Highway Megaproject	TRB	2014	Donath Mrawira, Jeff Rankin, A. John Christian
State Construction Quality Assurance Programs	NCHRP Synthesis 346	2005	
Wisconsin Division Major Projects Materials Review	FHWA Wisconsin Division	August 2016	
Zen and the Art of Highway Construction	ASQ World Conference on Quality and Improvement, St. Louis MO Vol. 64	2010	John Baranzelli