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Innovative Contracting**

**Risk Management Best Practices  
Final Research Report**



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<b>16. Abstract</b> The Michigan Department of Transportation (MDOT) has been successfully applying risk management on innovative contracting methods and was looking to formalize and build upon its current risk management guidance. Research was conducted to document industry risk management best practices to provide recommendations for developing and implementing a comprehensive Risk Management Program for the MDOT Innovative Contracting Unit (ICU). These best practices were used to develop standardized guidance documents and tools to better assist project managers in managing project risk to improve project delivery on a consistent basis. A Risk Management Workbook was developed consisting of an Excel-based tool of interactive and linked risk management process workflows and scalable templates to be used across various project types, sizes, and throughout all phases of project development. Risk reports provide a summary of high priority risks and the status of key project development activities. Training and testing of the Risk Management Workbook occurred during a pilot project risk workshop providing MDOT staff access to the tool and a demonstration of the risk management process and workflows. A training module was produced to provide MDOT staff a self-guided walkthrough of the tool or training can be combined with project risk workshop facilitation.			
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## ACRONYMS

ATC	Alternative Technical Concept
CDOT	Colorado Department of Transportation
CMGC	Construction Manager General Contractor
CPM	Critical Path Method
CRA	Cost Risk Assessment
CTB	Commonwealth Transportation Board
DB	Design-Build
DBB	Design-Bid-Build
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
FOPI	Finding of Public Interest
GDOT	Georgia Department of Transportation
ICU	Innovative Contracting Unit
MDOT	Michigan Department of Transportation
MnDOT	Minnesota Department of Transportation
MoDOT	Missouri Department of Transportation
NDOT	Nevada Department of Transportation
P3	Public-Private Partnership
PDM	Project Delivery Method
PDSM	Project Delivery Selection Matrix
PM	Project Manager
RBCE	Risk-Based Cost Estimate
RFP	Request For Proposal
RID	Reference Information Documents
RM	Risk Management
ROW	Right-Of-Way
SCDOT	South Carolina Department of Transportation
SME	Subject Matter Expert
TxDOT	Texas Department of Transportation
VDOT	Virginia Department of Transportation
WSDOT	Washington Department of Transportation



# EXECUTIVE SUMMARY

## ***Introduction***

Risk management is a project planning and control function that includes proactive efforts to identify, mitigate, and control risk throughout the project delivery process. The Michigan Department of Transportation (MDOT) has been successfully applying risk management on innovative contracting methods and was looking to formalize and build upon its current risk management guidance.

Research was conducted to document industry risk management best practices to provide recommendations for developing and implementing a comprehensive Risk Management Program (“RM Program”) for the MDOT Innovative Contracting Unit (ICU). These best practices were used to develop standardized guidance documents and tools to better assist project managers (PM) in managing project risk to improve project delivery on a consistent basis. Making project risk management more effective and efficient for PMs and staff will help to improve MDOT’s business practices, project outcomes, and streamline project delivery.

Key objectives included:

- Identifying national transportation project risk management best practices
- Documenting effective transportation project risk management methods that can be applied today in Michigan
- Improving and building upon MDOT’s existing risk management guidance
- Identifying gaps in the MDOT ICU RM Program
- Focusing on customizing the guidance for PMs that are not to be an administrative burden
- Recommending an implementation strategy for the MDOT ICU RM Program

## ***Risk Management Investigation Phase***

The purpose of the Risk Management Investigation Phase was to document risk management best practices currently in use and develop a set of risk management best practice recommendations for the Risk Management Development Phase. The team performed the following activities:

- Conducted MDOT staff interviews of representatives in both traditional and alternative project delivery.
- Performed public sector industry outreach with select transportation agencies currently using risk management processes to solicit feedback on ongoing work and lessons learned from their RM Programs.
- Conducted interviews with FHWA representatives to gain national and local perspective on risk management practices.
- Conducted interviews with representatives from the local and national contracting community for their experiences with MDOT projects and to gain their perspective on contracts and related risk elements.

- Conducted desktop surveys of the current literature and federal and state guidance to identify risk management best practices currently being performed at the program and project levels on alternative delivery projects.
- Facilitated a peer exchange workshop with individuals from federal and state agencies, and representatives from MDOT with a focus on the identification and use of risk management best practices and identify the effectiveness of risk management tools currently in use on those projects and programs.

The result of the Risk Management Investigation Phase was a summary of the best practice recommendations to implement in the development of risk management tools and processes to develop and formalize MDOT ICU's RM Program. The following list highlights many of the best practice findings:

- Obtain leadership support to help program acceptance, region buy-in and promote risk philosophy.
- Develop risk management processes, guidance, and training by project phase.
- Tailor a scalable and customizable RM Program to account for project size, cost, region, phase, and overall project risk profile.
- Develop processes and tools that are simple, standardized and documented.
- Keep risk management documentation concise and move away from large guidance documents.
- Emphasize early project team collaboration and risk management discussions at the inception of a project.
- Begin the stakeholder/public engagement process early and continue through project lifecycle.
- Identify risks of greatest concern and focus the attention on critical items.
- Focus on mitigating schedule risks.
- Provide information to the group prior to a risk workshop to prepare and be ready for interactive discussion.
- Hold risk workshops at major phases and/or milestones.
- Include subject matter experts (SME) from multiple disciplines in risk workshops to help cover all project areas.
- Encourage discussion of opportunity risks that benefit the project.
- Utilize risk-based cost estimates (RBCE) to help determine risk-based contingencies.
- Update contingencies to reflect assumptions used in the estimates.

### ***Risk Management Development Phase***

The objective of the Risk Management Development Phase was to develop a set of formal risk management guidance documents, templates and tools based on the best practices identified from the Risk Management Investigation Phase. These included the following items:

- Innovative contracting guidance document for use statewide that defines risk management practices for MDOT staff.
- Risk management templates and tools including a project risk management plan ("RM Plan), risk breakdown structure, risk assessment matrix, and risk register.

- Specific templates, tools and forms to be utilized to support MDOT risk identification, analysis and evaluation, response planning, mitigation, monitoring and reporting
- Training materials and conduct training on the use of templates, tools, and other deliverables.

The approach consisted of the development of a Risk Management Toolbox (“RM Toolbox”) consisting of an Excel-based Risk Management Workbook (“RM Workbook”) of interactive and linked Risk Management Workflows (“RM Workflow”) for each phase of project delivery. The RM Workbook was specifically tailored for implementation by PMs to address gaps in MDOT’s current RM Program and to improve and build upon MDOT’s existing risk management guidance.

A key research objective was to focus on customizing the guidance for PMs to successfully implement risk management on projects on a consistent basis, establish formal risk management processes and procedures, and to provide PMs with a formal set of guidance documents and tools to effectively implement risk management.

The RM Workbook is organized into the following seven sections:

- Risk Management Workbook Introduction (Intro Worksheet): Provides a general risk overview, purpose of the RM Workbook, contents of the RM Workbook, and its use for MDOT projects.
- Risk Management Best Practices (Worksheet 1.0): Provides a graphical summary the key risk management best practices.
- Risk Management Workflow (Worksheet 2.0): Contains the major risk management process steps of the RM Plan, including identification and selection, development, procurement, and implementation.
- Risk Management Plan (Worksheet 3.0): Contains formal instructions for implementing the major risk process steps, including Initial Risk Meeting, Risk Review and Planning, Risk Analysis and Allocation Meetings, and Risk Updates and Reporting.
- Risk Management Procedure (Worksheet 4.0): For use at risk workshops, consisting of risk identification, risk assessment, and risk response planning.
- Risk Documentation (Worksheets 5.0 through 5.4): Contains the templates and tools to use for documenting the risk management process as part of the Risk Management Procedure (“RM Procedure”), including a Risk Register template (“Register”), Risk Breakdown Structure template (“RBS”), Rating Guidelines template, and a Risk Contingency and Schedule Impact Calculation template (“Contingency Calculation”).
- Risk Reporting (Worksheets 6.0 through 6.2): Contains the reporting templates, including a summary list of High Priority Risks and a Risk Assessment Checklist (“Checklist”).

### ***Risk Management Implementation Phase***

The Risk Management Implementation Phase consisted of developing and delivering an interactive training program on the RM Workbook and associated templates, documents and tools while providing examples of best practices and lessons learned on projects and programs in conjunction with the instruction. The development approach for the training was based on the findings from the Risk Management Investigation Phase and Risk Management Development Phase and to remain consistent with MDOT’s *Innovative Construction*

*Contracting Guide*. The RM Program and training presentation were also developed consistent with the seven processes in the *Project Management Body of Knowledge* (PMBOK) area for risk management.

Draft versions of the RM Workbook were released throughout the Risk Management Development Phase and Risk Management Implementation Phase to provide MDOT staff an opportunity to train and provide feedback creating an interactive process of MDOT staff learning to use the tools and RS&H improving the tools. This helps implement a feedback loop for continuous improvement of the RM Program.

There were two stages developed for the Risk Management Implementation Plan. The first stage was focused on providing risk management training using the US-131 Design-Build Project as a pilot project in a risk workshop setting. This gave MDOT staff and the project team the opportunity to execute early risk management activities during the project Development Phase by observing the four-step RM Plan and utilizing the documents and tools provided within the RM Workbook.

The project team participated in Initial Risk Meetings and documented risks in the Register. In step with best practices, a pre-workshop survey was distributed to the project team populated with key project risks identified in an Initial Risk Meeting. The team reviewed the existing risks and assigned a rating level to each risk. The responses provided to this questionnaire were used to initiate the risk identification discussions at the workshop. To continue with pre-workshop activities and to provide project team members with additional information leading into the workshop, RS&H set up a series of ten breakout meetings individualized per risk category to interview SMEs on the findings from the risk survey.

The objective of the two-hour workshop was to provide a walkthrough of the RM Workbook as opposed to a full project assessment. Three risks were selected to train the participants through the four steps of the RM Plan and three steps of the RM Procedure in order make use of the risk management process and demonstrate the full project Development Phase RM Workflow. For each of the three risks, the qualitative ratings were changed in the Register and the Rating Guidelines were modified to provide training on use of the Contingency Calculation and the process for calculating the quantitative cost and schedule impacts of Event Driven Risks. The result of the workshop was a draft risk register for the project team to build upon and a list of High Priority Risks to use for RM Plan Step 4 – Risk Updates and Reporting.

The second stage of the Implementation Plan was to develop a training module in the form of a self-guided presentation through the RM Workbook. This enabled the user to step through the iterative process and in combination with the RM Workbook provided the instructions to successfully integrate risk management activities into project management. The training presentation can be customized for use on active projects enabling the training to be conducted in conjunction with on-going project risk management activities. The RM Workbook can be used on an active project to conduct a risk workshop and develop a risk register for the project. The training can be combined with a project risk workshop facilitation, where training is provided as a morning session followed by a project workshop in the afternoon.

# 1. INTRODUCTION

Risk management is a project planning and control function that includes proactive efforts to identify, mitigate, and control risk, including risk response planning, throughout the project delivery process from early project planning through the identification and selection, development, procurement, and implementation phases.

Many transportation departments use innovative contracting methods to reduce the costs of constructing facilities, accelerate project completion schedules, manage project risks efficiently and to obtain greater certainty regarding future costs. Techniques to identify, evaluate, avoid and manage risks are critical in achieving this goal.

Michigan Department of Transportation (MDOT) selected RS&H to research and document industry risk management best practices to identify gaps in current risk management practices and provide recommendations for developing and implementing a comprehensive Risk Management Program (“RM Program”) for the MDOT Innovative Contracting Unit (ICU).

MDOT was looking to formalize and build upon its current risk management guidance to better assist project managers (PM) to manage project risk to improve project delivery on a consistent basis.

## 1.1 Background

MDOT has been successfully applying risk management on innovative contracting methods for several years and has learned many lessons that should be documented. Risk management processes and procedures have been improved but due to the limited staff within the unit and the demanding project workload, risk management guidance has not been formalized or documented. This research provides recommendations and guidance documents to standardize and formalize the MDOT ICU risk management procedures, making project risk management more effective and efficient for PMs and staff, improving MDOT's business practices, reducing project risk to improve project outcomes and streamlining project delivery.

## 1.2 Objectives

MDOT ICU was seeking to research risk management best practices to develop and formalize its project risk management procedures and template. The contract deliverables included a formal set of documented risk management instructions, templates, tools and training documents.

The study will also improve the institutional understanding of the importance, benefits, and practicality of risk management and provide guidance to educate and train staff to implement the recommended best practices.

Documenting the risk management best practices that have been effectively utilized in Michigan, in other states or internationally for future use in Michigan will help MDOT better manage project risk to improve its project delivery program.

Key research objectives included:

- Improve and build upon MDOT's existing risk management guidance.
- Focus on customizing the guidance for PMs that are not to be an administrative burden.

- Identify national transportation project risk management best practices.
- Document effective transportation project risk management methods that can be applied today in Michigan.
- Identify gaps in the MDOT ICU RM Program.
- Recommend an implementation strategy for the MDOT ICU RM Program.

### **1.3 Scope**

The activities performed under this contract included conducting research and documenting industry risk management best practices, then providing recommendations for developing and implementing a comprehensive RM Program for the MDOT ICU.

The deliverables for this contract are intended to foster wider education and buy-in from PMs, staff, and consultants for MDOT staff to better manage project risk on a consistent basis from early project planning through the identification and selection, development, procurement, and implementation phases.

The MDOT ICU currently manages project risks based on project size and complexity, except for Federal Highway Administration (FHWA) classified Major Projects at \$500M and above, for which FHWA-required risk management protocols are observed.

The scope of work was identified in the project request for proposals (RFP) as follows:

- Conduct a survey of the literature (such as federal and other state guidance documents as well as scholarly research, industry journals and publications) to identify risk management best practices.
- Conduct a state of the practice survey of other DOTs.
- Evaluate MDOT's current state of the practice and documentation needs, including outreach to Michigan contractor and consultant professional organizations.
- Conduct a peer exchange for technology transfer between identified best practice states/agencies.
- Develop an innovative contracting engineer's guidance document for use statewide that defines risk management practices for MDOT staff.
- Develop risk management templates and tools including, but not limited to, project Risk Management Plan ("RM Plan"), risk breakdown structure, risk assessment matrix, and risk register.
- Develop specific templates, tools and forms to be utilized to support MDOT risk identification, risk analysis and evaluation, risk response planning, risk mitigation, risk monitoring and reporting, and instructions/training documents for use of all templates and tools.
- Develop training materials and conduct training on the use of templates, tools, and other deliverables.
- Develop a research report with summary of findings and recommendations.

## 2. RISK MANAGEMENT INVESTIGATION PHASE

### 2.1 Introduction

The purpose of the Risk Management Investigation Phase was to document risk management best practices currently in use by state agencies and develop a set of risk management best practice recommendations for the Risk Management Development Phase.

The Risk Management Investigation Phase consisted of the following activities:

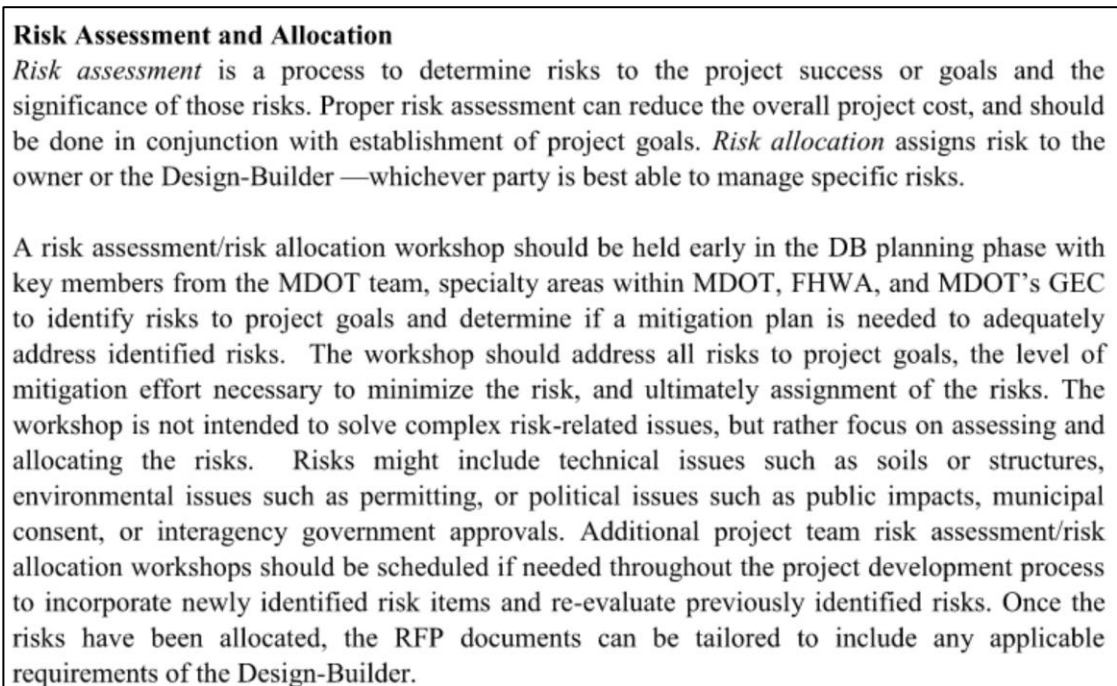
- Conducted MDOT staff interviews
- Performed public sector outreach
- Conducted contractor interviews
- Performed literature review and a desktop survey
- Facilitated a peer exchange workshop

These activities are described below. The recommendations for the Risk Management Development Phase are found at the end of this chapter.

### 2.2 Current State of Practice

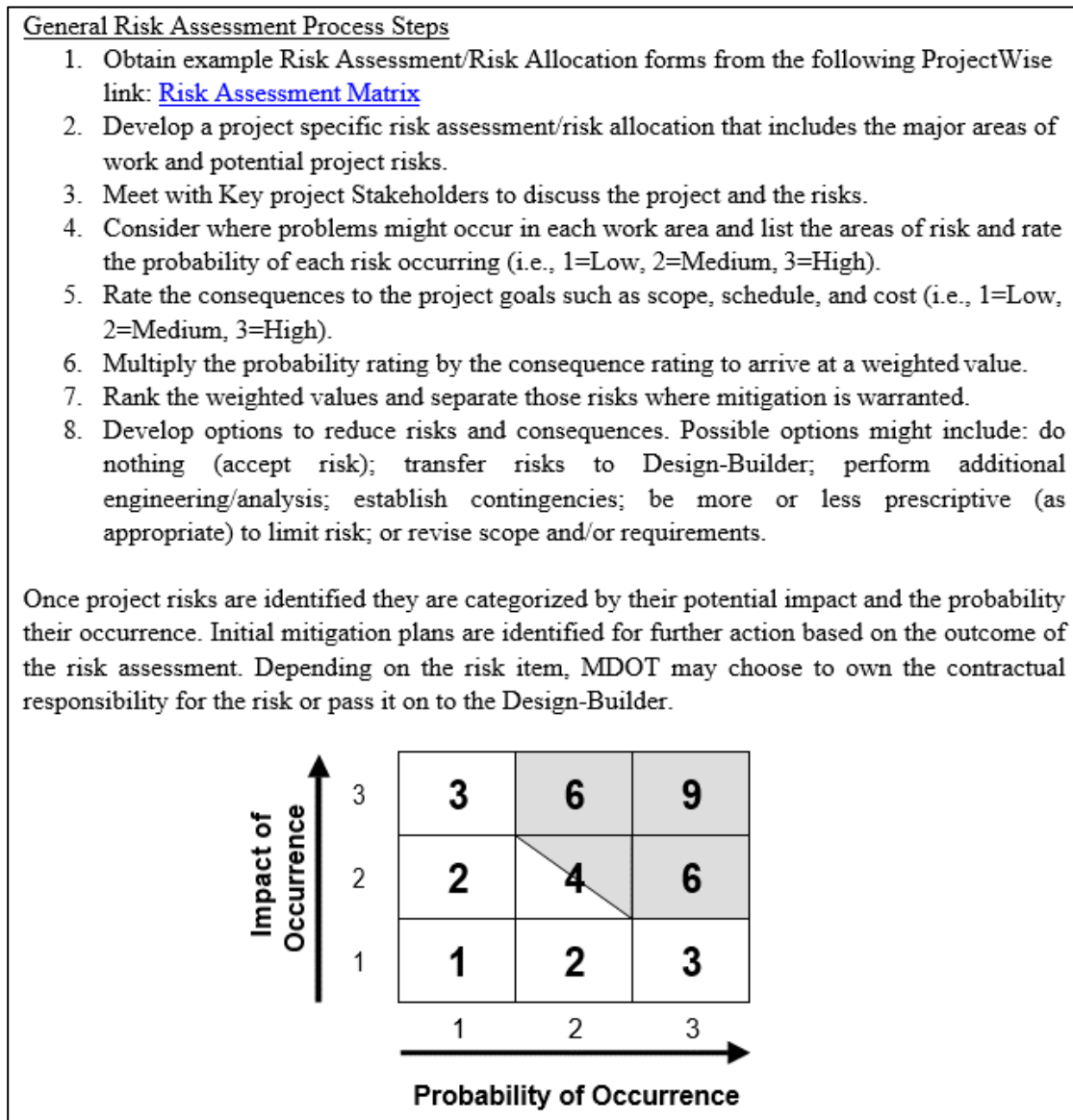
The goal of the Risk Management Investigation Phase was to build upon the current state of practice, identifying any gaps to identify opportunities to make improvements to the RM Program at MDOT.

Risk management guidance for the MDOT ICU is in MDOT's *Innovative Construction Contracting Guide*. Appendix C within this guide includes guidelines for the procurement of design-build (DB) projects and describes a risk assessment and allocation process in the figure below.



**Figure 2.2-1: MDOT's Risk Assessment and Allocation Process**

The guide also provides “General Risk Assessment Process Steps” as shown in Figure 2.2-2.



**Figure 2.2-2: MDOT’s General Risk Assessment Process Steps**

### 2.3 MDOT Interviews

Six representatives from the Planning, Design, Construction, and Operations Divisions involved in both traditional and alternative project delivery were interviewed in small group sessions for their perspective on the current MDOT risk management procedures and to gain insight into lessons learned.

Representatives were asked about each of the following topics. The bullet points that follow represent suggested strategies for a more effective RM Program based upon the responses and conversations.



**1. How are you currently using risk management and to what extent is it being used within your agency or unit? If risk management practices are not being implemented, what are some strategies to promoting the use of risk management?**

- Risk management is used on large projects as required by FHWA, but not currently on traditional projects.
- MDOT ICU Leadership reviews Risk Management Reports and keeps the team accountable to carrying out a risk management approach to projects.
- Need a risk management champion to make sure the teams are working together in a collaborative environment and holding the teams accountable to carrying out the RM Program.
- Need a goal/objective - the why - to be clear to the project team.
- Need a documented risk management guide that is not overly lengthy and is user friendly.
- Need to provide training on a regular basis that focuses primarily on the benefits and then the process.

**2. Do you think MDOT's current risk management practices are working effectively on your projects or programs or across the agency as a whole? If not, what are some of the key hurdles, deficiencies, or barriers that you face implementing risk management successfully? If not, what are your recommendations for improvements to overcome those challenges and/or deficiencies?**

- Provide better delineation of roles & risks between DOT and contractor. There are grey areas that could use better definition.
- Find the right balance between prescriptive and performance criteria.
- Provide both DOT and industry training for innovative contracting expectations and administration.
- Provide a standard program that can be used in all regions and provide consistency between projects.
- Need more education and widespread release of risk management resources to improve adoption throughout the DOT.
- The RM Program should be flexible based on both project size and cost but also location so that risks can be better customized.
- It is important that the RM Program be presented in an easily digestible format, a simple framework, and that champions for the program are located throughout the organization, not just at the upper levels.

**3. At what stage(s) of project delivery are you using risk management, such as within the planning process or during the Development or Implementation Phases (construction and operations)?**

- An RM Program can benefit both traditional and innovative project delivery type projects and should be developed with all project phases in mind.

**4. In your experience, what are some of the areas that MDOT could do better in more effectively responding to risk and mitigating risks before they become issues (e.g., scoping, schedule, cost, financing and funding, public/stakeholder involvement)?**

- The public and stakeholders tend to be the biggest risk to the project scope, schedule, and budget and need attention in an RM Program.
- 5. Do you think more project team coordination and the use of risk management tools are needed during early project planning and development to address risk?**
    - Risk management efforts should be scaled based on where you are in the project lifecycle.
  - 6. How do you think we can customize and tailor our risk management tool kit to meet the challenges of this new COVID-19 era?**
    - Training sessions and RM Program rollout should be held online and encourage engagement through small breakout sessions.
  - 7. What are the key risk items that you feel need to be better addressed in the RFP documents to reduce the number of claims and disputes (e.g., definition of design and construction requirements, right-of-way (ROW), environmental commitments, railroad coordination, differing site)?**
    - Define who owns railroad risks when plans change between planning and construction.
    - Geotechnical and underground elements tend to be the biggest risks.
  - 8. Do you think the DOT could do better in more effectively responding to schedule risk on projects (e.g., planning – time determination schedule, progress and payment – schedule process requirements in the RFP, tracking progress – contract time administration, informing – stakeholder coordination)?**
    - Emphasize the importance of developing high quality contract time determination schedules to set a project up for success.
    - Reevaluate the significant risk (liquidated damages) put on the contractor for not meeting the schedule.
    - Provide the ability to revise the schedule as delays occur or change orders are processed.
    - Encourage all projects, not just the major ones, to focus on mitigating schedule risks.
    - Ensure critical path method (CPM) scheduling specifications are added to all projects, provide value, and are fair.

## **2.4 Public Sector Outreach**

Industry outreach interviews were conducted by the RS&H team with select transportation agencies currently using risk management processes, including state departments from Colorado (CDOT), Florida (FDOT), Minnesota (MnDOT), Texas (TxDOT), and Virginia (VDOT) programs. The RS&H team contacted public agency representatives to solicit feedback on ongoing work, current and emerging practices, and most importantly to identify any current gaps and lessons learned from their RM Programs.

Representatives were asked about each of the following topics. The bullet points that follow represent suggested strategies for a more effective RM Program based upon the responses and conversations.

**1. Do you think the DOT's current risk management practices are working effectively on your projects or programs or across the agency as a whole? If not, what are some of the key hurdles, deficiencies, or barriers that you face implementing risk management successfully?**

- Consider automating the risk management process where possible to make it more user friendly.
- Have a consistent application of risk management among projects/procurements.
- Create an incentive or a requirement to use scalable processes on all projects to help instill a culture of risk management.
- Develop risk register templates to be used across the enterprise for consistency.
- Ensure tracking of risks at all project phases (identification and selection through operations).
- Emphasize risk management practices between milestones.
- Have regularly scheduled risk management check-ins with PMs to give them the tools needed to successfully manage their project's risk.
- Reporting tools should highlight the current active risks and should also reflect on previously identified risks (whether they have become issues or have been effectively mitigated) as well as potential future risks.
- Risk management training should be enterprise-wide and for all levels to create a culture of risk management.
- Risk management training/resources should specifically address traditional project delivery vs. innovative contract delivery methods.
- Continuously update training and resources to properly roll out new tools or processes and ensure staff are aware of these resources and actively utilize them.
- Better define the expectations for risk owners so that they may better understand their responsibilities towards chasing down risks and the level of effort needed for certain types of risks.

**2. In your experience, what are some of the areas that the DOT could do better in more effectively responding to risk and what are your recommendations for improvements?**

- Implement risk management early.
- Focus on training.
- Highlight risk management during the pre-procurement and procurement phases.
- Be more transparent about risks not only within the DOT, but also externally with the contractor/proposers.
- Manage stakeholder risk by engaging them early in the project lifecycle.
- Consider not transferring risk to the contractor on items that could impact the timely completion of the project or significantly influence the bid price. Be more prescriptive where needed.
- Manage project funding risks by updating the cost estimates frequently, at least annually.

**3. Are there any key risk items that you feel need to be better addressed in the DOT alternative project delivery RFP documents?**

- Preserve the DOT/contractor relationship by continuously reassessing risk allocation.

#### **4. Pre-planning and coordination**

- Perform early pre-planning and coordination to help mitigate risks such as utility coordination and concept drawings.

#### **5. Risks within the RFP**

- Use boilerplate language. Changes to this language cannot be modified without approval with appropriate justifications.

#### **6. Workshop experience**

- Provide a range for costs and an adjectival rating to help facilitate workshops.
- Risk workshops with multi-discipline participation is the key to help identify risks and impacts.

#### **7. Training and meetings**

- Need to train newer PMs on risk and show more experienced PMs a more progressive approach.
- Hold regular meetings with well-qualified staff participating and documenting the response to risk questions.

#### **8. What were some of the key hurdles or barriers that were faced at its inception and what strategies did you use to overcome those challenges?**

- Obtain DOT Central Office leadership support to help regions buy in to and adopt risk management processes.

#### **9. Do you approach risk the same way for different delivery models such as design-bid-build (DBB), DB, public-private partnerships (P3), and construction manager general contractor (CMGC)?**

- Approach risk differently depending on delivery method.
- The risk profile should be evaluated and considered in the selection of a delivery model.

#### **10. What are several best practice techniques that have proven successful for the consistent implementation of an RM Program? What are some things that you have tried, but that did not work out well?**

- Prior to the risk workshop, provide information to the group to prepare and be ready for interactive discussion.

#### **11. What are some approaches that you have implemented that allow for multiple disciplines to discuss risks from an agency, program, and project perspective to better identify, assess and manage risk and address uncertainty in the life of a project, within a program or across an organization?**

- Include multiple disciplines at workshops for beneficial interactions. This allows participants to think how other risks can affect their specific areas or disciplines.

#### **12. What role does industry have on your risk management guidelines and procedures?**

- Include industry review to provide feedback on issues related to risk, contracts, and scope.

### **13. How are risks incorporated into your cost estimating and schedule programming of projects?**

- Analyze high risks to determine if the project should proceed or if other contract measures should be taken.
- Utilize risk metrics to determine if additional scope or field surveys are needed to better determine geotechnical issues, additional ROW needs or other impacts to the schedule.
- Utilize risk measurements to determine the level of contingency on a project.
- Cost estimates should be stripped of risk and contingencies and then provide a separate risk cost that can be documented and quantified to better manage the costs as the project develops.

### **14. Other strategies**

- Educate industry on the risk management methods the DOT has developed for their program, contract language, contract template and precedent allocations to enable industry to align their internal risk assessments.
- Actively develop lists of common/typical risks from lessons learned that can be used as a foundation for risk register development and risk workshop discussions.
- Gather lessons learned at the end of each project phase.
- Address risk exposure regarding contract compliance with a distinct plan or action that outlines who is responsible for verifying that contract requirements are being met and who is responsible for administering consequences if they are not.
- Utilize risks to help drive what the RFPs need to include.
- Do not overcomplicate the risk management approach and keep it scalable.
- Find a champion to help prioritize the use of risk management and overall culture.

## **2.5 FHWA Interviews**

Three representatives from the Office of Innovative Program Delivery and Michigan Division of the Major Projects Team were interviewed to gain FHWA's national and local perspective on risk management practices.

Representatives were asked about each of the following topics. The bullet points that follow represent suggested strategies for a more effective RM Program based upon the responses and conversations.

#### **1. What has been your experience of applying the principles of risk management on projects and programs at MDOT? What are some of the key hurdles or barriers that were faced implementing risk management at MDOT and what strategies did you use to overcome those challenges?**

- Employ formal risk management procedures on all projects, not just alternative delivery ones.
- Have a documented approach to risk management so that PMs know their expectations and what they need to do and when throughout the project lifecycle.

- Before implementing an RM Program, focus on education so that staff understand the goals and become familiar with the process. Get buy-in from staff and set expectations early emphasizing the importance of active participation.
  - Emphasize diversity: Have a diverse group of people involved in the risk management discussions.
  - Spend the time to dive into the uncommon/unique aspects of a project to better understand them and identify the associated risks.
  - Don't stop at the initial risk assessment, continue to hold follow-up meetings as the project develops and establish a schedule for follow-up activities as part of the risk management process.
- 2. In your experience, what do you think agencies could do better in more effectively responding to risk and mitigating risk before they become issues (e.g., scoping, schedule, cost, finance and funding, and public/stakeholder involvement and awareness)?**
- Continue coordinating with the public and stakeholders from the beginning of the project and through the project lifecycle. Make sure political figures are included early in the stakeholder/public engagement process to head off any complications down the line.
  - Encourage a focus on detailed costing and scheduling for non-traditional components of projects. Bring in more expertise as needed to get this right.
  - Encourage more flexibility in schedule revisions if it will help to mitigate unforeseen risks.
- 3. Do you think more project team coordination and the use of risk management tools is needed during early project planning and development to address risk?**
- Emphasize early project team collaboration: Start having risk management discussions at the inception of a project (planning phase) with staff representing all phases of the project (environmental, planning, development, construction, and operations). Continue discussions throughout project lifecycle.
  - Provide guidance on how detailed the risk discussions should be at each project phase (environmental, planning, development, construction, and operations).
- 4. Do you think agencies can do a better job implementing their risk management guidance and incorporating FHWA guidance, tools, and research into their management of projects and programs (e.g., Second Strategic Highway Research Program Risk Management Solutions, enterprise risk management)?**
- Focus on developing a common awareness with all DOT staff of the tools available and the benefits of having an RM Program.
  - Tailor risk assessment tools to the risk severity of the project.
  - All high-risk projects should follow a formal risk management process for documenting project risks regardless of the overall cost.
- 5. How do you think we can customize and tailor our risk management tool kit to meet the challenges of this new COVID-19 era?**

- Hold training sessions to roll out the new program where MDOT leadership can explain some of the history of why the program was developed so staff can gain a better understanding of the goals and intent for the organization.
  - Encourage engagement with the material and enable staff to ask questions and provide feedback.
  - Have structured breaks so that the sessions are more focused and productive.
- 6. What were some of the key hurdles or barriers that were faced at its inception and what strategies did you use to overcome those challenges?**
- Better understand risk relationships during the risk assessment process. Different project risks work together and affect each other.
- 7. What requirements are project or division required to follow as part of your RM Program?**
- Process should be scalable and work not only for major projects but also on smaller projects, which are most of what DOTs develop.
  - For each project, establish a risk management budget based on the level of risk and size of the project.
- 8. Whose responsibility is risk management on a particular project?**
- All disciplines involved with a project have the responsibility to identify and mitigate risks.
- 9. What methods and strategies has your team used to promote a risk management culture at the agency, program, or project level?**
- Inform participants that some qualitative risks can be assessed outside the quantitative model, like market risks and political risks. Not all risk can have a derived cost.
  - Need more education on the differences between “escalation” and “inflation” when costing risk.
- 10. What strategies has your agency or team developed to incorporate risk management into project and program management that have added value and benefited decision-making and planning?**
- Build consistent training across the agency.
- 11. Do you feel there are improvements you would like to make in your RM Program? And if so, what are they?**
- Need more understanding of the basic principles and terminology, fundamental risk concepts and processes, and the relationship between different risks.
  - Set a budget for risk management and risk assessment processes.
- 12. From a leadership perspective, have you had a “champion” in a key leadership position that promoted the RM Program? If so, what are the keys to developing a comprehensive RM Program and gaining the support of leadership at the division level and in other areas of the agency?**
- Find a champion that understands the benefits of a strong risk management process.

- Leadership needs to embrace and support risk management to help the program be accepted and promote the philosophy of risk.

**13. What are several best practice techniques that have proven successful for the consistent implementation of an RM Program? What are some things that you have tried, but that did not work out well?**

- There needs to be buy-in from the PM to initiate and continually monitor risks using the risk register.
- Aim for increased levels of interaction between multiple disciplines within a virtual workshop environment.

**14. What are some approaches that you have implemented that allow for multiple disciplines to discuss risks from an agency, program, and project perspective to better identify, assess and manage risk and address uncertainty in the life of a project, within a program or across an organization?**

- Demonstrate real project experiences in training sessions so that participants can see how the risk processes and procedures work.

**15. Other strategies**

- Need a formal process for documenting lessons learned. Should expect each PM to contribute to a lessons learned database and should be a checkbox included in project closeout.

## **2.6 Contractor Interviews**

Representatives from the contracting community, including both local and national contractors, were interviewed for their experiences with MDOT projects and to gain their perspective on contracts and related risk elements.

Representatives were asked about each of the following topics. The bullet points that follow represent suggested strategies for a more effective RM Program based upon the responses and conversations.

**1. Alternative Technical Concepts (ATC) process – Do you feel proper confidentiality is being maintained during the process? Have you experienced any conditional approvals making incorporation of the ATCs into the proposal difficult? Have you experienced a resistance to incorporating new innovations? Has the Department provided adequate and timely feedback to incorporate ATCs into proposals?**

- The innovative MDOT ICU team should maintain an active role throughout the DB pre-bid process of every project to ensure a consistent level of engagement, confidentiality, and approval. This is required to reestablish contractor's confidence and salvage the existence of ATCs in the bidding process. MDOT should also extend the timeline of the entire bid process for DB projects to provide contractors with sufficient opportunity to investigate, price, approve and incorporate ATCs into their bids.

**2. Pre-bid questions and responsiveness – Do you think the Department provides sufficient clarity and timely responses to questions to reduce risk and uncertainty in the RFP documents to prepare a competitive bid? Is there anything the Department**



**could do differently to provide a more competitive bidding environment? Have you experienced any instances where your questions have gone unanswered, not posted, or found to be in error while building the project?**

- A higher level of priority is needed with MDOT responses to pre-bid questions. The contractor's MDOT contact person needs to have proper and timely access to key members of the MDOT Design and Construction teams to gather a proper, complete, and contractual response to any inquiries.

**3. Use of Reference Information Documents (RID) – Is the use of RID as reference documents adequate/appropriate for bidding purposes or do you feel there should be a greater ability to rely on information provided by the Department? What items within the RID would you consider adequate/inadequate? Which items within the RID reduce bidder risk? Which would you consider most important?**

- MDOT ICU team should work to establish a set standard of deliverables that will be included in all RID documents being provided.

**4. Stipend – Is the process for establishing the stipend amount appropriate? If not, what recommendations do you have?**

- MDOT ICU should limit shortlisted bidders to three to provide renewed interest, competitiveness, and resources to the bidding teams.
- MDOT should establish a set criterion for determining stipend amounts based upon the descending order of a project's complexity, scope, location, and cost.

**5. Use of at-risk or shared-risk items in DB contracts – Have you found the use of these items to be too widespread or too limited? Do you feel they should be incorporated into the project's critical path method? Should the unit prices be set or left blank for the bidder?**

- Shared-risk items should follow standard pay items and specifications to ensure bid pricing is more accurate. MDOT should include the basic assumptions that were used in the determination of the shared-risk items so greater clarity is provided to the contractor on the circumstances surrounding the work to be performed. MDOT should mandate that shared-risk items are to be included, when applicable, into the projects CPM schedule and evaluate extension of time related to these items per the standard specifications.

**6. Risk pool – Are the shared-risk amounts and thresholds provided in the RFP documents to address contract risk appropriate (for example, unidentified utilities, utility owner delay)? What are the key risk items that you feel need to be better addressed in the RFP documents?**

- The contract obligations regarding utility coordination needs to be revisited. MDOT should detail out the contract assumptions regarding the utilities and they should be reflected in the CPM schedule. Any loss or gain directly attributed to the utility company will be shared but any lack of coordination will rest with the contractor. Example: Utility company will need two weeks to design their relocation plan after the contractor has provided approved ready for construction drawings. Once approved, the utility company

will take four weeks to schedule and complete their work. Those assumptions are detailed in design books and included in the CPM.

**7. Third party coordination (e.g., utilities, railroad) – Are the contractor obligations related to these third parties clearly spelled out in the bid documents? Do you feel the level of responsibility / risk is proper? What improvements / suggestions do you have for these issues?**

- The contract obligations regarding utility coordination needs to be corrected. MDOT should detail out the contract assumptions of when utility design will start (e.g., 70%, ready for construction), along with a firm timeline for their design and relocation efforts so it can be properly reflected in the CPM schedule. Any loss or gain directly attributed to the utility company will be shared but any lack of coordination will rest with the contractor.

**8. Construction schedule – Does the Department in its RFP documents provide achievable completion deadlines for projects in conjunction with reasonable damage amounts for failure to achieve those deadlines?**

- Contract time determination schedules should be required on all major projects and all DB projects. Contracts should not require a contractor to perform “at risk” work to meet the project schedule. A set policy of partial submittals, packages, staging or segments of work must be established by MDOT to provide contractors a clear set of assumptions when bidding/scheduling the project.

**9. Project cost – Is there an optimum project cost for you to engage in a project solicitation? Is there a project size considered too large for you to submit a competitive bid on?**

- Advanced planning and a publication of the bid pursuit calendar is needed on all major projects to avoid overlapping pursuits. Failure to address this issue will result in a decrease in competition, and raise risk and pricing. This is especially a significant issue within the disadvantaged business enterprise community.

**10. Is the Department’s use of miscellaneous quantities troublesome? Do you feel it increases risk on the contractor? Do you have suggestions/improvements for its use?**

- The variance of a unit price can be ten times depending on the assumptions made on the circumstances surrounding the work being performed. Having ten areas of curb measuring ten feet each all over the project is substantially more expensive than one single run of 100 feet of curb. MDOT should strive to include the assumptions that went into the determination of the quantities to provide some clarity to the contractor so they can provide more accurate pricing. The current practice is resulting in contractors pricing miscellaneous work items at a significant premium that may be unnecessary if MDOT clarified the circumstances surrounding the quantity.

**11. Are you experiencing issues with sole source suppliers/subcontractors – contract language, delivery dates, payment terms, etc.?**

- The utilization of sole source suppliers or subcontractors should be avoided wherever possible. When unavoidable, MDOT should establish a set of standards or protocols

that should be used to properly vet the firm being listed. MDOT should not provide special consideration or wave any prequalification requirements to ensure the prime contractor is not taking on unnecessary risk.

## **12. Other strategies**

- MDOT needs greater investment in their prebid geotechnical investigations. A significant premium is being paid via contractor's conservative bid time assumptions vs upfront complete geotechnical analysis.
- One-on-one meetings need a set attendee list (e.g., geotechnical, bridge specialist, interchange geometrics) so the meetings are productive and directives timely. They can be cancelled if not needed.
- In the RFP, MDOT should list out the conflicted designers and consultants on the DB projects. In addition, we are seeing waivers provided that clearly violate the conflict of interest either with construction engineering & inspection pursuits (being able to cover substandard design) or as a part of the DB team (unfair bid advantage).
- Advanced and more reliable notice on upcoming DB projects. Information is selectively being released that is severally impacting competition.

## **2.7 Literature Review and Desktop Survey**

RS&H conducted desktop surveys of the current literature for industry best practices, federal guidance, and state guidance. The team reviewed available reports and studies to identify risk management best practices currently being performed by state departments, including CDOT, FDOT, Georgia (GDOT), MnDOT, Missouri (MoDOT), Nevada (NDOT), South Carolina (SCDOT), TxDOT, VDOT, and Washington (WSDOT), as well as FHWA.

The research focused upon risk management practices at the program and project levels. All of the reviewed agencies have some level of documented risk management approach. However, the risk approach varied by project delivery, level of guidance provided, and available tools to perform risk management.

Literature review of agency documentation focused on alternative delivery, including DB and P3 programs. It was noted if agencies provided risk assessment for traditional DBB delivery, however, processes have not been detailed.

The following sub-sections summarize the information gathered from the state agencies and provides agency hyperlinks to relevant information. The information is organized by the type of documentation, tools and risk processes that the agency has available, project phases that utilize risk management, general information regarding the agency's organization, training opportunities, and use of risk with cost estimating and schedules, if made available.

## 2.7.1 Colorado Department of Transportation

[www.codot.gov/business/project-management/scoping/risk-management](http://www.codot.gov/business/project-management/scoping/risk-management)

### Documentation

- Design-Build Manual, September 2016: Contains risk management processes
- P3 Management Manual, November 2020: Contains risk management processes
- Risk management guidance directly on CDOT website pages

### Tools

- Project Delivery Selection Matrix (PDSM): Used for assessing project delivery method
- Risk Assessment Tool: Provides the risk register template
- Risk Library: Database within Risk Assessment Tool of over 70 common risks
- Project Cost Planner Tool: Develops risk-based cost estimates (RBCE) using historical data in a statistical format
- @Risk: Third-party software utilized for Monte Carlo analysis on major projects

### Risk Process

- Follows five-step process (identification, analysis, planning, allocation, control)
- Risk library to populate risk register
- Qualitative: Adapted from FHWA with 5-point scale; probability > 90% added to estimate
- Scalable: Low-risks project areas require low level of development to address; high-risk project areas need more significant development
- Risk registers: Required for major DB projects and region decision to maintain for smaller projects; required for all P3 projects
- Risk register is used as a checklist during RFP development

### Phased Approach

- Initial Project Development: PDSM process to determine delivery method; develops RM Plan as part of project delivery plan
- For P3 recommendation, report with key risks presented to the High Performance Transportation Enterprise Board
- For P3, risk register updates and workshops in six phases: project development, pre-procurement, procurement, implementation, operations, and handback
- Implementation: Maintain risk register through construction; regular risk meetings

### Risk Management Organization

- Alternative Delivery Program: DB projects
- High Performance Transportation Enterprise: P3 projects
- State divided among five CDOT Regions that support each department. Each region develops projects and leads cost estimating and risk assessment efforts for their projects
- Workshops facilitated by each department; regions provide subject matter experts (SME)

### Training

- Developed training program for all major DB projects

### Cost Estimates and Schedules

- Parametric estimating using Project Cost Planner Tool during initial design development
- 30% contingency is standard
- Probabilistic RBCE using @Risk P70 level to determine contingency

## 2.7.2 Florida Department of Transportation

[www.fdot.gov/programmanagement](http://www.fdot.gov/programmanagement)  
[www.fdot.gov/designsupport/toolbox/default.shtm](http://www.fdot.gov/designsupport/toolbox/default.shtm)

### Documentation

- Project Delivery Methodology Risk Initiation Review Checklist, May 17, 2013
- Risk Based Graded Approach Worksheet Development Guidelines, March 29, 2019
- Guide to Including Project Risks/Unknowns in Long Range Estimate

### Tools

- Risk Based Graded Approach Worksheet Template
- Risk Register Template
- Risk Analysis Modeling Tool: Determines Project Risks/Unknowns in Long Range Estimate based on risks

### Risk Process

- No formal guidance/procedure or mandate
- Follows four-step process (identification, assessment, response, monitoring)
- Risk assessment required only if adding contingency amount to the long range estimate
- Qualitative: Risk Based Graded Approach Worksheet; probability in 20-25% increments
- Scalable by project cost
- Cost < \$100M and if not requiring workshop: Use Risk Analysis Modeling Tool; qualitative
- Cost between \$100M - \$500M: Workshop; quantitative register; commercial risk modeling
- Complex project or cost > \$500M: Consultant-led risk analysis workshop
- Acquires permits and ROW prior to DB contract award

### Phased Approach

- Project Planning: Use Project Delivery Methodology Risk Initiation Review Checklist so processes are covered
- Project Initiation: Use Risk Based Graded Approach Worksheet
- Procurement: P3 RFP templates; some risk mitigation built in

### Risk Management Organization

- Centralized office with seven districts and the Florida Turnpike Enterprise
- Statewide Risk Management Team: Implement quantitative analysis at the project level during project development; includes State Value Eng, State Estimates Eng, State PM Eng, District Util Admin, District Court Eng
- Regional Risk Management Teams: Includes District Value Eng, District Estimates Eng, Design PM, Construction PM; monthly teleconferences with Statewide Risk Management Team; identifies and supports workshops

### Training

- Initially provided quarterly training to directors, PMs, and design engineers
- Holds training expo on entire risk management process once a year
- Provides quarterly training on its recorded modeling tool

### Cost Estimates and Schedules

- Utilizes initial contingency at 5% increments up to 25% for estimating
- Uses RBCE; replacing the traditional cost contingency with a risk-based contingency

### 2.7.3 Georgia Department of Transportation

[www.dot.ga.gov/PS/Innovative/DesignBuild](http://www.dot.ga.gov/PS/Innovative/DesignBuild)

[www.dot.ga.gov/PS/Innovative/P3](http://www.dot.ga.gov/PS/Innovative/P3)

#### Documentation

- Plan Development Process, Revision 3.2, December 16, 2019
- Design-Build Manual, March 1, 2018
- P3 Manual, October 22, 2020

#### Tools

- Utility Risk Matrix
- Risk Allocation Matrix Template: Located within the Design-Build Suitability Assessment; not qualitative or quantitative; identify risks, assign owner, and provide mitigation strategy
- Design-Build Suitability Assessment: Used for DB candidacy
- Design-Build Project Scalability Memo: Project ranking system to categorize DB projects representing varying levels of complexity and risk ranging from low to high
- Comprehensive Risk Assessment for Transportation software – use at GDOT Office of Innovative Delivery to perform systematic risk analysis; incorporates typical risks in planning estimates

#### Risk Process

- No formal guidance/procedure; risk management is located within DB documentation
- Provides outline for early risk management for DBB delivery
- Develop independent utility RM Plan to identify utility risk factors
- Follows four-step process (identification, assessment, response, monitoring), although template does not provide qualitative or quantitative assessments
- Project team meets frequently to update the RM Plan

#### Phased Approach

- Preliminary/Scoping Phase: Risk discussion during Project Team Initiation Process
- Innovative Delivery PM prepares Design-Build Suitability Report and Risk Matrix
- Pre-Procurement: Initial workshop for comprehensive risk analysis; consider facilitator

#### Risk Management Organization

- Office of Innovative Delivery: DB delivery
- P3 Division

#### Training

- Training not identified that covers risk or estimating processes

#### Cost Estimates and Schedules

- Uses RBCE using percentage-based contingency
- Integrates risk management decisions into cost estimates and project schedules

## 2.7.4 Minnesota Department of Transportation

[www.dot.state.mn.us/designbuild/index.html](http://www.dot.state.mn.us/designbuild/index.html)

[www.dot.state.mn.us/pm/processes.html](http://www.dot.state.mn.us/pm/processes.html)

[www.dot.state.mn.us/pm/cost.html](http://www.dot.state.mn.us/pm/cost.html)

### Documentation

- Guidance is not consolidated; processes across several individual documents
- Cost Estimating and Cost Management Technical Reference Manual
- Cost Estimation Process Improvement and Organizational Integration Project – Risk and Contingency
- Project Risk Management Process
- Project Risk Management Reference
- Risk and Contingency Fact Sheet
- Total Project Cost Estimating Potential Guidelines
- Length, Width and Depth Cost Estimating Guidance

### Tools

- Risk Register Template
- Risk Checklists
- Total Project Cost Estimate Template
- Length, Width and Depth Cost Estimating Template
- Acumen Risk: Monte Carlo for small and medium projects and works well with scheduling
- @Risk – Third-party software utilized for Monte Carlo analysis on major projects

### Risk Process

- Risk management is located within short documentation on website
- Follows four-step process (identification, assessment, response, monitoring)
- Utilizes red flag lists and risk checklists
- Four-Tiered Scalability: Uses risk and complexity and not cost to define a project and determine quantitative requirements; split into minor, moderate, and major
- Minor: Identification
- Moderate: Risk register; response; qualitative assessment
- Major: Workshop; quantitative assessment; RM Plan; Monte Carlo

### Phased Approach

- Delivery Method Selection Approach: Initial risk assessment
- Plan Project Development Phase: Complete risk register

### Risk Management Organization

- DB part of MnDOT Office

### Training

- Available for the cost estimating module

### Cost Estimates and Schedules

- Uses RBCE with percentage-based contingency
- Minor: Percentage-based contingency
- Moderate: Contingency based on three-point estimating; possible use of Acumen Risk
- Major: Three-point estimate and Monte Carlo simulation

## 2.7.5 Missouri Department of Transportation

[www.modot.org/design-build-information](http://www.modot.org/design-build-information)

[epg.modot.org/index.php/Category:149](http://epg.modot.org/index.php/Category:149) [Project Delivery Method Determination and Risk Assessment](#)

### Documentation

- Engineering Policy Guide, Category 149, March 28, 2014

### Tools

- Risk Assessment Brainstorm Worksheet: Register list
- Risk Assessment Worksheet: Calculate risk factor to sequence risks

### Risk Process

- No formal guidance/procedure; documentation located within Engineering Policy Guide
- Follows three-step process (identification, assessment, allocation)
- Qualitative assessment: Calculate Risk Factor using impact (0-6), effort (0-6), and probability (0-1)
- Scalable by project cost
- Cost > \$10M and high-risk project: Monte Carlo
- Cost > \$25M: Workshop
- Risk management process is not built into DBB delivery

### Phased Approach

- Project Delivery Method (PDM) Determination Process: Utilizes high-level risk assessment
- Procurement: Risk Assessment Workshop: Detailed risk assessment; includes core team members, SMEs, and optional facilitator

### Risk Management Organization

- DB part of MoDOT Office

### Training

- Training not identified that covers risk or estimating processes

### Cost Estimates and Schedules

- Cost and schedule impacts are not identified



## 2.7.6 Nevada Department of Transportation

[www.nevadadot.com/doing-business/documents-and-publications](http://www.nevadadot.com/doing-business/documents-and-publications)

### Documentation

- Project Delivery Selection Approach
- Risk Management and Risk-Based Cost Estimation Guidelines
- Project Management Guidelines, 2010
- Project Estimation Wizard Instructions

### Tools

- Risk Register Template
- Risk Tracking and Analysis Tool for Small and Medium Size Projects: Quantitative Risk Tool
- Project Estimation Wizard

### Risk Process

- Independent thorough risk management guidelines
- Applies to DBB and DB delivery
- Provide risk assessments on all projects; develop RM Plan
- Follows four-step process (identification, assessment, response, monitoring)
- Scalable by project cost
- Cost < \$10M: Qualitative assessment
- Cost from \$10M - \$25M: Qualitative required; suggests quantitative workshop
- Cost between \$25M - \$100M: Qualitative required; Cost Risk Assessment (CRA) workshop
- Major projects and costs > \$100M: CRA workshop; quantitative assessment; consultant-facilitated; internal and external SMEs in time slots

### Phased Approach

- Use project delivery selection approach with high-level review of risk components.
- Project risk cost updates every one to two years with possible CRA workshop

### Risk Management Organization

- Centralized agency
- Project Management Division for major projects > \$100M and innovative delivery

### Training

- Training not identified that covers risk or estimating processes

### Cost Estimates and Schedules

- Qualitative risk allowance percentages are set between 3% (low risk) up to 15% (high risk)

## 2.7.7 South Carolina Department of Transportation

[www.scdot.org/business/design-build.aspx](http://www.scdot.org/business/design-build.aspx)

### Documentation

- Design-Build Procurement Manual, February 28, 2017
- 2018 Design-Build Peer Exchange, February 4, 2019

### Tools

- Project Delivery Selection Matrix Template (SCDOT internal only)
- Risk Matrix (SCDOT internal only)
- Project Cost Estimate Guidelines and Template (SCDOT internal only)

### Risk Process

- Processes are not documented
- Utilize feedback from SMEs to determine high, moderate, and low risks.
- Allocate risks to either SCDOT, DB team, or both and discuss mitigation strategies
- Does not typically acquire permits, early ROW acquisition, or early utility relocation prior to DB contract execution.

### Phased Approach

- Project Definition Report: Review goals and discuss project risks
- PDM selection process or workshop: Perform risk assessment
- Risk matrix developed that refines assessment from project selection process
- Pre-Procurement: Finalize risk matrix prior to request for qualifications advertisement or one-phase RFP
- Procurement: Utilize risk matrix in the development of the scope of work in the RFP

### Risk Management Organization

- Design-Build Group: Administers DB and Alternative Delivery Methods Program

### Training

- Training not identified that covers risk or estimating processes

### Cost Estimates and Schedules

- Cost and schedule impacts are not identified

## 2.7.8 Texas Department of Transportation

[www.txdot.gov/inside-txdot/division/transportation-programs/ppm.html](http://www.txdot.gov/inside-txdot/division/transportation-programs/ppm.html)

[www.txdot.gov/inside-txdot/division/debt.html](http://www.txdot.gov/inside-txdot/division/debt.html)

### Documentation

- Design-Build Procurement Overview Manual, April 11, 2017
- Procedure 114 – Risk Management, December 19, 2019
- Risk Management Guide for Alternative Delivery Program, December 2019
- Risk Management Guide for Alternative Delivery Program (O&M), December 2019
- Design-Build Estimate User Reference Guide, December 8, 2017

### Tools

- Alternative Delivery Support Tool: Determine suitability of DB delivery method
- Risk and Issue Register
- Project Cost Estimate

### Risk Process

- Independent thorough risk management guidelines
- Follows four-step process (identification, assessment, response, monitoring)
- Risk team of 8-12; District and Alternative Delivery Division identify risk “champion”
- Focus on project-specific risks and scalable by project cost
- Qualitative: Use 1-3 or 1-5 scale
- Quantitative: Monte Carlo for FHWA cost estimate review; not used for internal analysis
- Risk register updated semi-annually; quarterly on major projects
- Programmatic DB contract language: shift risk allocation to party best to manage
- Major project or cost > \$500M: Consultant-led risk analysis workshop

### Phased Approach

- Project Delivery: Utilize Alternative Delivery Support tool to determine DB candidacy
- Planning/Pre-Procurement: Workshop 1 or combined with Design Concept Conference; qualitative; initial risk register; optional workshop 2
- Procurement: Workshop 3 for major projects; quantitative; update risk register
- Implementation: Workshop 4; update risk register
- Maintenance: Workshop 5; update risk register

### Risk Management Organization

- Project Finance, Debt and Strategic Contracts Division
- Strategic Contracts Management Section: Alternative Delivery Division and alternative delivery projects
- Districts: Manage risk register

### Training

- Risk-Based Construction Cost Estimating: Offered monthly on virtual platform
- Project Scope Management: Risk management offered monthly

### Cost Estimates and Schedules

- Uses RBCE
- Utilizes percentage-based agency costs based on historical trends
- Calculates contingency based upon event-driven risks estimating

## 2.7.9 Virginia Department of Transportation

[www.virginia.gov/business/alternative\\_project\\_delivery.asp](http://www.virginia.gov/business/alternative_project_delivery.asp)

[www.virginia.gov/business/design-build.asp](http://www.virginia.gov/business/design-build.asp)

### Documentation

- Design-Build Procurement Manual, April 2017
- Project Risk Management, PMO-15.0, February 1, 2015
- Design-Build Requirements for Advertisement, IIM-APD-1.2, November 9, 2017
- P3 Risk Management Guidelines, March 2015

### Tools

- Risk Management Worksheet: Qualitative risk register template
- Risk Register: Modified to account for qualitative and quantitative analysis

### Risk Process

- Independent thorough risk management guidelines
- Risk analysis performed for all DB projects regardless of value, by law
- Follows five-step process (identification, assessment, response, allocation, monitoring)
- Finding of Public Interest (FOPI) must be in place prior to project development and a high-level preliminary risk assessment is part of this process
- After FOPI approval, quantitative assessment with risk allocation matrix and RM Plan
- Tier II projects and construction cost > \$5M: Apply project risk management practices
- Provides compensation for ROW; purchases high-risk properties up front to mitigate risk

### Phased Approach

- Risks and register are reassessed at each project development phase milestone
- High-Level Screening: Initial risk discussions; seek input for list of critical risks
- Detailed-Level Screening: Informal risk workshop; initial risk register; preliminary qualitative assessment; develop Detailed-Level Screening Report
- Development: Initial risk workshop; qualitative assessment with 1-5 scale; quantitative expected value analysis; Monte Carlo analysis if desired; develop RM Plan
- Procurement: Second risk workshop; update register and plan; Risk Analysis Meeting prior to RFP release; review risks with impacts before commercial close
- Implementation: Monitor risk register quarterly
- Operations: Monitor risk register quarterly

### Risk Management Organization

- Design-Build Program part of Alternative Project Delivery Division
- FOPI must be approved by the Chief Engineer and Commissioner
- High-risk or cost > \$100M: Risk Mitigation Plan developed and Commissioner provides briefing to the Commonwealth Transportation Board (CTB)
- All P3 projects regardless of risk profile are briefed to the CTB

### Training

- Training programs, including project management, through web-based learning system

### Cost Estimates and Schedules

- Used RBCE

## 2.7.10 Washington Department of Transportation

[wsdot.wa.gov/construction-planning/project-management/risk-assessment/home](http://wsdot.wa.gov/construction-planning/project-management/risk-assessment/home)

### Documentation

- Project Management Online Guide: Web-based documentation
- PDM Selection Guidance, September 2019
- Project Risk Management Guide, February 2018
- Cost Estimate Validation Process
- Project Risk Analysis Model Users Guide, March 2018

### Tools

- Risk Breakdown Structure
- Sample Risk Elements
- RBCE Self-Modeling Tool
- Risk Workshop Report Summary
- Qualitative Risk Assessment Spreadsheet
- Project Risk Analysis Model

### Risk Process

- Independent thorough risk management guidelines
- All projects have an RM Plan
- PM decides how to ensure risks are being eliminated or mitigated
- Follows six-step process (planning, identification, qualitative, quantitative, response, monitoring)
- Scalable by project cost
- Cost < \$10M: Qualitative spreadsheet in the Project Management Online Guide
- Cost between \$10M - \$25M: Quantitative; informal workshop using the self-modeling spreadsheet
- Cost between \$25M - \$100M: Self-modeling spreadsheet in scoping phase and quantitative CRA workshop in subsequent phases
- Costs > \$100M: Cost Estimate Validation Process workshop; quantitative assessment; consultant-facilitated; internal and external SMEs; DB model is recommended

### Phased Approach

- PDM Selection Process: Includes risk assessment

### Risk Management Organization

- Sophisticated approach with a core team of internal experts; mandated from legislature

### Training

- Previously held probability and risk assessment design and cost estimation classes

### Cost Estimates and Schedules

- Cost < \$3M: informal process based on significant risks
- Cost between \$3M - \$10M: RBCE on project-by-project decision based on complexity
- Cost > \$10M: RBCE
- Projects with more than a 15% contingency must go through RBCE process

## **2.8 Peer Exchange Workshop**

Part of RS&H's research effort included a Peer Exchange Workshop with individuals from eight state agencies, FHWA, and representatives from MDOT. The four-hour workshop was conducted on December 8, 2020 in a virtual setting.

The workshop focused on the identification and use of risk management best practices and risk management tools by the participating agencies to use as best practice guidance in the development and implementation of an MDOT RM Program. The goal of the workshop was to assess national best practices and lessons learned from programs that are implementing risk principles on their projects and identify the effectiveness of the tools currently in use on those projects and programs.

### **2.8.1 Topics**

In coordination with MDOT, RS&H identified two main topics of interest that would be addressed at the exchange and covered over two sessions.

- The first topic during Session 1 covered the tools that are being used for risk management and the processes that are being followed to populate and apply those tools for a specific project.
- The second topic during Session 2 covered the organization and structure needed to execute an RM Program effectively and instill a culture of risk management throughout an agency.

Within each session, two state agencies were requested to prepare a presentation providing insights into their program and covering these topics. A discussion period was held within each session to capture the attendee's experiences with those topics.

### **2.8.2 Discussion and Key Takeaways**

Identified below are the key takeaways from the workshop. The project team incorporated these into discussions with workshop participants to help determine which practices are most important to MDOT and to prioritize MDOT's needs.

A survey of the key takeaways was provided to MDOT participants on the importance of implementing these strategies within the MDOT RM Program. These results are provided within each subsection and labeled as "MDOT Feedback."

#### ***Scalability***

- Depending on project size, risk management requirements are customized for the specific needs of the project. Risk response adjustments can be made both before and after risk mitigation to see the change.
- The complexity of available tools can be quite different depending on the project.
- Have a minimum defined process based on project size. The PM could make the decision to utilize a more robust risk management process as needed.
- MDOT Feedback: Projects at MDOT range from multi-year designs with nine-digit construction prices to small two-to-three-week projects worth only tens of thousands of dollars. A robust risk analysis is not needed for every project.

## **Tools**

- Keep tools simple to make them user friendly and allow for teams to continue use without major relearning on each project.
- Having a list of typical risks transferred/retained is helpful for the industry.
- CDOT utilizes two risk workbooks: qualitative first and then quantitative if project meets criteria.
- CDOT is piloting an online PM info system called OnTrack. Risk management processes and risk registers will reside with the project information.
- CDOT actively tracks risk management lessons learned and utilizes FHWA database. Lessons learned reports for most alternative delivery projects are available online.
- TxDOT's Excel-based risk and issue register sequentially follows their four-step risk management process.
- TxDOT has a new Construction Cost Estimating Guide that includes quantifying risk-based contingency.
- VDOT utilizes a list of typical risks to go along with their risk register.
- Tools for allocating risk for WSDOT include workshops, contract templates that cover common risks, consistent/defined owner processes, a risk matrix, completion & general warranty, and a risk register.
- WSDOT provides all PM resources through a web-based toolbox on their public website to allow for easy access to documentation and training.
- MDOT Feedback: Tools should be self-explanatory whenever possible. PMs may use it once and not have another project requiring risk analysis for a year or more.

## **Risk Process**

- In a CDOT risk matrix, risks are not removed from registers but stricken out to keep a running history of the risk.
- The CDOT Chief Engineer directive states that every project will complete a Project Delivery Plan (PDP) and risk workbook is part of that plan (preliminary risk matrix).
- The CDOT Chief Engineer requires every project to have a PDP that includes a risk management workbook and risk matrix.
- CDOT has no formal measure of risk management process but is moving in that direction.
- Risk registers are discussed in CDOT meetings to pool resources to address and manage risks.
- CDOT uses a handoff meeting between design and construction to discuss risk register and transfer responsibilities for ownership.
- Utilize the red flag technique to identify risks of greatest concern and focus the attention on these critical items for discussion at monthly meetings.
- TxDOT uses a four-step risk process on a five-point scale.
- VDOT uses a five-step process with a three-point scale – critical risks (above 6) to address in a documented RM Plan are sent to be addressed to the CTB.
- A risk analysis is performed for all VDOT DB projects, regardless of project cost or contract value.
- A FOPI is required for all VDOT DB projects.

- WSDOT has a great relationship with the contracting community and works in conjunction with industry to allocate risk fairly and assign to those best fit to handle.
- Many states perform preliminary work, including cultural resources, geotechnical, and utility investigations.
- 91% of participants either agreed or strongly agreed that their RM Program can be improved.
- About half the participating agencies are implementing continuous formal risk management processes in DBB delivery, outside of FHWA requirements.
- MDOT Feedback: Agree strongly with CDOT's process of not removing risks from the register.

### ***Risk Workshops***

- CDOT uses facilitated workshops for larger projects.
- TxDOT completes workshops for small and large projects with both internal and external participants.
- FDOT focuses on quantitative risk workshops resulting in a risk register and tornado diagram of the top ten risks for both cost and schedule. Initial workshops are 2½ days with the project team, cost estimator & FHWA participating for its entirety while SMEs are broken down into two-hour sessions. Updated workshops typically last one day. They have completed three or four virtual risk workshops to date.
- TxDOT holds three types of workshops for both DBB and DB: Risk, Risk Update (two-hour workshop every six months to one year), and planning for Risk-Based Contingency Estimating (a quantitative approach using three-point estimating to determine contingency).
- TxDOT used to have six-to-eight-hour single day workshops. TxDOT noted their success having virtual workshops over a two-week period with an increase in attendance. The same amount of time is spent in a workshop, but multiple two-hour brainstorming sessions are utilized to discuss in a smaller setting. After the groups rejoin for risk assessment, there is a gap until the risk response session, giving additional time to prioritize risks and help prevent virtual workshop fatigue. The multi-day workshop allows owners and facilitators time to work on workshop actions between sessions.
- VDOT provides eight-hour or longer workshops prior to project advertising and serves lunch to keep participants engaged for the duration.
- Timing of workshops is important and is most effective after DB training.
- TxDOT's virtual workshops utilize a "whiteboard" recording participant feedback directly into presentation slides for later transfer to the risk register. Adding visuals to the slides and providing attendee polling provides an alternative way to present and receive information and reduces virtual fatigue.
- MoDOT has had success using Menti polling for participation in virtual workshops.
- Most states cited the biggest concern for risk workshops is educating attendees, especially younger inexperienced staff, on the risks associated with the specific delivery method since this can play a large impact on the risk profile. Many SMEs attending workshops have a DBB background and may not have experience with risk associated with DB projects.



- Several agencies stated a major issue with their current workshops is the lack of time to discuss mitigation strategies.
- Workshop participants are encouraged to consider opportunity risks that improve the project since these are often overlooked.
- MDOT Feedback: Workshops need to be efficient use of staff time.

### ***Organizational Structure of Risk Management***

- CDOT has a decentralized organization across five regions. Each region is part of the development of statewide processes before approval. For large projects, CDOT reports risk workbooks to FHWA, leadership, and the Transportation Commission. Smaller projects track and monitor risk at the region level. Significant changes in cost or schedule are subject to a change management process with a Governance Committee.
- Educating staff on the DB processes can be a challenge in a decentralized structure as well as passing along years of lessons learned.
- SCDOT is centralized through DB implementation. For all DB projects statewide, two PMs develop, procure, and manage risk from project conception to contract execution. However, the administration of the contracts is decentralized. SCDOT noted a challenge in the continuity of risk management between pre- and post-award.
- Both TxDOT and NDOT have centralized project management offices for risk management.
- The VDOT Alternative Project Delivery Division originally managed both P3 and DB procurements, however the Virginia Office of Public-Private Partnerships (VAP3) was formed and manages P3. Projects over \$100M require decisions be made by the Highway Commissioner and a briefing to the CTB.
- Risk Management at WSDOT is a collaborative process between the Strategic Analysis and Estimating Office (SAEO), regions and construction unit. The regions act as mini headquarters and construction is involved in industry outreach and hold AGC monthly meetings.
- MDOT Feedback: Risk workshops could be implemented at the project level with a statewide coordinator similar to the value engineering (VE) process. The Statewide Coordinator involvement could be included at a project cost threshold, similar to the VE process, or handled at the region level.

### ***Screening Process***

- To support traditional vs alternative project selection, CDOT utilizes the PDSM that includes high level risk management. The PDSM is published to the public and the Chief engineer has final approval of any PDSM recommendation. The Project Delivery Plan (PDP) contains a preliminary qualitative risk matrix.
- FDOT, NDOT, TxDOT, and WSDOT utilize a similar project selection tool. For TxDOT, risk ratings are determined at district levels and then presented to leadership. For NDOT, risk transfer is one of the primary factors in determining delivery method.
- Initial risk assessment on MoDOT projects is part of the project delivery selection tool. The PM utilizes the tool to help support the delivery selection.

- CDOT cautions that high level screening is great but easily manipulated and requires training. Risk management tools are decision making tools, not justification tools. Biases need to be recognized and documented.
- MDOT Feedback: The risk assessment process at the screening level should be different than assessing risks for project construction because so much is unknown at the beginning of a project.

### ***Training***

- Many agencies provide risk training for PMs. CDOT PMs receive risk training as part of their PM training. TxDOT hosts a Project Management Institute that simulates a virtual workshop. WSDOT provides an annual DB training summit containing 17 different training modules, including risk management, and both internal and external parties are invited.
- Switching to virtual training has led to a large increase in attendance.
- WSDOT provides the same risk training for both DBB and DB.
- WSDOT publishes training on their public-facing website.
- Discuss strengths and weaknesses of each delivery method. WSDOT adds that training and specific questions in selection guidance material is helpful.
- MDOT Feedback: Training should be easy and efficient.

### ***Risk Reporting and Transparency***

- Public disclosure of risk analysis varied among states.
- WSDOT does not publish risk analysis data publicly. CDOT's risk documents are considered working documents and not subject to disclosure.
- MDOT stated the challenge in keeping information back due to the Freedom of Information Act. There is a financial risk if risk information is provided to the public.
- MoDOT provides a joint risk assessment with contractors while TxDOT stated caution in jointly assessing risks with contractors to avoid potential misuse of this information.
- Many states make their DB standard template contract available on their public website.
- MDOT Feedback: Risk assessment would make sense as a supporting document and possibly as RID for DBB projects.

### ***Cost Estimates and Schedules***

- CDOT cost estimates are prepared and regions determine how they will manage and update risks.
- Risks removed on CDOT projects remain in the register to enable the contingency carried by those risks to be removed from estimates.
- FDOT cost estimates with risk values are updated annually to feed into the work program.
- NDOT typically updates major project risk estimates annually as part of the financial plan update requirements. Non-major projects receive updates at major milestones up to implementation and depending on the delivery method.
- NDOT identifies and quantifies risks with the contractor to develop a "risk reserve" for Construction Manager at Risk (CMAR) contracts.

- NDOT collects historical construction estimates through the large volume of DBB projects.
- Both NDOT and TxDOT utilize three-point estimating.
- TxDOT sourced FHWA guidance to quantify risk-based contingency which assists with predictability on projects.
- ScDOT uses risk-based percentage contingency estimating on projects less than \$500M and risk-based probabilistic contingency-based estimating on projects greater than \$500M.
- VDOT provides design-builders with a scope validation period to validate design and identify concerns of completing the design within the contract price. This helps alleviate risk being included in bids for scope issues that cannot be reasonably identified prior to award. VDOT's scope validation process can help lower contingency and reduce the number of claims.
- WSDOT has a snapshot of risks pre-mitigated vs post-mitigated to assess impacts to cost and schedule and effectiveness of their RM Program on a specific project.
- MDOT Feedback: Estimates, especially job programming estimates, need to account for risks.

### ***Building a Culture of Risk Management***

- When discussing building or changing a culture, CDOT relies heavily on the ADKAR change management model: Awareness, Desire, Knowledge, Ability, Reinforcement.
- Although staff retention has been an issue for FDOT, "the passion for the program is what kept the program going." Risk is not formally built into the FDOT organization and can be found within only 10% of FDOT position descriptions, although it should be in more roles.
- Through their approach to risk management, WSDOT has seen a major culture shift towards risk management at the DOT.
- Because CDOT is decentralized, it is difficult to develop a risk culture, so they aim for five different "normalized" cultures across the regions.
- Having a risk champion allows for clarity on risks and ultimately learning lessons. MoDOT supports this being a separate DOT position.
- Building a culture is "less about the tools and more about the expertise of people involved in the process."
- MDOT Feedback: MDOT fosters a risk adverse culture and needs to continue to work towards building a culture of managing risk.

## **2.9 Recommendations for Risk Management Development Phase**

As an interim deliverable to culminate the Risk Management Investigation Phase, RS&H provided MDOT with an Interim Summary Research Report summarizing the findings from the Risk Management Investigation Phase.

The report included a summary of the best practice recommendations to implement in the Risk Management Development Phase. The report and the recommendations were reviewed with MDOT prior to beginning Risk Management Development Phase work.

Below is a summary of the risk management best practices recommendations identified in the Risk Management Investigation Phase that RS&H, in coordination with MDOT, utilized in the Risk Management Development Phase to develop and formalize MDOT ICU's current risk management practices.

### ***Phased Approach***

- Track risks and continue risk discussions throughout the project lifecycle.
- Develop risk management processes and associated documentation by project phase.
- Provide guidance and training for risk discussions at each project phase.
- Utilize handoff meetings to transfer risk ownership responsibilities between phases.
- Document lessons learned at the end of each project phase.

### ***Scalable Process***

- Simplify the risk management approach and keep a simple risk management framework.
- Tailor a scalable and customizable RM Program to account for project size, cost, region, phase, and overall project risk profile.
- Employ formal risk management procedures on both traditional and innovative project delivery type projects.
- Consider a risk management budget on each project based on the level of risk and project size.

### ***Documentation and Tools***

- Develop processes and tools that are simple, standardized and documented.
- Keep tools simple to make them user friendly and allow for teams to continue their use without major relearning on each project.
- Develop a risk register template to be used across the enterprise for consistency.
- Keep risk management documentation concise and move away from large guidance documents.
- Maintain a list of lessons learned and include typical risks that have been transferred or retained.
- Actively develop lists of common/typical project risks from lessons learned to facilitate risk register development and risk workshop discussions.

### ***Project Team Responsibilities***

- Emphasize early project team collaboration and risk management discussions at the inception of a project. Include staff representing multiple phases of the project.
- Hold regularly scheduled meetings with SMEs to document status of risks.
- Establish a schedule for project follow-up activities and discussions as part of the risk management process.
- Identify risks of greatest concern and focus the attention on critical items at monthly meetings.
- Utilize risk discussions to help drive what needs to be addressed in the project RFP.

- Report on retired risks or risks that have become issues to update lessons learned and contingencies.

### ***Risk Workshops***

- Provide workshops for small and large projects and scale participation accordingly, provide guidance for frequency, duration and participants for project teams to consider.
- Provide information to the group prior to the workshop to prepare and be ready for interactive discussion.
- Prepare workshop guidance for a virtual platform, including tips to avoid virtual fatigue.
- Consider a multi-day workshop or longer, especially in a virtual setting.
- Hold workshops at major phases and/or milestones. Schedule follow-up workshops at set durations during longer project phases.
- Include SMEs from multiple disciplines to help cover all project areas.
- Encourage project-specific discussion and encourage increased levels of interaction between multiple disciplines within a workshop environment, either virtual or in-person.
- Encourage discussion of opportunity risks that benefit the project.
- Provide a standard range for costs in workshops and an adjectival rating guide.
- Include time to discuss risk mitigation strategies.

### ***Training***

- Provide consistent risk management training enterprise-wide and for all levels to create a culture of risk management and successful execution.
- Besides processes, include benefits and goals of risk management, as well as fundamental risk principles, concepts, terminology, and financial understanding (e.g., escalation vs. inflation).
- Distinguish how risk management is different between traditional project delivery and innovative contract delivery methods.
- Include relationships between risks and how different project risks work together and affect one another.
- Include real project experiences to help participants understand the applications, processes and concepts, so they can relate to their experiences too.
- Provide consistent risk management training between project phases.
- Define expectations for agency risk owners so they may better understand their responsibilities towards risk identification, resolution, and level of effort.
- Provide online training sessions prior to risk workshops and encourage engagement through small breakout sessions.
- Update training and resources to keep up with new processes and tools.

### ***Industry and Stakeholders***

- Begin the stakeholder/public engagement process early and continue through project lifecycle.
- Enhance relationship with industry and the contracting community to allocate risk fairly and assign to those best fit to handle.

- Educate industry on the risk management methods developed by the agency so they may align their internal risk assessments and assumptions.
- Consider industry review to provide feedback on issues related to risk, contracts, and scope.
- Consider providing design-builders with a scope validation period to validate design and identify concerns of completing the design within the contract price.
- Use boilerplate language to help risk management remain consistent between projects and procurements.
- Provide clear delineation of risk ownership between agency and contractor.

### ***Cost Estimates and Schedules***

- Update estimates and contingencies based on retired risks or risks that have become issues and have a consistent way to reflect assumptions and contingencies used in the estimates.
- Manage project funding risks by updating the cost estimates annually and at major milestones.
- Utilize RBCE to help determine risk-based contingencies.
- Build risk management processes into the project schedule.
- Focus on mitigating schedule risks.

### ***Leadership Support and Risk Culture***

- Obtain leadership support to help program acceptance, region buy-in and promote risk philosophy.
- Establish a risk management champion and supporting staff throughout the agency to help prioritize the use of risk management processes and promote the overall culture.
- Ensure project PMs initiate and continually monitor risks using the risk register and other risk management tools.
- Get buy-in from staff and set expectations early emphasizing the importance of active participation and potential required risk reporting to help ensure effective and broad use of risk management throughout MDOT.
- Provide widespread release of risk management resources to improve adoption throughout the agency.

## **3. RISK MANAGEMENT DEVELOPMENT PHASE**

### **3.1 Introduction**

After receiving feedback from MDOT on the recommendations in the Interim Summary Research Report, RS&H received notice to proceed to begin the Risk Management Development Phase.

The objective of the Risk Management Development Phase was for the RS&H team to develop a set of formal risk management guidance documents, templates and tools based on the best practices identified from the Risk Management Investigation Phase to improve and build upon MDOT's existing risk management guidance and to fill gaps in MDOT's current risk management practice.

RS&H coordinated the development of the specific risk management guidance documents, templates and tools with MDOT and presented a recommended implementation strategy for MDOT consideration at a meeting on January 25, 2021. The approach consisted of the development of a Risk Management Toolbox ("RM Toolbox") consisting of an Excel-based Risk Management Workbook ("RM Workbook") of interactive and linked Risk Management Workflows ("RM Workflow") for each phase of project delivery incorporating the recommendations from the Risk Management Investigation Phase. The proposed approach was reviewed with MDOT for consideration at the meeting. MDOT provided feedback before concurring with the approach and issuing notice to proceed.

A key research objective was to focus on customizing the guidance for PMs to successfully implement risk management on projects. The risk management guidance documents, templates and tools were intended to foster wider education and buy-in from PMs, project team staff, and MDOT consultants, and not to be an administrative burden. They will be an additional tool in the PM's project management toolbox to mitigate and control cost, schedule and quality risks on projects on a consistent basis from early project planning through the identification and selection, development, procurement, and implementation phases.

The development of the templates and tools was intended to provide PMs with the specific templates and tools needed to support MDOT risk identification, risk analysis and evaluation, risk response planning, risk mitigation, risk monitoring, and risk reporting for each of the project delivery phases. RS&H provided user instructions for use of all templates and tools, developed training materials, and conducted training on the use of the templates and tools.

In addition to conducting interviews with MDOT staff during the Risk Management Investigation Phase, RS&H conducted a survey of MDOT staff to develop a list of key recommended best practices from the Risk Management Investigation Phase to incorporate into the development of the RM Toolbox consisting of risk management templates and tools including, but not limited to, project RM Plan, risk breakdown structure, risk assessment matrix, and risk register, as described below.

## 3.2 Risk Management Toolbox

The RM Toolbox of documents and tools developed for use by MDOT PMs consists of an RM Workbook of RM Workflows and interactive links, as described in this Section 3, and a training module developed for training, as described in Section 4.

The RM Workbook consists of an RM Plan template, a Risk Management Procedure (“RM Procedure”) and associated risk management documents and tools developed in association with the feedback received from MDOT and the best practices identified in the Risk Management Investigation Phase. The development of the RM Toolbox was specifically tailored to meet the objectives stated in the RFP for implementation by PMs addressing gaps in MDOT’s current RM Program and to improve and build upon MDOT’s existing risk management guidance.

The key best practices used in the development of the RM Toolbox included:

- Focus on providing risk management guidance, processes and tools for PMs that are not to be an administrative burden.
- Prepare a comprehensive RM Plan for PMs.
- Define a formal process for PMs and project team to follow.
- Provide flexibility for PMs to customize process.
- Identify PMs as champions (champion a continuous process).
- Focus on specific steps to transition between phases.
- Develop easy-to-use interactive, user-friendly workflows.
- Include a continuous feedback loop for lessons learned.
- Schedule regular training to educate team on the process and use of the proposed RM Toolbox and RM Plan.
- Provide guidance on incorporating risk contingency into cost estimates.
- Update current guidelines incorporating risk management best practices from the Risk Management Investigation Phase.
- Develop risk management tools for PMs that can be referenced from the guidelines.
- Provide a single RM Plan template for PMs for projects by phase.
- Ensure that risks are effectively managed.
- Prepare formal and detailed process steps by project phase for PMs with flexibility to customize.
- Customize by phase with project-specific risk profile assignments (level of effort "tiering" based on project phase, project, size, complexity, and risk attributes).
- Formalize enterprise risk management approaches using a holistic approach to support decision-making and improve successful achievement of MDOT ICU’s strategic goals and objectives.
- Emphasize establishing a risk management culture and embedding risk management practices within the existing MDOT ICU’s business processes to build trust from stakeholders and buy-in from internal and external project team members.
- Focus on clearly defining the organizational roles and responsibilities within MDOT to identify project, program and agency risks early to promote awareness of risk, and provide team members with the tools to address risk resulting in better decision-making and fewer surprises.



A draft copy of the RM Workbook documents and tools was prepared and submitted to MDOT for interim review in March, July, and November 2021.

### 3.3 Risk Management Workbook

The RM Workbook was developed to establish formal risk management processes and procedures and to provide PMs with a formal set of guidance documents and tools to effectively implement risk management for each project delivery phase. The RM Workbook consists of interactive and linked RM Workflows with step-by-step instructions.

The RM Workbook is organized into seven sections across 17 worksheets. The tabs at the bottom of each worksheet are color-coded and labeled to guide the user to the appropriate location within the risk management process, as shown in Figure 3.3-1. Screenshots of the RM Workbook and associated worksheets can be found in Appendix B.



*Figure 3.3-1: Risk Management Workbook Layout*

#### 3.3.1 Risk Management Workbook Introduction (Intro Worksheet)

This section provides a general risk overview, purpose of the RM Workbook, contents of the RM Workbook, and its use for MDOT projects.

#### 3.3.2 Risk Management Best Practices (Worksheet 1.0)

This section provides a summary of the key risk management best practices identified in the Risk Management Investigation Phase and coordinated with MDOT for use by PMs on projects. These best practices are intended as supplemental guidance for PMs to consider facilitating implementation of the formal RM Program as PMs navigate the RM Workbook and implement the process steps. A list of the key risk management best practices that are provided in the RM Workbook is provided in Appendix A.

#### 3.3.3 Risk Management Workflow (Worksheet 2.0)

This section provides an RM Workflow of the major risk management process steps of the RM Plan within each of the project delivery phases:

- Identification and Selection
- Development
- Procurement
- Implementation

#### 3.3.4 Risk Management Plan (Worksheet 3.0)

This section provides the formal instructions for implementing the major process steps defined in each of the RM Workflows. Individual plans are provided for each project delivery phase. The use of the RM Plan is described in more detail in Section 3.4.

### **3.3.5 Risk Management Procedure (Worksheet 4.0)**

This section describes the formal risk management process for use at risk workshops, consisting of risk identification, risk assessment, and risk response planning. The RM Procedure is referenced by the RM Plan, as further described in Section 3.5.

### **3.3.6 Risk Documentation (Worksheets 5.0 through 5.4)**

This section provides the templates and tools to use for documenting the risk management process as part of the RM Procedure. The Risk Register template (“Register”) was developed as a tool for documenting outcomes of risk workshops and tracking project risks throughout the project delivery process. To provide the user with guidance to navigate the formal risk management process, the Register is set up to follow the RM Procedure and can be customized for each of the project delivery phases. A description of each input within the Register is provided as well as a Risk Breakdown Structure template (“RBS”) to customize the risk categories for each risk. The Register is linked to a Rating Guidelines template as well as a Risk Contingency and Schedule Impact Calculation template (“Contingency Calculation”). The Register and associated tools are referenced by the RM Procedure, as further described in Section 3.6.

### **3.3.7 Risk Reporting (Worksheets 6.0 through 6.2)**

The final section of the RM Workbook contains the reporting templates, including two Risk Reports (“Reports”). The first is a summary list of High Priority Risks documenting qualitative cost and schedule impacts linked to the Register. The second is a Risk Assessment Checklist (“Checklist”) that is used to report the status of key project development activities being tracked in the project schedule. The reporting features are further described in Section 3.6.

## **3.4 Risk Management Plan**

The RM Plan is a comprehensive risk management tool to facilitate the implementation of risk management and incorporate risk management principles and practices into daily project management activities to better address risk on projects.

The RM Plan template within the RM Workbook provides the PM with a formal set of detailed procedural step-by-step instructions to perform risk management activities for each of the project delivery phases based on industry recognized best practices and guidance received from MDOT staff. This can be customized by PMs for a project to include a project-specific risk profile assignment that defines the anticipated level of effort or “tiering” of the risk management process to be utilized based on project size, complexity, risk attributes.

There are four major process steps that are customized by delivery phase.

- Initial Risk Meeting – A transition meeting from the prior delivery phase assessing risk management needs.
- Risk Review and Planning – A team risk meeting and performing risk management activities.
- Risk Analysis and Allocation Meetings – Performing risk analysis.
- Risk Updates and Reporting – Monitoring and updating the Register on a monthly basis including monthly Risk Reports.

During the project Implementation Phase, the second and third steps (Risk Review and Planning, Risk Analysis and Allocation Meetings) are replaced by Transition Training to be held after contract execution and prior to design commencement.

The icon legend, shown in Figure 3.4-1, provides 11 icons that are located throughout the RM Workbook. These icons contain embedded links that take the user to the relevant section within the RM Workbook that is associated with a specific risk management step.



**Figure 3.4-1: Risk Management Plan Icon Legend**

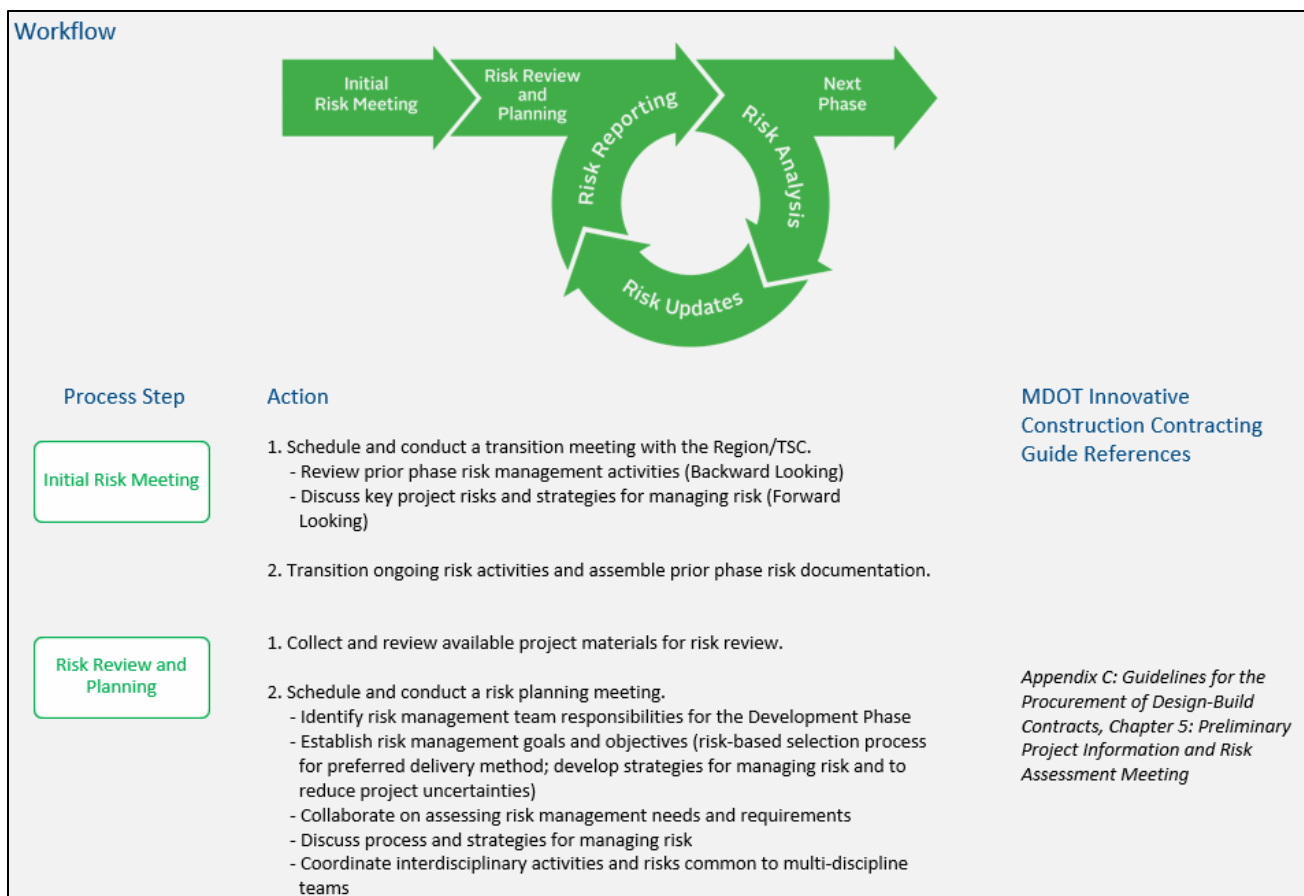
The project delivery phase workflow shown in Figure 3.4-2 contains links that when selected takes the user to an RM Plan providing an RM Workflow of detailed actions for each of the major process steps customized for each project delivery phase. It is important to note that “Development Phase” and “Implementation Phase” within the context of project delivery phases and the RM Plan denote phases within a project lifecycle and are not intended to signify the “Risk Management Development Phase” or “Risk Management Implementation Phase” that are the major work efforts described within Sections 2.0 and 3.0 of this report.



**Figure 3.4-2: Project Delivery Phase Workflow**

The detailed actions are intended to focus PMs on key steps to take for the successful implementation of risk management on projects based on best practices and lessons learned on recent MDOT projects, including the importance of engaging in early risk management activities to mitigate scope, quality and schedule risk and exposure to claims during construction. These are supplemented by references to relevant sections in the *Innovative Construction Contracting Guide* describing risk management processes and procedures for alternative delivery projects.

Figure 3.4-3 shows a portion of the project Development Phase RM Plan. Similar figures can be found within the RM Workbook for each of the delivery phases.



**Figure 3.4-3: Risk Management Plan for the Project Development Phase**

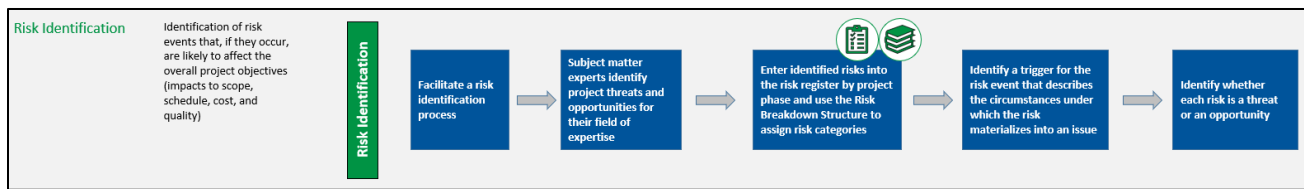
### 3.5 Risk Management Procedure

The RM Procedure is a formal step-by-step workflow for PMs to conduct the risk management process at risk workshops that builds upon MDOT’s current risk assessment ratings practice described in the *Innovative Construction Contracting Guide*, Appendix C, as described in Section 2.2 of this report. The RM Procedure is referenced in Step 3 of the RM Plan (Risk Analysis and Allocation Meetings) in the RM Workbook, which is included as Appendix B.

The RM Procedure incorporates the detailed best practice process steps identified in the Risk Management Investigation Phase for a three-step process consisting of the identification, assessment, and response of project risks. Documentation of the RM Procedure occurs within the Register. Figures 3.5-1, 3.5-2, and 3.5-3 provide workflows of each of the steps of the RM Procedure.

#### 3.5.1 Identification Step

The Identification Step includes detailed guidance for the identification of risk events that, if they occur, are likely to affect the overall project objectives (impacts to scope, quality, schedule and budget) including both threat and opportunity risks.

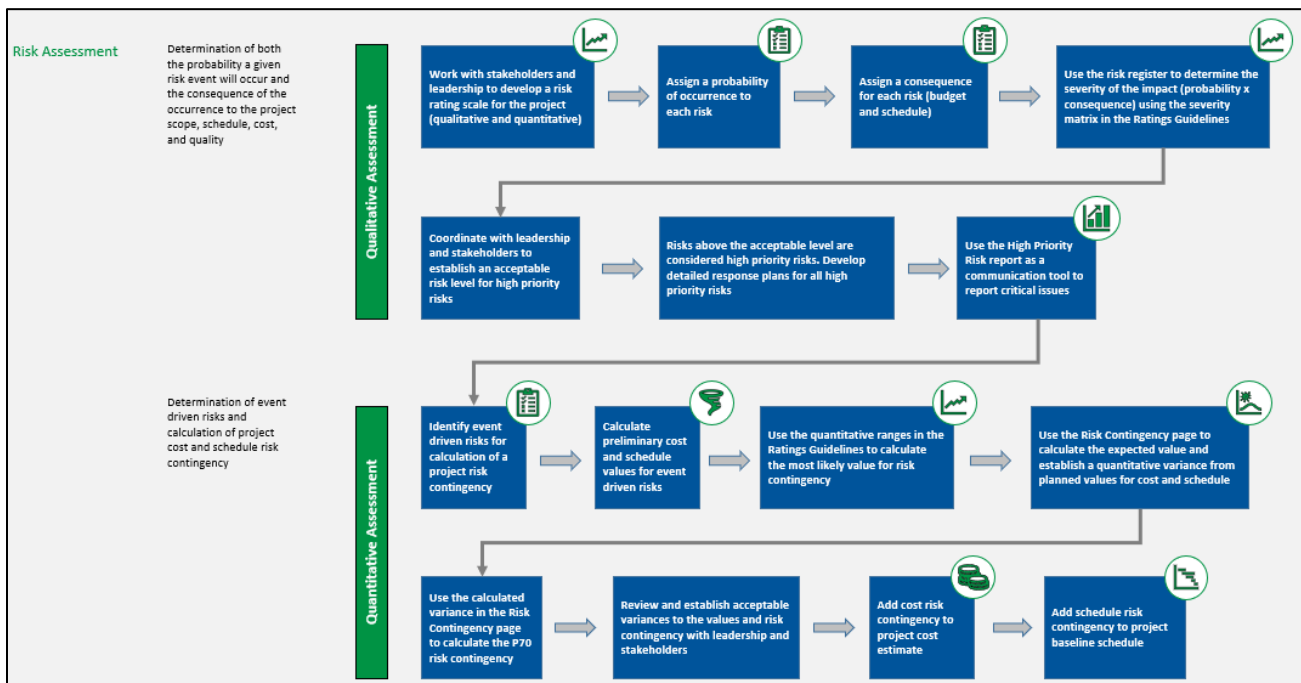


**Figure 3.5-1: Risk Management Procedure Showing the Risk Identification Step**

During the Identification Step, an identified risk is classified through the use of drop-down menus within the Register. The risk is assigned a number, categories using the RBS, and provided a phase assignment (assigned to the project phase to which the risk is applicable). The risk is given a name, a detailed description, a trigger for initiation of the risk (when the impacts of the risk would become a project issue to be remedied by the project team), and identified as either a risk threat or opportunity.

### 3.5.2 Assessment Step

The Assessment Step includes both qualitative and quantitative assessments. This step includes the process for determining both the probability a given risk event will occur and the consequence of the occurrence to the project scope, schedule, cost and quality. The RM Procedure uses a qualitative rating scale of 1 to 3, where 1=Low, 2=Medium, and 3=High, to classify the probability and consequence in accordance with MDOT’s current risk assessment guidance in the *Innovative Construction Contracting Guide*. The severity of the impact is then calculated by multiplying the probability of occurrence by the consequence of the impact.



**Figure 3.5-2: Risk Management Procedure Showing the Risk Assessment Step**

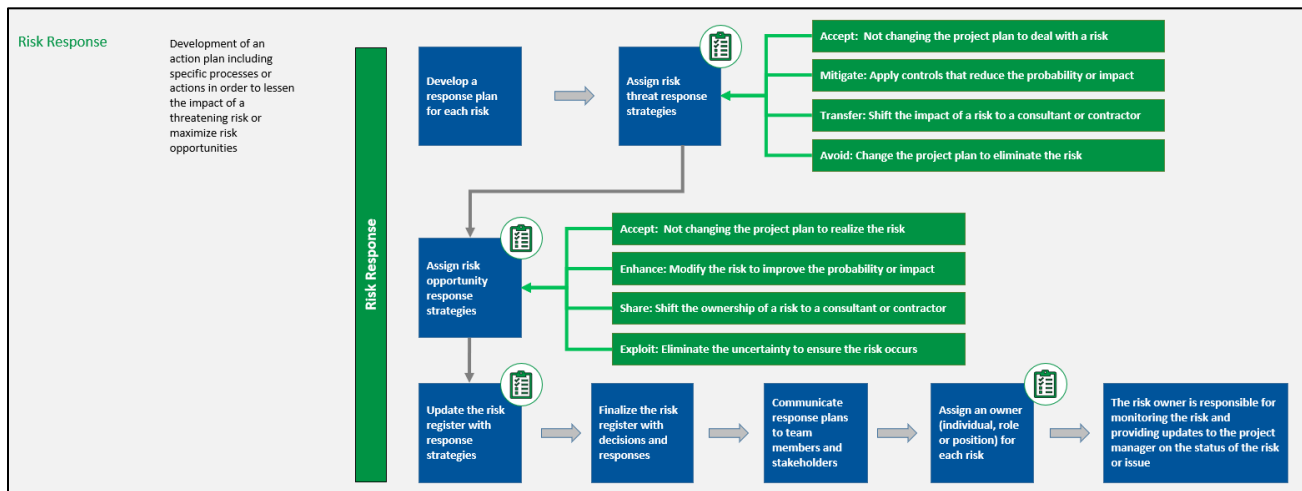
For risk events which have multiple impacts to scope, schedule, cost and quality, the RM Workbook builds upon MDOT’s current practice by adding the individual impact to calculate an impact score to help prioritize the risks for the purpose of developing response plans, reporting and monitoring the risks.

Part of the assessment is to consider how a schedule risk can affect the team’s ability to reach a specific project milestone. There are 16 project milestones provided by a drop-down menu in the Register ranging from an early project development activity through the maintenance period. The impacted milestone may be an event within the project phase specific to that risk or it may impact an activity further out in the schedule.

The process described in the *Innovative Construction Contracting Guide* is also developed further by including guidance on performing quantitative assessments. During the Assessment Step, the determination is made whether the risk is an “Event Driven Risk,” a risk that has a quantifiable cost or schedule impact that will be captured either as risk contingency in the project cost estimate or shown as a schedule impact to the project schedule. The calculation of the quantitative cost and schedule impacts is described below in Section 3.6.

### 3.5.3 Response Step

The last step in the RM Procedure is the Response Step, used to develop an action plan for addressing the risk impacts calculated in the Assessment Step. The Response Step defines specific processes or actions intended to reduce the impact of risk threats or maximize risk opportunities.



**Figure 3.5-3: Risk Management Procedure Showing the Risk Response Step**

Response strategies are assigned to each risk. For threats, the options can include to accept the risk by taking no further action to reduce the impact; mitigate the impacts with a specific activity or action, such as, performing additional engineering/analysis; transfer the risk to a party who is best able to minimize the impact; or avoid the risk by changing the project plan to eliminate the risk.

For opportunities, the options can include to accept the risk by taking no further action to increase the risk impact; enhance the risk by increasing the probability and/or impact thereby maximizing benefits realized for the project; share a portion of risk ownership with a party who is best able to maximize the impact; or exploit the risk by changing the project plan to eliminate the uncertainty associated with a risk by making sure the risk occurs.

All risks, regardless of the response strategy, are assigned an owner within the project team who is responsible for monitoring the risk and associated response plan. Ownership should be a specific person on the project and not a project role nor assigned to the PM. This allows for

better accountability in responding to and monitoring the risk. The owner will routinely report on the progress of the response plan in achieving the goals of the response strategy.

A risk status dropdown menu provides options to set the status as either not started, active (ongoing), dormant (not started), or retired (complete). Risks that are set as retired are not factored into the contingency nor are they included on the High Priority Risk report.

Notes should be added to keep the team informed of actions to address the risk. A contingency plan can also be established as part of the response plan.

### 3.6 Documents, Templates and Tools

The RM Workbook includes links and references to the risk management documents, templates and tools associated with the RM Plan and RM Procedure. As stated in Section 3.3 of this report, the following templates are tools to facilitate documentation of risks and outcomes when working through the RM Procedure:

- Register
- RBS
- Rating Guidelines
- Contingency Calculation

The following templates (Risk Reports) are reporting tools to highlight and prioritize active risks and monitor key project development activities:

- High Priority Risks
- Checklist

Each of the documents, templates and tools are formatted to enable PMs to produce clean outputs to track and monitor project risks on a monthly basis as described in Step 4 of the RM Plan (Risk Updates and Reporting). The tools were developed to be flexible and customized to address the needs of a specific project implementing the best practices from the Risk Management Investigation Phase.

#### 3.6.1 Risk Register

The Register builds upon MDOT’s current Risk Assessment Matrix referenced in the *Innovative Construction Contracting Guide* incorporating the best practices from the Risk Management Investigation Phase for developing user-friendly tools. The Register is flexible for use during each project phase with the ability to be customized to address the specific project needs of PMs. The Register is a documentation tool for PMs to document, track, monitor, update and report on project risks. Figure 3.6-1 provides a portion of the Register template.

RISK NUMBER	RISK CATEGORY	RISK SUB-CATEGORY	PROJECT PHASE	RISK NAME	RISK DESCRIPTION	RISK TRIGGER	THREAT / OPPORTUNITY	PROBABILITY	SEQUENCE	IMPACT	SEQUENCE	IMPACT	IMPACT SCORE	MILESTONE IMPACTED	EVENT DRIVEN RISK	RISK RESPONSE STRATEGY	RESPONSE PLAN	RISK OWNER	RISK STATUS	NOTES
										0		0	0							
										0		0	0							
										0		0	0							

Figure 3.6-1: Risk Register

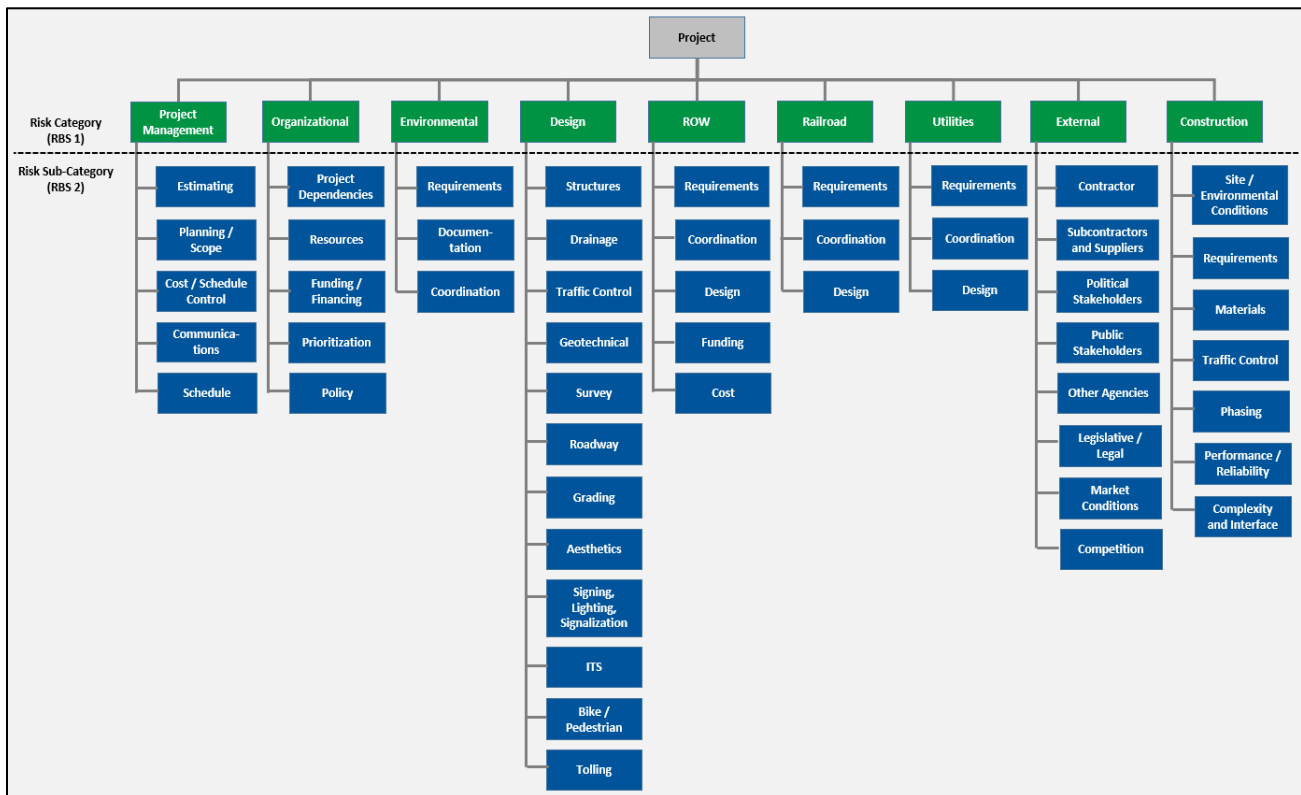
The Register is used to document the outcomes and decisions of the risk management process described in the RM Procedure, including risk identification, risk assessment, and the development of risk response plans, which are typically formulated at the risk workshops. In addition, the Register is used to document contingency plans, in the event risk responses are deemed to be ineffective, and includes options to add risk monitoring and control tracking notes.

The Register section of the RM Workbook contains user instructions to navigate the Register to supplement the guidance in the RM Procedure.

### 3.6.2 Risk Breakdown Structure

Part of the Identification Step within the RM Procedure is to assign a category and sub-category to each unique risk within the Register. This hierarchical approach enables the team to organize risks by subject in a consistent manner across projects, helps the team to assign risks to SMEs from multiple disciplines, and enables the team to report the number of risks or cumulative impact score by category.

The RBS is split between nine higher-level categories (RBS 1) and 51 sub-level categories (RBS 2) in the Register. A drop-down menu built into the Register enables the user to select an RBS 1 category and subsequent RBS 2 sub-category structured under the selected RBS 1 category. Figure 3.6-2 shows the two levels of the RBS.



**Figure 3.6-2: Risk Breakdown Structure**

When used across several projects, risks within the same RBS can be directly compared across projects to see trends and areas for future focus. If particular risks are frequently



occurring, then system-wide responses can be developed and implemented to minimize threats and maximize opportunities.

### 3.6.3 Rating Guidelines

As stated in Section 3.5 of this Report, the Rating Guidelines are referenced during the Assessment Step of the RM Procedure. This step includes the process for determining both the probability a given risk event will occur and the consequence of the occurrence to the project scope, schedule, cost and quality. Qualitative assessment ratings (low, medium, and high) are assigned a numeric quantity (1, 2, and 3) to facilitate calculating impacts and the severity of the impact is calculated by multiplying the probability by the consequence.

The Register is linked to the Ratings Guidelines to provide the information needed to perform the qualitative assessment rankings. Probability and consequence bounds for low, medium, and high are defined by the user for probability, cost consequence, and schedule consequence. These bounds are scalable to the size and duration of each project and may be set by the management team for each project. The ratings provided in the template are guidelines and cost consequence default settings are based on estimated project cost. Brief descriptions for these ranges are also provided.

- Probability Rating
  - 1-Low – Unlikely to occur, improbable; up to 25%
  - 2-Medium – Likely to occur, from possible to probable; from 25%-75%
  - 3-High – Highly likely to occur, has occurred on past projects with similar conditions; beyond 75%
- Consequence Rating
  - 1-Low – Mild, slight impact; up to 1% of project cost; up to 1 month
  - 2-Medium – Moderate, significant impact; from 1-3% of project cost; from 1-3 months
  - 3-High – Critical, severe impact; beyond 3% of project cost; beyond 3 months

As shown in Figure 3.6-3, ratings are assigned a color, dependent upon threat or opportunity classification, and a severity matrix shows a heat map for the risk impact to cost and schedule.

Probability Ratings			Consequence Ratings					
Opportunities and Threats			Opportunities			Threats		
1-Low	2-Medium	3-High	3-High	2-Medium	1-Low	1-Low	2-Medium	3-High
Unlikely to occur, improbable	Likely to occur, from possible to probable	Highly likely to occur, has occurred on past projects with similar conditions	Critical, severe impact	Moderate, significant impact	Mild, slight impact	Mild, slight impact	Moderate, significant impact	Critical, severe impact

Severity Matrix							
Opportunities			Threats				
Probability	3	9	6	3	3	6	9
	2	6	4	2	2	4	6
	1	3	2	1	1	2	3
		3	2	1	1	2	3
		Consequence					

**Figure 3.6-3: Rating Descriptions and Severity Matrix**

The Rating Guidelines are also linked to the Contingency Calculation to derive an initial quantitative assessment from the qualitative assessment ratings for each Event Driven Risk, as further described below. Sliders are provided to help the user set the Rating Values for probability and consequences used in the Contingency Calculation and have maximum and minimum values based upon the established bounds, as shown in Figure 3.6-4.

Probability (Percentage)			Cost Consequence (Dollars)			Schedule Consequence (Days)		
Medium Lower Bound	25%		Medium Lower Bound	\$ 370,000		Medium Lower Bound	30	
Medium Upper Bound	75%		Medium Upper Bound	\$ 1,110,000		Medium Upper Bound	90	
Assessment Rating	Rating Bounds	Rating Value	Assessment Rating	Rating Bounds	Rating Value	Assessment Rating	Rating Bounds	Rating Value
1-Low	Up to 25%	25%	1-Low	Up to \$370.0K	\$220,000	1-Low	Up to 30 Days	30
2-Medium	26% to 74%	50%	2-Medium	\$371.0K to \$1.10M	\$640,000	2-Medium	31 Days to 89 Days	60
3-High	75% and Above	75%	3-High	\$1.11M and Above	\$3,500,000	3-High	90 Days and Above	90

**Figure 3.6-4: Assessment Rating Bounds and Values**

As described in the following section, Minimum and Maximum values used to calculate project contingency and project schedule impacts are defined by the project team by setting offsets from the Most Likely value for each project phase, as shown in Figure 3.6-5.

Minimum and Maximum Offsets from Most Likely Values for Event Driven Risks		
Phase	Minimum	Maximum
Identification and Selection	25%	30%
Development	20%	25%
Procurement	10%	15%
Implementation	3%	5%

**Figure 3.6-5: Minimum and Maximum Offsets from Most Likely Values**

### 3.6.4 Risk Contingency and Schedule Impact Calculation

As stated in Section 3.5 of this Report, the Contingency Calculation is a tool referenced during the Assessment Step of the RM Procedure. During this step, the determination is made in the Register whether a risk is an “Event Driven Risk,” a risk that has a quantifiable cost or schedule impact that will be captured either as risk contingency in the project cost estimate or shown as a schedule impact in the project schedule. The Contingency Calculation is used to capture these Event Driven Risks and calculate project risk contingency and project schedule impacts. Risks that have a retired risk status within the Register are not included in the list of Event Driven Risks. The order of risks in the Contingency Calculation aligns with the order of risks within the Register; if risks are sorted in the Register, the risks will be presented in the same order in the Contingency Calculation.

The Contingency Calculation shown in Figure 3.6-6 links with the Register to reference the risk number and risk name for each Event Driven Risk. The quantitative probability of occurrence and cost and schedule consequence rating values are defined in the Rating Guidelines based on the qualitative values provided in the Register. The “Most Likely” cost and schedule impact in the Contingency Calculation is based on the Rating Value entered in the Rating Guidelines. These quantitative Most Likely cost and schedule impacts are provisional quantitative assessments of the risk impacts and are subject to review and update by the project team to determine the most appropriate impact of the risk for the determination of the risk contingency and project schedule impact.

EVENT DRIVEN RISK ITEMS														
RISK NUMBER	RISK NAME	PROBABILITY OF RISK OCCURRENCE	ESTIMATED COST IMPACT						ESTIMATED SCHEDULE IMPACT (DAYS)					
			MINIMUM	MOST LIKELY	MAXIMUM	EXPECTED ESTIMATED COST RISK	VARIANCE	CONTINGENCY	MINIMUM	MOST LIKELY	MAXIMUM	EXPECTED ESTIMATED SCHEDULE RISK	VARIANCE	CONTINGENCY
			Subtotals: \$ - 0.00E+00 \$ -						Subtotals: 0 0.00E+00 0.0					

			<b>Cost Risk Contingency</b>						<b>Schedule Risk Contingency</b>		
Confidence Level	50%	P50	\$	-		Confidence Level	50%	P50	0	days	
(Percent Chance of	70%	P70	\$	-		(Percent Chance of	70%	P70	0	days	
Not Exceeding)	90%	P90	\$	-		(Percent Chance of	90%	P90	0	days	
						Not Exceeding)					

**Figure 3.6-6: Contingency Calculation Used to Capture Event Driven Risks**

The Contingency Calculation uses the RBCE best practice to calculate the Expected Estimated Cost Value and Expected Estimated Schedule Value. Minimum and Maximum values are defined by the project team within the Rating Guidelines by setting offsets from the Most Likely value for each project phase. The weighted mean is calculated using these Most Likely, Minimum, and Maximum values and multiplied by the probability of risk occurrence. The sum of the Expected Estimated Cost Values and the Expected Estimated Schedule Values results in the P50 risk contingency and project schedule impacts, respectively, where P50 represents a 50% probability that the impact will not exceed the calculated value. The sum of the variances of the individual Event Driven Risks is used to calculate the P70 and P90 risk contingency for the project cost estimate and project schedule.

**3.6.5 High Priority Risks Report**

The High Priority Risk report template is a reporting tool to highlight and prioritize active risks for the purpose of developing response plans, and report and monitor key project development activities. This report provides a list of “High Priority Risks,” that is, risks that are not retired and are qualitatively rated as “High Impact” for either cost or schedule according to the Severity Matrix provided in the Rating Guidelines. This can include both Event Driven Risks and non-Event Driven Risks. The report is formatted to generate a report for the monthly risk updates described in Step 4 of the RM Plan.

The High Priority Risk report is linked to the Register and contains two reporting sections. The first section is a qualitative overview table that includes the risk number, risk name, ratings for both cost impact and schedule impact, and the overall impact score. Opportunities and threats are color-coded according to the Rating Guidelines. Regardless of the sequence of risks within the Register, the risks are sequenced in descending order by impact score, which is the combined total of the cost impact and schedule impact for a risk. The second section contains additional information in notecard format for each of the risks provided in the first section, including project phase, RBS 1 category, risk description, risk owner, response plan, and notes. Figure 3.6-7 shows the two sections of the High Priority Risk Report.

RISK NUMBER	RISK NAME	COST		SCHEDULE		IMPACT SCORE
		COST IMPACT	RISK IMPACT	SCHEDULE IMPACT	RISK IMPACT	

**Summary of High Risk Items**

Risk Register Item	
Overall Risk Rating	
Category (RBS 1)	
Risk Description	
Responsible Party	
Response Plan	
Notes	

**Figure 3.6-7: High Priority Risk Report**

### 3.6.6 Risk Assessment Checklist Report

Impacts to the project development schedule resulting from delay in achieving project development milestones are reported in the Checklist. The RM Workbook includes monthly output reports of the status of development activities being tracked in the project schedule to assess the risk on a monthly basis of not achieving defined project target milestones.

Assessment Ratings	Risk Impact	Assessment Criteria
1	Low	Criterion is on schedule to complete on or before the preferred milestone date.
2	Medium-Low	Criterion has passed the preferred milestone date but is on schedule to complete by a less preferred but acceptable milestone, or the finish date has been extended one time.
3	Medium	Criterion has extended the finish date two times.
4	Medium-High	Criterion has extended the finish date three times.
5	High	Criterion has missed both preferred and alternate milestone dates, or has extended the target milestone four or more times.

Project Name:		Assessment Date:			
Project Readiness Criteria	Current Status	Begin Date	Target Completion Date	Risk Rating	Completion Date <sup>1</sup>
1 Environmental Status	•				
Summary:					
2 Schematic Development	•				
Summary:					
3 Right-of-Way (% of Parcels Acquired)	•				
Summary:					
4 Utility Investigations (SUE)	•				
Percent Complete:					
Summary:					
5 Geotechnical Investigations (% Complete)	•				
Summary:					
6 Risk Assessment	•				
Summary:					
7 Funding Status	•				
Summary:					
8 Additional Comments on Project Readiness That Could Affect Procurement Schedule					
Summary:					
Notes:					
1. Actual or anticipated completion date					

**Figure 3.6-8: Risk Assessment Checklist Report**

The Checklist in Figure 3.6-8 documents activities identified during the Risk Management Investigation Phase that typically need higher scrutiny from the project team in order to be ready to advance the project. Target milestones are defined in the project schedule for the completion of specific activities in order to advance the project and the progress of these activities and the percent completes are reported in the Checklist as part of the monthly reporting in order to make the project team aware of current status and the milestones needing to be achieved.

## **4. RISK MANAGEMENT IMPLEMENTATION PHASE**

### **4.1 Introduction**

RS&H coordinated with MDOT to initiate an implementation strategy that enhances MDOT philosophies related to risk management, utilizes training of MDOT staff on the use of the RM Workbook and tools, and provides a basis for the implementation of an RM Program. The intent of the training program is to provide MDOT PMs and staff with a foundation for the consistent implementation of risk management principles and practices on projects. Objectives of the training were to:

- Engage participants through a combination of examples, lessons learned, and activities
- Stress the importance, benefits, and value of risk management as a systematic process for identifying, assessing, and responding to risk and managing resources
- Emphasize proactive and dynamic risk management – early and often risk assessments throughout the life of a project
- Focus on the use of risk management to build consensus and overall team cohesiveness
- Emphasize risk management as a tool for communication and consultation with internal and external stakeholders.

### **4.2 Implementation Plan**

The Implementation Plan consists of developing and delivering an engaging and interactive training program on the RM Workbook and associated templates, documents and tools while providing examples of best practices and lessons learned on projects and programs in conjunction with the instruction. The RM Workbook was released several times throughout the Risk Management Development and Risk Management Implementation Phases to provide MDOT staff an opportunity for review. RS&H has provided updates in response to review and training feedback creating an interactive process of MDOT staff learning to use the tools and RS&H improving the tools. This helps implement a feedback loop for continuous improvement of the RM Program. Training for executive level staff will be done separately.

There were two stages developed for the Implementation Plan. The first stage was focused on providing risk management training during a pilot project risk workshop by utilizing the RM Plan to execute the RM Procedure as outlined within the RM Workbook. The second stage was to deliver training material to MDOT on the use of the RM Workbook and the associated documents, templates and tools.

#### **4.2.1 Training Phase 1**

In March 2021, MDOT staff determined that the first stage of training and testing using the RM Workbook should be centered around an MDOT pilot project. The US-131 Design-Build Project was selected as a project that would give MDOT staff and the project team the opportunity to execute early risk management activities during the project Development Phase utilizing the documents and tools provided within the RM Workbook. The RM Workbook was distributed to enable MDOT staff and team members the opportunity to try out the tool and provide feedback

leading to an iterative process of learning and improving upon the developed tools through the Risk Management Implementation Phase.

### ***Initiating the Risk Management Plan***

Part of the training and testing of the RM Workbook was to activate the four-step RM Plan for the US-131 Project. The RM plan is used to define the risk management activities on projects customized for each phase based on project size, complexity, and risk attributes with links to documents and tools to perform the activities.

#### ***RM Plan Step 1 – Initial Risk Meeting***

In April 2021, the team initiated the RM Plan by conducting an early Initial Risk Meeting with MDOT leadership. During this Risk Management Pilot Project Coordination Meeting, the team outlined the scope, schedule, roles and responsibilities for the pilot process. RS&H was tasked with facilitating a risk workshop utilizing the risk management tools on the US-131 Project and would share the RM Workbook for additional feedback from MDOT going into the workshop.

In early September 2021, the team held a subsequent Risk Meeting with MDOT staff to provide an RM Workbook Training Session to present the RM Workbook contents and provide a workbook demonstration. The presentation focused on when and how to engage in the risk management process on MDOT innovative project delivery projects, provided a training overview of the concise and user-friendly set of risk management documents, and utilized the tools that define the processes needed to manage risk. The training session and overview provided another opportunity for team members to test out the RM Workbook features and how to use the tools during the pilot process.

#### ***RM Plan Step 2 – Risk Review and Planning***

The team scheduled a risk planning meeting in late September 2021 to roll-out of the risk activities for the pilot project with the larger project team. As part of the Risk Review and Planning step, there were five key activities planned for this meeting:

- Review project information
- Document key potential risks in the Register
- Review project base cost and schedule
- Prepare the Checklist
- Prepare for the Risk Workshop

This meeting included an overview of the MDOT risk management process by RS&H and a US-131 Project overview provided by MDOT staff. The team brainstormed potential project risks and developed a set of 11 key project risks for further discussion and drafted strategies for managing those key risks. An initial risk register was prepared using the Register in the RM Workbook. The team also reviewed the project cost and schedule assumptions, discussed the importance of the Checklist, and prepared for the workshop.

RS&H collected project information and prepared a pre-workshop risk survey to distribute to team members and SMEs. In mid-October 2021, the RS&H team provided a US-131 Pre-Risk Workshop Questionnaire to project team leaders for approval to distribute. The survey

provided a series of risk topics compiled from the Initial Risk Meeting in September, in an abbreviated risk register format, as shown in Figure 4.2-1.

Number	Risk Category	Risk Topic	Risk Description	Risk Assessment Ratings			Risk Response	Notes
				Probability	Consequence	Impact (Probability x Consequence)		

**Figure 4.2-1: Pre-Risk Workshop Questionnaire Format**

This questionnaire was intended to review the existing risks and identify new risks that will impact the project and the level of threat or benefit the risk poses to the project’s success. The questionnaires were distributed to project team members and SMEs and participants were instructed to provide a qualitative response to the risks provided using the ratings scale shown in Figure 4.2-2, update the response plan if necessary, and add additional risks. The responses provided to this questionnaire would be used to initiate the risk identification discussions at the workshop.

		Ratings Scale		
		Probability	Consequence	Impact
Low	1: Unlikely to Negligible	1: Cost increase negligible or could be overcome with minor contingency; Schedule delay negligible or could be overcome with minor schedule restructuring (i.e., use of float)	1 or 2	
Medium	2: '50/50'	2: Cost increase requires noticeable to significant expenditure of contingency; Schedule delay may require cost (e.g. pay for acceleration) or changes in scope to recover	3 through 5	
High	3: Likely to Near Certain	3: Cost increase is significant and unrecoverable or requires changes in scope to recover; Schedule delay is unrecoverable or would require significant cost/changes in scope to overcome	6 through 9	

**Figure 4.2-2: Pre-Risk Workshop Questionnaire Qualitative Ratings Scale**

**RM Plan Step 3 – Risk Analysis and Allocation Meetings**

The team prepared for the risk workshop by determining the scope of the workshop, desired qualitative outputs, size of the workshop, and prepared an agenda. In early November 2021, RS&H set up a series of ten breakout meetings, individualized per risk category, and lasting 30 minutes to two hours. The goal of the meetings was to provide further insight into risk workshop expectations and to interview SMEs on the findings from the risk survey. Questionnaire results were discussed during each meeting and results were compiled using the Register. The breakout categories included:

- Traffic and Safety
- Construction
- ITS
- Design
- Drainage
- Utilities
- Geotechnical
- Project Management
- ROW
- Environmental



The US-131 Project Development Phase Risk Workshop was held in mid-November 2021 with MDOT staff, the project team, and SMEs. RS&H met with MDOT staff ahead of time to set the scope for this workshop. The project is in the early stages of the project Development Phase and the objective of the two-hour workshop was to provide a walkthrough of the RM Workbook as opposed to a full project assessment and completion of the Register. A project overview was provided by MDOT staff and a summary of the survey results for the key project risks was provided.

The majority of risk identification, risk assessment, and risk response steps, as part of the RM Procedure, were completed prior to the workshop based upon the Initial Risk Meetings and discussion from the survey results. The Workshop was used partially as a verification of the top priority risks. RS&H selected three risks and walked the participants through the four steps of the RM Plan and three steps of the RM Procedure in order to delivery training on the use of the risk management process and demonstrate the full project Development Phase RM Workflow. For each of the three risks, the qualitative ratings were changed in the Register and the Rating Guidelines were modified to provide training on use of the Contingency Calculation and the process for calculating the quantitative cost and schedule impacts of Event Driven Risks. The result of the workshop was a draft risk register for the project team to build upon, a list of High Priority Risks to use for RM Plan Step 4 – Risk Updates and Reporting, and a draft training presentation for MDOT to use in future training.

#### **4.2.2 Training Phase 2**

The development approach for the training was based on the inputs and findings from the Risk Management Investigation Phase and Risk Management Development Phase and the guidance prescribed in the 2016 FHWA *Risk Management Guidance* identifying the four principal risk process steps of risk identification, risk analysis, risk response planning, and risk monitoring and control. This guidance is widely accepted and adopted by the DOTs that were researched during the Investigation Phase and is used as the basis for MDOT's current IC risk management procedures referenced in Chapter 5 of the *Innovative Construction Contracting Guide*. The RM Program and training presentation was also developed consistent with the seven processes in the *Project Management Body of Knowledge* (PMBOK) area for risk management.

#### ***Training Module***

The training presentation is provided as a self-guided walk-through of the RM Workbook. It enables the user to step through the iterative process and in combination with the RM Workbook provides the instructions to successfully integrate risk management activities into project management. The presentation providing examples of best practices and lessons learned on projects and programs in conjunction with the instruction.

The training presentation can be customized for use on active projects enabling the training to be conducted in conjunction with on-going project risk management activities. The RM Workbook can be used on an active project to conduct a risk workshop and develop a risk register for the project. The training can be combined with a project risk workshop facilitation, where training is provided as a morning session followed by a project workshop in the afternoon.

## 5. CONCLUSION

Risk management is part of a continuous project management process and should be integrated into everyday program and project decision-making. Through formalized risk management guidance, MDOT will be in a better position to assess and manage uncertainty, refine project assumptions, and develop mitigation strategies so risks do not become issues.

Successful implementation of a Risk Management Program begins with providing PMs and project teams with the tools and techniques based on best practices to make better-informed decisions. By seeing the value of incorporating risk into program and project management decision-making processes, MDOT is equipped to mitigate scope, schedule and cost impacts on a continuous basis. The benefits of risk management are realized when formal risk management is introduced on a project as early as possible and the development process continues throughout the project lifecycle.

Research was conducted to document industry risk management best practices to provide recommendations for developing and implementing a comprehensive RM Program. These best practices were used to develop standardized guidance documents, templates and tools to build upon MDOT ICU's current risk management practices. This will better assist PMs in managing project risk to improve project delivery on a consistent basis. Making project risk management more effective and efficient for project managers and staff will help to improve MDOT's business practices, project outcomes, and streamline project delivery.

The tools were developed to support MDOT risk identification, risk analysis and evaluation, risk response planning, risk mitigation, risk monitoring, and risk reporting for each of the project delivery phases. To support the guidance and tools, user instructions were developed for the use of templates and tools, and training was conducted on the use of the templates and tools. The guidance and tools are intended to foster wider education and buy-in from PMs, project team staff, and MDOT consultants, and not to be an administrative burden. They will be an additional tool in the PM's project management toolbox to mitigate and control cost, schedule and quality risks on projects on a consistent basis.

## REFERENCES

- “Category:149 Project Delivery Method Determination and Risk Assessment.” *MoDOT Engineering Policy Guide*. Accessed November 8, 2020. [https://epg.modot.org/index.php/Category:149\\_Project\\_Delivery\\_Method\\_Determination\\_and\\_Risk\\_Assessment](https://epg.modot.org/index.php/Category:149_Project_Delivery_Method_Determination_and_Risk_Assessment).
- Colorado Department of Transportation. *Design-Build Manual*. Denver, CO: 2016.
- Colorado Department of Transportation. *P3 Management Manual*. Prepared by RS&H and Clary Consulting. 2020.
- “Cost Estimation Process Improvement and Organizational Integration Project – Risk and Contingency.” *Minnesota Department of Transportation Project Management*. Accessed October 9, 2020. [https://edocs-public.dot.state.mn.us/edocs\\_public/DMResultSet/download?docId=1844885](https://edocs-public.dot.state.mn.us/edocs_public/DMResultSet/download?docId=1844885).
- “Design-Build at MoDOT.” *Missouri Department of Transportation Design-Build Information*. Accessed November 8, 2020. <https://www.modot.org/design-build-information>.
- “Design-Build Contracting.” *Minnesota Department of Transportation Design-Build*. Accessed December 15, 2020. <http://www.dot.state.mn.us/designbuild/index.html>.
- Federal Highway Administration. *Risk Management Guidance*. 2016.
- Georgia Department of Transportation. *Design-Build Manual, Revision 4.3*. Atlanta, GA: 2018.
- Georgia Department of Transportation. *P3 Manual, Version 2.1*. Atlanta, GA: 2020.
- Georgia Department of Transportation. *Plan Development Process, Revision 3.2*. Atlanta, GA: 2019.
- “Guide to Including Project Risks/Unknowns in Long Range Estimate (LRE).” *Florida Department of Transportation Guide to Including Project Risks*. Accessed November 3, 2020. <https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/designsupport/districts/d4/kbfiles/guidetoincludingprojectrisks.docx>.
- “LWD Cost Estimating Guidance.” *Minnesota Department of Transportation Project Management Total Project Cost Estimate Guidance*. Accessed October 9, 2020. <http://www.dot.state.mn.us/pm/documents/lwd-cost%20-estimating%20-method.doc>.
- Michigan Department of Transportation. *Innovative Construction Contracting Guide*. 2015.
- Minnesota Department of Transportation. *Cost Estimation and Cost Management Technical Reference Manual*. 2008.
- Nevada Department of Transportation. *Project Management Guidelines, Second Edition*. 2010.
- Nevada Department of Transportation. *Risk Management and Risk-Based Cost Estimation Guidelines*. 2012.
- “Project Delivery Methodology (PDM) Risk Initiation Review Checklist.” *Florida Department of Transportation Risk Progress Checklist*. May 17, 2013. [https://www.fdot.gov/docs/default-source/content-docs/it/pdm/9\\_qc\\_reviews/Risk\\_Initiation\\_Checklist.docx](https://www.fdot.gov/docs/default-source/content-docs/it/pdm/9_qc_reviews/Risk_Initiation_Checklist.docx).

- "Project Delivery Selection Approach (PDSA)." *Nevada Department of Transportation*. Accessed December 15, 2020. <https://www.dot.nv.gov/home/showpublisheddocument/7075>.
- "Project Estimation Wizard Instructions." *Nevada Department of Transportation*. Accessed December 15, 2020. <https://www.dot.nv.gov/home/showpublisheddocument/7178>.
- "Project Management." Nevada Department of Transportation Project Management and Training. Accessed December 15, 2020. <https://wsdot.wa.gov/engineering-standards/project-management-training>.
- Project Management Institute. *Project Management Body of Knowledge (PMBOK), Sixth Edition*. 2017.
- "Project Risk Management Process." *Minnesota Department of Transportation Project Management*. Accessed October 9, 2020. [https://edocs-public.dot.state.mn.us/edocs\\_public/DMResultSet/download?docId=1844880](https://edocs-public.dot.state.mn.us/edocs_public/DMResultSet/download?docId=1844880).
- "Project Risk Management Reference." *Minnesota Department of Transportation Project Management*. Accessed October 9, 2020. [https://edocs-public.dot.state.mn.us/edocs\\_public/DMResultSet/download?docId=1844820](https://edocs-public.dot.state.mn.us/edocs_public/DMResultSet/download?docId=1844820).
- "Risk and Contingency Fact Sheet." *Minnesota Department of Transportation Project Management*. Accessed November 24, 2020. <https://www.dot.state.mn.us/pm/pdf/risk-contingency-fact-sheet.pdf>.
- "Risk Based Graded Approach Worksheet Development Guidelines." *Florida Department of Transportation Project Managers Tool Box*. March 29, 2019. <https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/designsupport/toolbox/gradedapproachworksheetdevelopmentguidelines.docx>.
- "Risk Management." *Colorado Department of Transportation Business Center*. Accessed September 21, 2020. <https://www.codot.gov/business/project-management/scoping/risk-management>.
- South Carolina Department of Transportation. *Design-Build Procurement Manual, Version 1.0*. 2017.
- South Carolina Department of Transportation. *2018 Design-Build Peer Exchange*. Columbia, SC: 2019.
- Texas Department of Transportation. *Design-Build Estimate (120-F1) and Multiple Options Summary (120-F3) User Reference Guide*. 2017.
- Texas Department of Transportation. *Design-Build Procurement Overview Manual*. 2017.
- Texas Department of Transportation. *Procedure 114 – Risk Management*. 2019.
- Texas Department of Transportation. *Risk Management Guide for Alternative Delivery Program*. 2019.
- Texas Department of Transportation. *Risk Management Guide for Alternative Delivery Program (O&M Phase)*. 2019.

- “TPCE Cost Estimating Potential Guidelines.” *Minnesota Department of Transportation Project Management Total Project Cost Estimate Guidance*. Accessed November 24, 2020.  
[https://edocs-public.dot.state.mn.us/edocs\\_public/DMResultSet/download?docId=1844802](https://edocs-public.dot.state.mn.us/edocs_public/DMResultSet/download?docId=1844802).
- Virginia Department of Transportation. *Design-Build Procurement Manual*. 2019.
- Virginia Department of Transportation. *Design-Build Requirements for Advertisement*. 2017.
- Virginia Department of Transportation. *P3 Risk Management Guidelines*. 2015.
- Virginia Department of Transportation. *Project Risk Management*. 2015.
- Washington State Department of Transportation. *Cost Estimate Validation Process*. Seattle: The Seattle Times, 2002.
- Washington State Department of Transportation. *Project Delivery Method Selection Guidance*. 2019.
- Washington State Department of Transportation. *Project Risk Analysis Model User’s Guide*. 2018.
- Washington State Department of Transportation. *Project Risk Management Guide*. 2018.

## **APPENDIX A – KEY RISK MANAGEMENT BEST PRACTICES**

The following risk management best practices were identified during the Risk Management Investigation Phase and are provided within the RM Workbook. This list supplements the best practices provided in Section 2.9:

### ***Project Planning and Control***

- Use the RM Workbook as a project planning and control tool
- Use proactive and reactive efforts to manage risk
- Remember that managing risk, addressing uncertainty, and refining and validating assumptions is an integral part of a project's planning, organization, and decision-making process
- Engage in risk response planning, whether informal or formal, as a part of overall project planning
- Develop a risk-based contingency as part of a project's overall budget contingency

### ***Risk Management Process***

- Focus the project team on identifying, assessing and reporting on the more significant risk items affecting the scope, schedule and cost
- Help support the transition of less experienced project personnel into the project
- Engage multiple disciplines to discuss risks on a project and assess how other risks may affect their part in the project
- Facilitate early planning and prioritizing of items for the team to work efficiently and initiate early mitigation

### ***Focus on Project Team***

Enable and facilitate team coordination and the ability to prioritize items. This allows the team to be focused on the right tasks at the right time and work efficiently. A project team can make more informed decisions when the entire team understands the risk profiles and impacts.

### ***Risk Management Culture***

Aim to establish a risk management culture and create specific guidance meeting the needs to help develop the guidelines and training. Such a culture allows the project team to clearly see the value of incorporating risk into project and program management decision-making and planning to mitigate scope, schedule and cost impacts.

### ***Flexible and Scalable Process***

The overall approach and processes in the RM Toolbox are not intended to be prescriptive. Variations based on project size, procurement duration and timing, and other issues will require that the risk management effort be adjusted to fit each specific project. The requirements, limitations, and actions necessary to ensure consistent reporting and the continuous improvement of the risk program are discussed in the RM Workbook.

## ***Risk Management as a Continuous Process***

As the project moves through the project development process, more project details are fleshed out and risk items are addressed. Risks are either no longer a problem because they did not occur or because sufficient information is available to better assess the concern. Additional risk items may also be discovered later during the development process. These should be added to the list of previously known risk items with strategies developed and worked as development continues.

Remember - the risk management process can be executed anytime for instances where project specific or unique risks could occur that are not identified and managed as stated previously.

### ***Importance of Risk Management – Guiding Principles***

- Establish a formal, continuous risk management process
- Reduce risk and uncertainty resulting in better pricing
- Ensure quality of project information and RFP documents
- Project manager focus
- Better cost estimates
- Foster risk culture
- Early risk identification
- Mitigation strategies so risks don't become issues
- Minimize risk to proposers resulting in better competition
- Promote awareness of key project risks

### ***Enterprise Risk Management***

A successful risk management process involves participation at various levels of an organization: from the project team and program levels to the agency and leadership level. Aim to deliver an integrated, multi-tiered, comprehensive risk management approach that communicates and addresses uncertainties of all management levels of an organization.

### ***Lessons Learned – Continuous Improvement***

Using a risk management process will improve the operation of a program by improving overall visibility, facilitating communication, and providing an excellent basis for capturing lessons learned. It can be challenging to implement lessons learned and best practices consistently across a program due to a lack of a fully documented and developed formal RM Program and in part to limited staff and resources. The key is to develop a feedback loop into the risk management process to incorporate lessons learned for continuous improvement.

# APPENDIX B – RISK MANAGEMENT WORKBOOK



## RISK MANAGEMENT WORKBOOK INTRODUCTION

### Overview

Risk management is a well-established project management process that focuses on the identification, assessment and evaluation of project risks for the primary purpose of reducing cost and schedule uncertainty on projects. Cost and schedule management are all very familiar to project managers and are key components of managing a project's delivery.

### Purpose

The purpose of this Risk Management Workbook ("Workbook") is to provide project managers with specific guidance on when and how to engage in the risk management process on MDOT innovative project delivery projects, including a concise set of risk management documents and tools that define the processes needed to manage risk.

### Content

The Workbook is a risk management toolbox of guidance documents and tools for project managers. The Workbook consists of embedded links to all the documents and tools needed to perform risk management on MDOT projects. The documents and tools are organized as follows:

- 1.0 Risk Management Best Practices for project managers to successfully navigate and implement risk management consistently on projects
- 2.0 Risk Management Workflow to implement a best practice Risk Management Plan
- 3.0 Risk Management Plan to guide project managers through the risk management activities for each phase of project development, including:
  - 3.1 Identification and Selection Phase
  - 3.2 Development Phase
  - 3.3 Procurement Phase
  - 3.4 Implementation Phase
- 4.0 Risk Management Procedure to provide project managers with detailed steps of the risk management process
- 5.0 Risk Register Documentation and tools to document risks and outcomes when working through the Risk Management process, including:
  - 5.1 Risk Register
  - 5.2 Risk Categories
  - 5.3 Rating Guidelines
  - 5.4 Risk Contingency
- 6.0 Risk Reporting to facilitate reporting and monitoring of risk management activities, including:
  - 6.1 High Priority Risks
  - 6.2 Risk Assessment Checklist

### Use

Project Managers can download this Workbook for internal use on MDOT projects. The reports within Section 6.0 can be saved and printed for use at internal project meetings and to provide updates to shareholders and administration.





## RISK MANAGEMENT BEST PRACTICES

**Overview**  
The following key risk management best practices are intended to provide project managers with general best practice guidance conducting risk management activities.

**Project Planning and Control**

- Use the risk management workbook as a project planning and control tool
- Use proactive and reactive efforts to manage risk
- Remember that managing risk, addressing uncertainty, and refining and validating assumptions is an integral part of a project's planning, organization, and decision-making process
- Develop a risk-based contingency as part of a project's overall budget contingency
- Engage in risk response planning, whether informal or formal, as a part of overall project planning

**Risk Management Process**

- Focus the project team on identifying, assessing and reporting on the more significant risk items affecting the scope, schedule and cost
- Help support the transition of less experienced project personnel into the project
- Engage multiple disciplines to discuss risks on a project and assess how other risks may affect their part in the project
- Facilitate early planning and prioritizing of items for the team to work efficiently and initiate early mitigation

**Focus on Project Team**

- Enable and facilitate team coordination and the ability to prioritize items. This allows the team to be focused on the right tasks at the right time and work efficiently. A project team can make more informed decisions when the entire team understands the risk profiles and impacts.

**Risk Management Culture**

- Aim to establish a risk management culture and create specific guidance meeting the needs to help develop the guidelines and training. Such a culture allows the project team to clearly see the value of incorporating risk into project and program management decision-making and planning to mitigate scope, schedule and cost impacts.

**Flexible and Scalable Process**

**SCALABLE**

- The overall approach and processes in the Risk Management Toolbox are not intended to be prescriptive. Variations based on project site, procurement duration and timing, and other issues will require that the risk management effort be adjusted to fit each specific project. The requirements, limitations, and actions necessary to ensure consistent reporting and the continuous improvement of the risk program are discussed in the Risk Management Workbook.

Risk Management as a Continuous Process

As the project moves through the project development process, more project details are fleshed out and risk items are addressed. Risks are either no longer a problem because they did not occur or because sufficient information is available to better assess the concern. Additional risk items may also be discovered later during the development process. These should be added to the list of previously known risk items with strategies developed and worked as development continues.

Remember - the risk management process can be executed anytime for instances where project specific or unique risks could occur that are not identified and managed as stated previously.



Importance of Risk Management – Guiding Principles



Enterprise Risk Management



A successful risk management process involves participation at various levels of an organization: from the project team and program levels to the agency and leadership level. Aim to deliver an integrated, multi-tiered, comprehensive risk management approach that communicates and addresses uncertainties of all management levels of an organization.

Lessons Learned – Continuous Improvement

Using a risk management process will improve the operation of a program by improving overall visibility, facilitating communication, and providing an excellent basis for capturing lessons learned. It can be challenging to implement lessons learned and best practices consistently across a program due to a lack of a fully documented and developed formal Risk Management Program and in part to limited staff and resources. The key is to develop a feedback loop into the risk management process to incorporate lessons learned for continuous improvement.





## RISK MANAGEMENT WORKFLOW

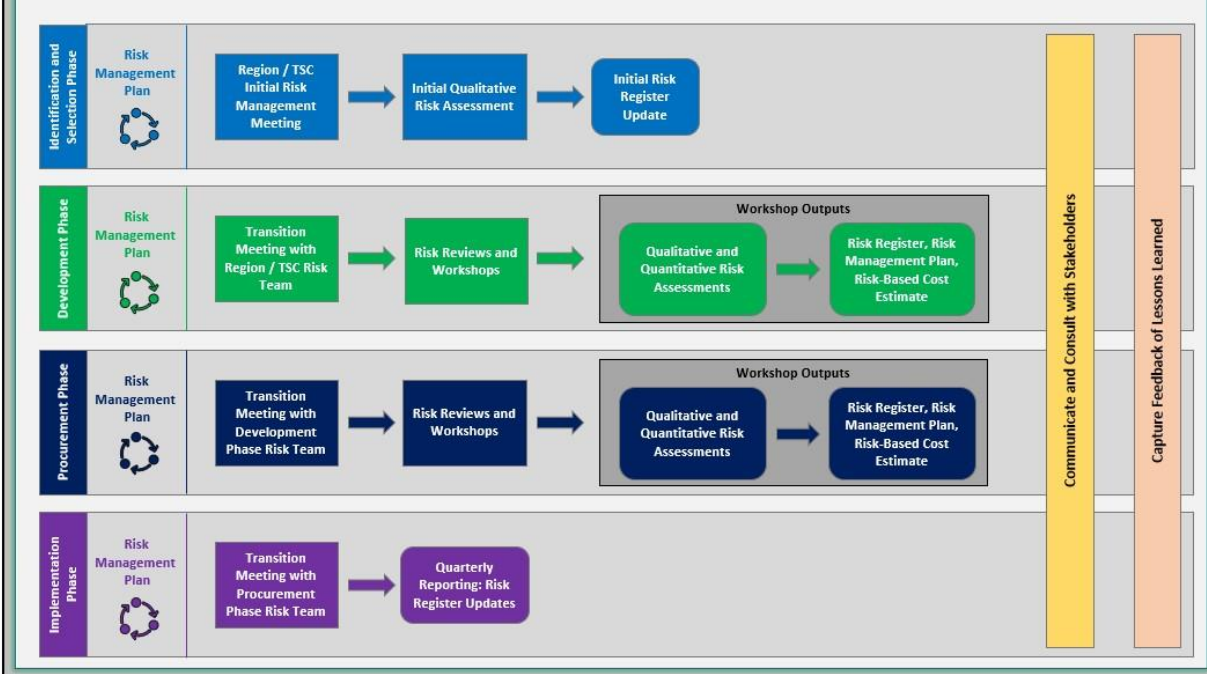
### Overview

The Risk Management Workflow provides an overview of the major risk management process steps of the Risk Management Plan within each of the project delivery phases:

1. Identification and Selection
2. Development
3. Procurement
4. Implementation

### Instructions

Utilize the project delivery phase workflows to determine next steps within the risk management process. Use the link embedded within the Risk Management Plan icon to jump to the major process steps customized for each delivery phase.





## RISK MANAGEMENT PLAN



### Overview

Define risk management activities on projects customized for each phase of project development based on project size, complexity, risk attributes with links to documents and tools to perform the activities.

### Instructions

Review the major process steps and risk management icons. Utilize the Delivery Phase Workflow to access content within the Risk Management Plan for each of the project delivery phases.

### Major Process Steps for Each Delivery Phase

**Initial Risk Meeting** | Transition meeting from prior delivery phase assessing risk management needs

**Risk Review and Planning** | Team risk meeting and performing risk management activities

**Risk Analysis and Allocation Meetings** | Performing risk analysis

**Risk Updates and Reporting** | Monitoring and updating the risk register on a quarterly basis including quarterly reports

### Icon Legend

These icons are located throughout the Risk Management Plan and subsequent Risk Management Procedure. Use the links embedded within these icons to jump to the associated item within the Workbook. The Cost Estimate and Baseline Schedule do not provide links within this Workbook.

	Risk Management Plan		Risk Breakdown Structure		Risk Contingency
	Risk Management Procedure		Rating Guidelines		High Priority Risks
	Risk Register		Event Driven Risks		Assessment Checklist
	Cost Estimate <i>(Outside of this Workbook - Links to Risk Contingency)</i>		Baseline Schedule <i>(Outside of this Workbook - Links to Risk Contingency)</i>		

### Delivery Phase Workflow for Risk Management Plan

Select one of the project delivery phases to begin the risk management activities.





**Overview**

Implement the major risk management process steps for the Identification and Selection Phase.

**Instructions**

Identify the current step within the Risk Management Plan. Review and complete the associated actions for that step. Click on an icon associated with an action to move directly to that page in the Workbook. Utilize the References identified for each step when necessary.

**Workflow**



**Process Step**

**Action**

**MDOT Innovative Construction Contracting Guide References**

Initial Risk Meeting

1. Collect and review available project materials to assist with a risk-based review of candidate projects for alternative delivery selection.
2. Schedule and conduct an initial risk meeting to review the project information.
  - Identify potential risks that may impact decision to select project for alternative project delivery
  - Refer to the candidate selection process described



*Appendix C: Guidelines for the Procurement of Design-Build Contracts, Chapter 2: Project Selection, Approval and Project Management*

Risk Review and Planning

1. Conduct initial risk management activities including a risk review to determine if non-traditional delivery methods could be advantageous.
2. Review initial risk list and add additional items applicable to assist in the project delivery selection process.
3. Schedule risk-based candidate project selection and allocation meetings.

*Appendix D: Guidelines for the Procurement of Construction Manager/General Contractor Contracts, Chapter 2: Project Selection, Approval and Project Management*

Risk Analysis and Allocation Meetings

1. Prepare a project scoping overview presentation for the meeting.
2. Conduct qualitative risk review and allocation meeting.
  - Determine appropriate attendance: Project Team members including Region/TSC, key specialty areas, and IC staff
  - Prepare and distribute an agenda prior to the meeting
3. Develop/update a project risk profile with risk allocations to assist in determination whether IC methods are advantageous for IC project delivery.
4. Evaluate whether a project is a suitable candidate for innovative contracting delivery.
  - Performance based incentives where the quality risk is shifted to the contractor who is responsible for corrective action throughout the performance life of the contract
  - Risk allocation where risk is transferred or shared with the contractor and where the contractor increases bid price based on the contractor's assessment of risk; such a pricing structure could also lower MDOT costs



*Chapter 2: Selection Information Table 2.1 – Innovative Contracting Recommendations*

Risk Updates and Reporting

1. Perform a risk-based review of project information on an annual basis in response to IC's call for innovative construction projects.
2. Review risk profile for suitability as an IC candidate project and assess whether project information should be submitted for ICC review.
3. Provide additional information as needed to support ICC risk review before making a final recommendation to the EOC.



**Overview**

Implement the major risk management process steps for the Development Phase.

**Instructions**

Identify the current step within the Risk Management Plan. Review and complete the associated actions for that step. Click on an icon associated with an action to move directly to that page in the Workbook. Utilize the References identified for each step when necessary.

**Workflow**



**Process Step**

**Action**

MDOT Innovative  
Construction Contracting  
Guide References

Initial Risk Meeting

- Schedule and conduct a transition meeting with the Region/TSC.
  - Review prior phase risk management activities (Backward Looking)
  - Discuss key project risks and strategies for managing risk (Forward Looking)
- Transition ongoing risk activities and assemble prior phase risk documentation.

Risk Review and Planning

- Collect and review available project materials for risk review.
- Schedule and conduct a risk planning meeting.
  - Identify risk management team responsibilities for the Development Phase
  - Establish risk management goals and objectives (risk-based selection process for preferred delivery method; develop strategies for managing risk and to reduce project uncertainties)
  - Collaborate on assessing risk management needs and requirements
  - Discuss process and strategies for managing risk
  - Coordinate interdisciplinary activities and risks common to multi-discipline teams
- Meet with key stakeholders including MDOT staff from the Region/TSC and key specialty areas, the FHWA, if applicable, and the GEC to discuss the project, its goals, schedule, funding constraints, and identify the initial major risks.
  - Conduct initial risk surveys and/or interviews to identify potential risks
  - Prepare an initial risk register to begin to prioritize risk events that may impact decisions
- Review the estimated project cost and schedule against the planned budgets and schedules to identify variance.
- Conduct initial scope verification.
- Prepare the Risk Assessment Checklist to schedule and begin to conduct preliminary engineering activities for risk mitigation in order to prepare for launching the procurement and developing the RFP documents:
  - Schematic development activities
    - Define project scope
    - Identify geometric constraints and criteria for delivering scope
    - Collaborate reviews with interdisciplinary teams during schematic development (drainage, constructability)
  - Geotechnical investigations - Coordinate development of an investigation plan by coordinating the work with the CFS Geotechnical engineering staff and Region Materials Office staff
  - Utility investigations - Perform utility investigations to identify potential conflicts and utility owners; develop preliminary conflict matrix and identify any long lead and high risk utility adjustments
  - Survey and ROW mapping - Mapping should be adequate to support completion of the environmental document and support preliminary engineering activities necessary to mitigate risk
- Use the Risk Assessment Checklist with preliminary schedule activities to track and assess status and assign a risk rating for activities during Development Phase.
  - Coordinate development of Project Readiness Checklist with MDOT Pre-procurement/Development Checklist and Development Schedule
- Schedule Development Phase risk workshop/risk team meeting.

Appendix C: Guidelines for the Procurement of Design-Build Contracts, Chapter 5: Preliminary Project Information and Risk Assessment Meeting

Appendix C: Guidelines for the Procurement of Design-Build Contracts, Chapter 13: Request for Proposals (RFP)

**Risk Analysis and Allocation Meetings**

1. Prepare a project overview presentation for each risk workshop/risk team meeting.
  - Project overview and status
  - Risk Management Process training, as applicable
2. Prepare for the risk workshop/risk team meeting:
  - Determine scope of workshop and desired outcomes (qualitative or quantitative; initial or update)
  - Size the workshop appropriately
  - Determine appropriate attendance: Project Team members including GEC, Agency Leadership, Project Stakeholders, and local Officials; FHWA attendance is required for PoDIs and optional for non-PoDI projects
  - Prepare and distribute an agenda prior to the meeting
  - Consider including a risk questionnaire to solicit feedback on risks prior to the workshop
  - Update register, if applicable, with feedback prior to the meeting
  - Prior to each workshop, define Risk Response strategies and control assignments; these should be ready to be discussed by identified parties for at least all High Priority risks
  - Prior to each workshop, develop or update, as appropriate, the preliminary project development schedule and preliminary cost estimate
3. Conduct workshop in accordance with Risk Workbook Procedure.
4. Perform post-workshop updates to the risk register and assessments consistent with the outcomes from the workshop.
5. Using the initial risk analysis, assess how risk will be allocated for the project. Risks should be allocated to the party best equipped to manage the risk.
6. If the alternative delivery method has not been determined, use the analysis to determine appropriate procurement method. Considerations include:
  - DB procurements are typically projects with low risk of unforeseen conditions
  - DBF are projects that are unable to be financed due to size or specific project risks
  - DBFO or DBFOM, also known as P3 projects, are projects which transfer specific design, construction, financial, operational, and maintenance responsibilities to the private sector partner for a specific period of time
  - CMGC is a procurement method where the A/E works with the Construction Manager/General Contractor to mitigate risk during the design phase with the CM at risk for delivering the project within the scope, schedule, and the established price

*Appendix C: Guidelines for the Procurement of Design-Build Contracts, Chapter 5: Preliminary Project Information and Risk Assessment Meeting*



*Section 5.1: Delivery Methods, 5.1A: Design-Build 5.1B: Design-Build-Finance 5.1C: Design-Build-Finance-Operate (or Maintain) 5.1D: Construction Manager/General Contractor*

*Chapter 2: Selection Information Table 2.1 – Innovative Contracting Recommendations*

*Section 4.3: Payment*

*Appendix D: Guidelines for the Procurement of Construction Manager/General Contractor Contracts, Chapter 3: Preliminary Project Information and Risk Assessment Meeting*

**Risk Updates and Reporting**

1. Risk monitoring and control:
  - Establish a process using the Risk Management Workbook for conducting quarterly updates
  - Track and respond to changes in risk on a quarterly basis
  - Review and update the risk register and risk contingency quarterly
2. Schedule quarterly meetings with the Risk Management Team to review current risk status:
  - Assign a member of the Risk Management Team to coordinate the updates with the Team
  - Develop and implement strategies for responding to changing risks
  - Use the updates from the latest workshop or quarterly update as the basis for discussions
  - If a risk workshop is conducted, then the updates from the workshop replace the quarterly update
3. Review and update the High Priority list.
4. Update the project cost estimate with changes to the cost risk contingency from the quarterly risk meeting or risk workshop.
5. Update the project development schedule with changes to the schedule risk contingency and any changes to activity milestones.
6. Prepare the quarterly report with current status:
  - Use quarterly risk reviews to develop documentation for reporting purposes to leadership
  - Report on High Priority risks and cost and schedule impacts
7. Evaluate whether a project is ready for procurement using readiness criteria in the Risk Assessment Checklist and Development Milestone Schedule. Considerations include:
  - The level of preliminary design needed to launch a procurement is typically 10%-30%, although depends greatly on the allowable risk tolerance for the project



*Appendix C: Guidelines for the Procurement of Design-Build Contracts, Chapter 12: Request for Qualifications (RFQ)*

*Appendix C: Guidelines for the Procurement of Design-Build Contracts, Appendix 12A: Design-Build RFQ Checklist*



RISK MANAGEMENT PLAN  
PROCUREMENT PHASE



Overview

Implement the major risk management process steps for the Procurement Phase.

Instructions

Identify the current step within the Risk Management Plan. Review and complete the associated actions for that step. Click on an icon associated with an action to move directly to that page in the Workbook. Utilize the References identified for each step when necessary.

Workflow



Process Step






Action

MDOT Innovative Construction Contracting Guide References

Initial Risk Meeting

1. Schedule and conduct a transition meeting with the Development Phase project team.
  - Review prior phase risk management activities (Backward Looking)
  - Discuss key project risks and strategies for managing risk during the procurement (Forward Looking)
2. Transition ongoing risk activities from the Development Phase and assemble prior phase risk documentation.
3. Collaborate with the Development Phase project team to update the risk register (retiring risks that are no longer active). 

Risk Review and Planning

1. Collect and review available project materials from the Development Phase for risk review.
2. Schedule and conduct a risk planning meeting.
  - Identify risk management team responsibilities for the Procurement Phase
  - Establish risk management goals and objectives (risk-based selection process for preferred delivery method, develop strategies for managing risk and to reduce project uncertainties)
  - Collaborate on assessing risk management needs and requirements
  - Discuss process and strategies for managing risk
  - Coordinate interdisciplinary activities and risks common to multi-discipline teams
3. Meet with key stakeholders including MDOT staff from the Regions/TSC and key specialty areas, the FHWA, if applicable, and the GEC to discuss the project, its goals, schedule, funding constraints, and to identify the major risks for the procurement.
  - Conduct initial risk surveys and/or interviews to identify potential procurement risks and perform initial impact assessments
  - Update the risk register based on survey feedback and begin to prioritize risk events that may impact decisions  
4. Review the estimated project cost and schedule against the planned budgets and schedules to identify variance.  
5. Verify alignment of project scope, cost and schedule assumptions.
6. Use the Risk Assessment Checklist to continue monitoring progress of preliminary engineering activities for risk mitigation:
  - a. Schematic development activities
    - Project scope validation and consistency with RFP requirements
    - Identify geometric constraints and develop RFP criteria for delivering scope
    - Collaborate reviews of the RFP documents with interdisciplinary teams during schematic development (roadway, drainage, constructability) to identify discrete risk events
  - b. Geotechnical investigations - Continue coordinating development of RFP requirements with the CFS Geotechnical engineering staff and Region Materials Office staff based on preliminary investigations
  - c. Utility investigations - Continue investigations begun during the Development Phase to reduce RFP risk pricing by identifying and evaluating potential conflicts, coordinating identification and adjustment solutions with utility owners, and developing a utility conflict matrix
  - d. Survey and ROW mapping - Mapping should be adequate to support completion of the environmental document and support preliminary engineering activities necessary to mitigate risk 

Appendix C: Guidelines for the Procurement of Design-Build Contracts, Chapter 5: Preliminary Project Information and Risk Assessment Meeting

Appendix C: Guidelines for the Procurement of Design-Build Contracts, Chapter 13: Request for Proposals (RFP)



Risk Analysis and Allocation Meetings

7. Use the Risk Assessment Checklist to track and assess status and assign a risk rating for ongoing activities to assess the readiness for release of the RFP.
  - Coordinate activities being tracked in the Risk Assessment Checklist with MDOT Procurement Checklist and Procurement Schedule



8. Schedule Procurement Phase risk workshop/risk team meeting.

1. Prepare a project overview presentation for each workshop/team risk meeting.
  - Project overview and status
  - Risk Management Process training, as applicable

2. Prepare for the risk workshop/risk team meeting:
  - Determine scope of workshop and desired outcomes (qualitative or quantitative; initial or update)
  - Size the workshop appropriately
  - Determine appropriate attendance: Project Team members including GEC, Agency Leadership, Project Stakeholders, and local Officials; FHWA attendance is required for PoDIs and optional for non-PoDI projects
  - Prepare and distribute an agenda prior to the meeting
  - Consider including a risk questionnaire to solicit feedback on risks prior to the workshop
  - Update register, if applicable, with feedback prior to the meeting
  - Prior to each workshop, define Risk Response strategies and control assignments; these should be ready to be discussed by identified parties for at least all High Priority risks
  - Prior to each workshop, develop or update, as appropriate, the preliminary project development schedule and preliminary cost estimate



Appendix C: Guidelines for the Procurement of Design-Build Contracts, Chapter 13: Request for Proposals (RFP)

3. Conduct workshop in accordance with Risk Workbook Procedure.

4. Use the risk analysis performed at the workshop to perform post-workshop updates to the risk register consistent with the outcomes from the workshop.

5. Update the procurement schedule and risk contingency for the project cost estimate based on the outcomes of the workshop.

6. Use the risk analysis to develop RFP documents. Assess how risk will be allocated for the project. Risks should be allocated to the party best equipped to manage the risk. Determine if shared risk items are required, define the shared risk item, and coordinate these with the development of the ITP and RFP:

- a. ITP - Prepare Form 4 - Proposal Price to include the DB lump-sum project, shared risk items identified in Book 1 – Section 12
- b. Book 1 - Review need for project-specific modifications to the Agreement to accommodate changes in risk allocation (i.e., shared risk items)
- c. Book 1, Section 6 - Access to Site; Utility Relocations; Environmental Mitigation - Review for potential risk allocation changes for right-of-way, utilities, and environmental compliance that may affect this chapter; risk allocations in the RFP documents are typically applicable to address right-of-way concerns, environmental items, geotechnical items, utility conflicts, third party items, and railroads
- d. Review Book 1, Section 12 - Shared Risk Item Work and Price Adjustments - Risk allocation changes to shared risk items could have a significant effect on the structure, content and details of Section 12
- e. Determine if shared risk items are required for structures and define the shared risk item
- f. Verify the prices for all shared risk items
- g. For CMGC contracts, determine shared risk items; MDOT may choose to own the contractual responsibility for the risk or pass it on to the contractor and have it included in the Guaranteed Maximum Price (GMP) portion of the construction services cost proposal; the risks will be used to identify criteria used to short-list or select contractors; review risk associated with item quantities and costs for the GMP

Appendix D: Guidelines for the Procurement of Construction Manager/General Contractor Contracts, Chapter 3: Preliminary Project Information and Risk Assessment Meeting

Section 5.1: Delivery Methods, 5.1E: Alternative Technical Concepts

Chapter 18: Alternate Technical Concepts (ATC)

Appendix C: Guidelines for the Procurement of Design-Build Contracts, Chapter 13: Request for Proposals (RFP)

7. Include Alternate Technical Concepts (ATC) risk analysis to assess contractor's proposed changes to contract requirements prior to bidding to evaluate whether the concepts provide the public with a product that is equal or better to the base design.

8. Perform the following risk analysis activities during procurement:
  - a. Mitigate project specific risks during development of the RFQ and RFP documents
  - b. Assess whether the RFP provides the desired blend of prescriptive vs performance-based requirements for a DB project; overly descriptive requirements can limit innovation and, in some cases, bring additional risk to MDOT if designs are prescribed to the DB contractor
  - c. Review the contractual language in the RFP to ensure the documents clearly define the Design-Builder's requirements and provide a constructable design in order to minimize MDOT's risk of claims due to plan errors and omissions
  - d. From the risk analysis, identify early coordination with third parties, and if necessary obtain as many agreements as possible with third parties prior to issuance of the RFP

Risk Updates and Reporting

1. Risk monitoring and control:
  - Establish a process using the Risk Management Workbook for conducting quarterly updates during the procurement
  - Track and respond to changes in risk on a quarterly basis
  - Review and update the risk register and risk contingency quarterly
2. Schedule and participate in quarterly meetings with the Risk Management Team to review current risk status:
  - Assign a member of the Risk Management Team to coordinate the updates with the Team
  - Develop and implement strategies for responding to changing risks
  - Use the updates from the latest workshop or quarterly update as the basis for discussions
  - If a risk workshop is conducted, then the updates from the workshop replace the quarterly update
3. Review and update the High Priority list.
4. Update the project cost estimate with changes to the cost risk contingency from the quarterly risk meeting or risk workshop.
5. Update the project development schedule with changes to the schedule risk contingency and any changes to activity milestones.
6. Prepare the quarterly report with current status:
  - Use quarterly risk reviews to develop documentation for reporting purposes to leadership
  - Report on High Priority risks and cost and schedule impacts
7. Evaluate whether the procurement is ready to progress to the next milestone using the Risk Assessment Checklist, Procurement Schedule and RFP checklist.



*Appendix C: Guidelines for the Procurement of Design-Build Contracts, Chapter 5: Preliminary Project Information and Risk Assessment Meeting, Appendix 5A: Initial Schedule*

*Appendix C: Guidelines for the Procurement of Design-Build Contracts, Chapter 15: RFP Package Review Meeting*





RISK MANAGEMENT PLAN  
IMPLEMENTATION PHASE



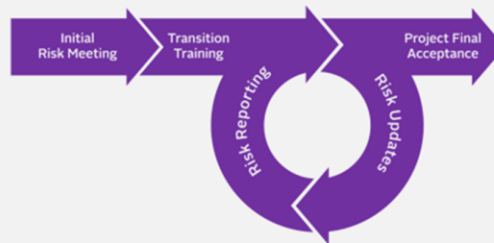
Overview

Implement the major risk management process steps for the Implementation Phase.

Instructions

Identify the current step within the Risk Management Plan. Review and complete the associated actions for that step. Click on an icon associated with an action to move directly to that page in the Workbook. Utilize the References identified for each step when necessary.

Workflow



Process Step

Action

Initial Risk Meeting

- Schedule transition meeting with Procurement Phase risk management team.
  - Determine appropriate attendance: Typically MDOT staff from IC, the Region/TSC and key specialty areas, the FHWA, key procurement team staff and the GEC
- Conduct transition meeting for knowledge transfer from Procurement team to Implementation team.
  - Collaborate on assessing risk management needs and requirements
  - Review on-going risk management activities from Procurement Phase
  - Coordinate transition activities and transition of risk management documentation from Procurement Phase (register and associated documentation)
  - Review roles of the parties
  - Discuss risk management activities
  - Resolution of contract claims and disputes, and issues related to contract interpretation
  - Define DADC responsibilities through FA
  - Discuss risk monitoring and reporting requirements

MDOT Innovative Construction Contracting Guide References

Appendix C: Guidelines for the Procurement of Design-Build Contracts, Chapter 5: Preliminary Project Information and Risk Assessment Meeting



Transition Training

- Schedule transition training.
  - Schedule for shortly after contract execution and prior to design commencement
  - Attendees should include MDOT staff from IC, the Region/TSC, key specialty areas, the FHWA, if applicable, and the GEC.
- Conduct transition training
  - Review key contract requirements negotiated during the procurement and negotiation phases (contractual timeframes, deliverables, contractual requirements, specifications, and commitments)
  - Review risk register and risk management process related to register updates and reporting as applicable for implementation team
  - Discuss project risks allocated to MDOT and strategies developed during the procurement for managing risk
  - Review lessons learned on previous projects and strategies for mitigating contractual risk (issues, claims, disputes) such as noncompliance and dispute resolution procedures



Guidelines for the Procurement of Design-Build Contracts, Chapter 26: Training

Risk Updates and Reporting

- Risk monitoring and control:
  - Establish a process using the Risk Management Workbook for conducting quarterly updates
  - Track and respond to changes in risk on a quarterly basis
  - Review and update the risk register quarterly
- Schedule and participate in quarterly meetings with the Risk Management Team to review current risk status:
  - Assign a member of the Risk Management Team to coordinate the updates with the Team
  - Develop and implement strategies for responding to changing risks
  - Use the updates from the latest workshop or quarterly update as the basis for discussions
- Prepare the quarterly report with current status:
  - Use quarterly risk reviews to develop documentation for reporting
  - Report on High Priority risks, cost and schedule impacts, and status of any issues, claims and disputes



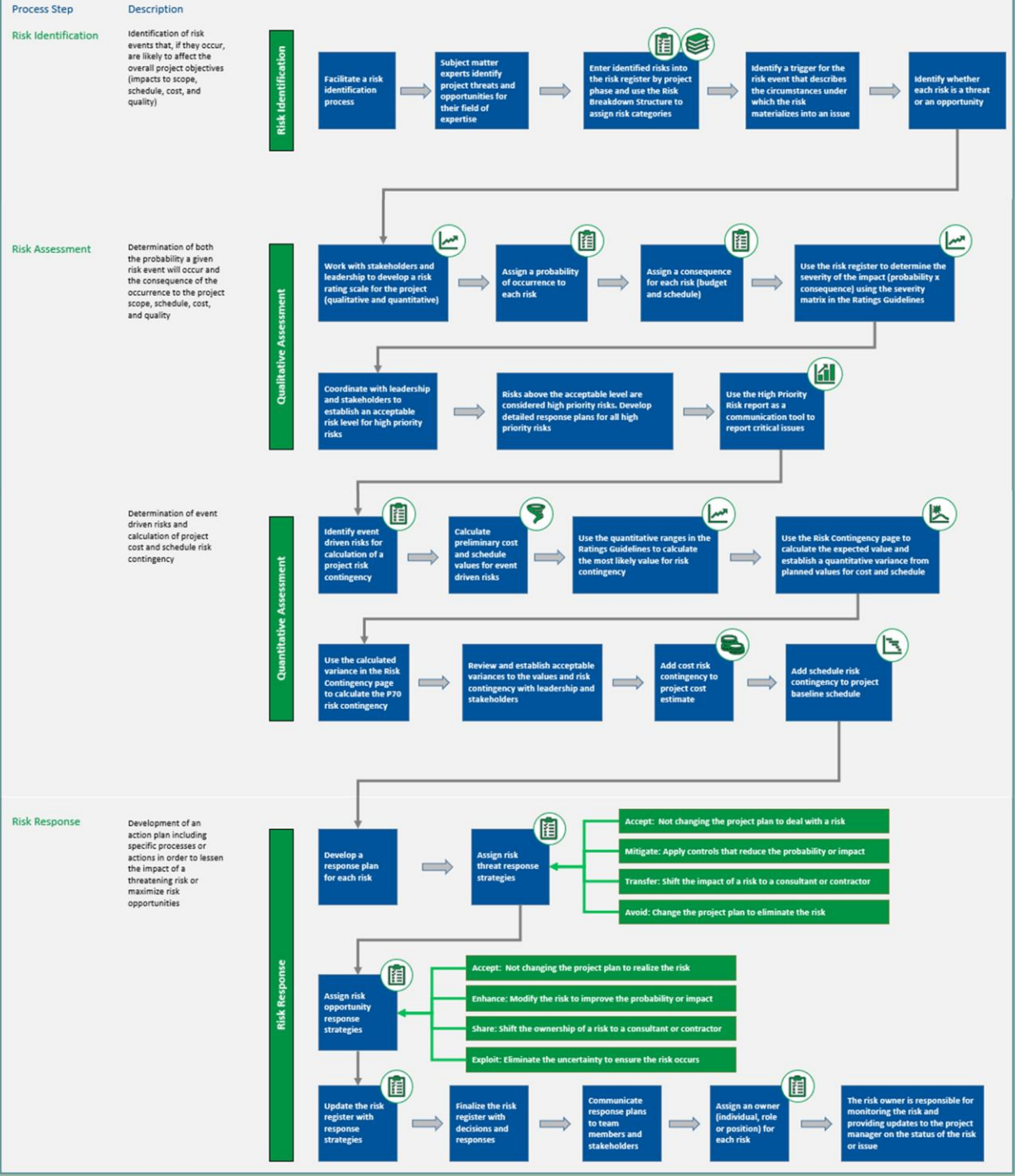


**Overview**

The Risk Management Procedure describes the formal risk management workflow to conduct the risk management process at risk workshops consisting of risk identification, risk assessment, and risk response. The Risk Management Procedure is referenced in the Risk Management Plan during the Risk Analysis and Allocation Meetings step.

**Instructions**

Follow the step-by-step workflow when conducting the risk management process at risk workshops. Utilize the risk register and associated tools to record risk events and risk documentation. Click on an icon associated with an action to move directly to that page in the Workbook.





RISK REGISTER DOCUMENTATION



Overview

Risk Register Documentation templates are tools to facilitate documentation of risks and outcomes when working through the Risk Management Procedure, including:

1. Risk Register
2. Risk Breakdown Structure
3. Rating Guidelines
4. Risk Contingency and Schedule Impact Calculation

Instructions

Utilize the descriptions provided below and associated risk tools to help define the inputs required for the Risk Register.

Risk Register Column	Risk Register Description
Risk Number	A unique identification number given to each risk/issue in sequential order beginning with 1.
Risk Category (RBS 1)	The primary classification or functional area that the risk/issue pertains to. See 5.2 for a risk breakdown structure (RBS 1) identifying the risk categories.
Risk Sub-Category (RBS 2)	The secondary classification or functional area that the risk/issue pertains to. This is a more detailed grouping of a particular risk/issue within RBS 1. See 5.2 "Risk Categories" for a risk breakdown structure (RBS 2) identifying the risk sub-categories.
Project Phase	Phase of the project development process the risk/issue is anticipated to occur in. There are four options: 1) Identification and Selection, 2) Development, 3) Procurement, and 4) Implementation.
Risk Name	A brief and unique name given to each risk/issue.
Risk Description	A specific detailed statement of the risk/issue with a goal of ensuring that other users of the register can interpret the risk/issue identified. Aim to use this form: "If <uncertain event>, then <effect on objectives>." or "Due to <definite cause>, <uncertain event> may occur, resulting in <effect on objectives>."
Risk Trigger	Description of a measurable or observable event or condition that may serve as a precursor, or indicator, that a risk/issue has occurred or is about to occur.
Threat / Opportunity	Identifying if a risk/issue could have either a negative (threat) or a positive (opportunity) effect on the outcome of a project.
Risk Assessment	Qualitative risk analysis used to assess risks.
Probability	The estimated likelihood or possibility of a risk/issue occurring based on the current state of the risk/issue. Probabilities of occurrence are expressed as low (1), medium (2), or high (3). See 5.3 "Rating Guidelines" for descriptions of each rating.
Consequence	The outcome of a risk/issue being a disadvantage (threat) or gain (opportunity) to the cost and schedule. Consequences are expressed as low (1), medium (2), or high (3). See 5.3 "Ratings Guideline" for descriptions of each rating.
Impact	The product of the qualitative rankings derived from the probability multiplied by the consequence for both cost and schedule.
Impact Score	The sum of the cost and schedule impacts for both cost and schedule for each risk/issue. Allows for sorting to determine the ranking or prioritization of the risks.
Milestone Impacted	The event in the life cycle of a project that could be affected by the risk/issue. The event can range from an early project development activity through the maintenance period.
Event Driven Risk	A risk that has a quantifiable cost or schedule impact that will be captured either as risk contingency in the project cost estimate or shown as an impact delay in the project schedule.
Response Strategy	For threats, the options to reduce risk probabilities of occurrence and impact consequences include 1) accepting the risk by taking no further actions to reduce the risk impact, 2) mitigating by performing additional engineering/analysis to reduce the probability and/or impact of a risk/issue, 3) transferring the risk/issue to another party who is best able to minimize the impact and/or probability of the risk/issue, or 4) avoiding the risk by changing the project plan to eliminate the risk/issue. For opportunities, the options to increase risk probabilities of occurrence and impact consequences include 1) accepting the risk by taking no further actions to increase the risk impact, 2) enhancing the risk/issue by increasing the probability and/or impact thereby maximizing benefits realized for the project, 3) sharing a portion of ownership of a risk/issue with a party who is best able to maximize its probability of occurrence and increase the potential benefits if it does occur, or 4) exploiting the risk by changing the project plan to eliminate the uncertainty associated with a risk/issue by making the risk occur - can be considered a more rigorous response than "enhance".
Response Plan	Primary plan to address the risk/issue and specific enough to implement. The plan may include steps to implementation or may include evaluating options to determine whether it would be effective prior to implementing.
Risk Owner	Person or people who are best suited to implement the response plan and monitor the risk/issue. If multiple people are assigned as owners, responsibilities of each owner should be made clear.
Risk Status	An option to set a risk as either not started, active (ongoing), dormant (not started), or retired (complete). Risks that are set as retired (complete) are not factored into contingency calculations nor are they included on the High Priority Risk report.



**RISK REGISTER**

**Overview**  
 The Risk Register is a comprehensive tool utilized to document, track, monitor, update and report project uncertainties. The Risk Register is flexible for use during each project phase with the ability to be customized to address specific project needs.

**Instructions**  
 Enter a project name, current phase, and date of current risk update. Complete each portion of the Risk Register that has a blue header strip as you work through the Risk Management Procedure. Utilize the filter drop-downs to prioritize risks by impact score to determine the highest priority risks or filter by category. Risks identified as Event Driven Risks will be factored into contingency calculations. Use additional rows at the bottom to add risks or hide rows that are not in use. To maintain the functionality of the Workbook, do not insert or remove rows or columns.



Project Name:  
 Current Project Phase:  
 Date of Current Update:

RISK NUMBER	RISK CATEGORY (RBS 1)	RISK SUB-CATEGORY (RBS 2)	PROJECT PHASE	RISK NAME	RISK DESCRIPTION	RISK TRIGGER	THREAT	OPPORTUNITY	COST		SCHEDULE		MILESTONE IMPACTED	EVENT DRIVEN RISK	RESPONSE STRATEGY	RESPONSE PLAN	RISK OWNER	RISK STATUS	NOTES
									PROBABILITY	CONSEQUENCE	IMPACT	CONSEQUENCE							
									0	0	0	0							
									0	0	0	0							
									0	0	0	0							

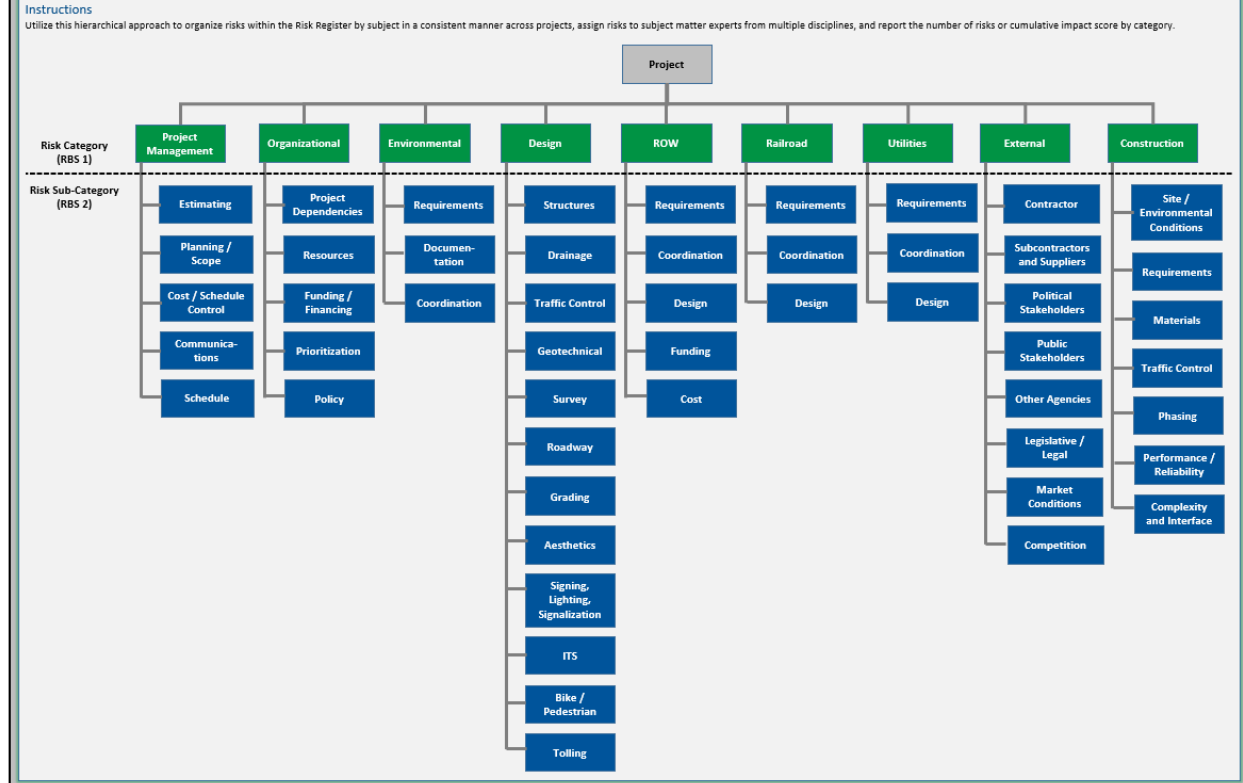


**RISK BREAKDOWN STRUCTURE**



**Overview**  
 The Risk Breakdown Structure (RBS) is split between nine higher-level categories (RBS 1) and 51 sub-level categories (RBS 2) in the Risk Register. A drop-down menu built into the Risk Register enables the user to select an RBS 1 category and subsequent RBS 2 sub-category structured under the selected RBS 1 category. When used across several projects, risks within the same RBS can be directly compared across projects to see trends and areas for future focus. If particular risks are frequently occurring, system-wide responses can be developed and implemented to minimize threats and maximize opportunities.

**Instructions**  
 Utilize this hierarchical approach to organize risks within the Risk Register by subject in a consistent manner across projects, assign risks to subject matter experts from multiple disciplines, and report the number of risks or cumulative impact score by category.





RATING GUIDELINES



Overview

The Rating Guidelines are referenced during the Assessment Step of the Risk Management Procedure. The Risk Register is linked to the Ratings Guidelines and qualitative assessment ratings (low, medium, and high) are assigned a numeric quantity (1, 2, and 3) to facilitate calculating impacts. The severity of the impact is calculated by multiplying the probability by the consequence. Ratings are assigned a color, dependent upon threat or opportunity classification, and a severity matrix shows a heat map for the risk impact to cost and schedule. Cost consequence default settings are based on estimated project cost and the ratings provided here are guidelines. Ratings for cost and schedule are scalable to the size and duration of each project and risk thresholds may be set by the management team for each project. The Rating Guidelines are also linked to the Contingency Worksheet to derive an initial quantitative assessment from the qualitative assessment ratings for each Event Driven Risk.

Instructions

Manual entry is required within the blue-colored boxes. Set the Medium Lower Bound and Medium Upper Bound for both probability and consequence to set thresholds for low, medium, and high Assessment Ratings. Use the arrows to set the Ratings Values for probability and consequence based upon the Ratings Bounds to be used in risk contingency calculations. Modify the offset percentages from the Most Likely value to change the minimum and maximum values in the risk contingency calculations.

Probability (Percentage)			Cost Consequence (Dollars)			Schedule Consequence (Days)		
Medium Lower Bound	25%		Medium Lower Bound	\$ 500,000		Medium Lower Bound	30	
Medium Upper Bound	75%		Medium Upper Bound	\$ 2,000,000		Medium Upper Bound	90	
Assessment Rating	Rating Bounds	Rating Value	Assessment Rating	Rating Bounds	Rating Value	Assessment Rating	Rating Bounds	Rating Value
1-Low	Up to 25%	25%	1-Low	Up to \$500.0K	\$220,000	1-Low	Up to 30 Days	30
2-Medium	26% to 74%	50%	2-Medium	\$501.0K to \$1.99M	\$640,000	2-Medium	31 Days to 89 Days	60
3-High	75% and Above	75%	3-High	\$2.0M and Above	\$3,500,000	3-High	90 Days and Above	90

Phase	Minimum	Maximum
Identification and Selection	25%	30%
Development	20%	25%
Procurement	10%	15%
Implementation	3%	5%

Probability Ratings			Consequence Ratings					
Opportunities and Threats			Opportunities			Threats		
1-Low	2-Medium	3-High	3-High	2-Medium	1-Low	1-Low	2-Medium	3-High
Unlikely to occur, improbable	Likely to occur, from possible to probable	Highly likely to occur, has occurred on past projects with similar conditions	Critical, severe impact	Moderate, significant impact	Mild, slight impact	Mild, slight impact	Moderate, significant impact	Critical, severe impact





**RISK CONTINGENCY**



**Overview**

The Contingency Worksheet is a tool referenced during the Assessment Step of the Risk Management Procedure to capture Event Driven Risks and calculate project risk contingency and project schedule impacts. The quantitative probability of occurrence and cost and schedule consequence rating values are defined in the Rating Guidelines based on the qualitative values provided in the Register. The order of risks in the Contingency Worksheet aligns with the order of risks within the Register. The Most Likely cost and schedule impacts is based on the Rating Value entered in the Rating Guidelines. The quantitative Most Likely cost and schedule impacts are provisional assessments of the risk impacts and are subject to review and update to determine the most appropriate impact of the risk. The sum of the Expected Estimated Cost Values and the Expected Estimated Schedule Values results in the P50 risk contingency and project schedule impacts, respectively, where P50 represents a 50% probability that the impact will not exceed the calculated value. The sum of the variances of the individual Event Driven Risks is used to calculate the P70 and



Project Name:  
Current Project Phase:  
Date of Current Update:

EVENT DRIVEN RISK ITEMS														
RISK NUMBER	RISK NAME	PROBABILITY OF RISK OCCURRENCE	ESTIMATED COST IMPACT						ESTIMATED SCHEDULE IMPACT (DAYS)					
			MINIMUM	MOST LIKELY	MAXIMUM	EXPECTED ESTIMATED COST RISK	VARIANCE	CONTINGENCY	MINIMUM	MOST LIKELY	MAXIMUM	EXPECTED ESTIMATED SCHEDULE RISK	VARIANCE	CONTINGENCY
			Subtotals: \$ - 0.00E+00 \$ -						Subtotals: 0 0.00E+00 0.0					

Note: Values are rounded and could create a potential for discrepancies in summed numbers.

Confidence Level 50%  
(Percent Chance of Not Exceeding) 70% 90%

Cost Risk Contingency	
P50	\$ -
P70	\$ -
P90	\$ -

Confidence Level 50%  
(Percent Chance of Not Exceeding) 70% 90%

Schedule Risk Contingency	
P50	0 days
P70	0 days
P90	0 days



**HIGH PRIORITY RISKS**



Project Name:  
Current Project Phase:  
Date of Current Update:

RISK NUMBER	RISK NAME	COST		SCHEDULE		IMPACT SCORE
		COST IMPACT	RISK IMPACT	SCHEDULE IMPACT	RISK IMPACT	

**Summary of High Risk Items**

<b>1</b>	
Risk Register Item	
Overall Risk Rating	
Category (RBS 1)	
Risk Description	
Responsible Party	
Response Plan	
Notes	

**Overview**

The High Priority Risk report template is a reporting tool to highlight and prioritize active risks for the purpose of developing response plans, and report and monitor key project development activities. This report provides a list of "High Priority Risks," that is, risks that are not retired and are qualitatively rated as "High Impact" for either cost or schedule according to the Severity Matrix provided in the Rating Guidelines. This can include both Event Driven Risks and non-Event Driven Risks. The High Priority Risk report is linked to the Risk Register and contains two reporting sections. The first section is a qualitative overview table. Opportunities and threats are color-coded according to the Rating Guidelines. The risks are sequenced in descending order by impact score, which is the combined total of the cost impact and schedule impact for a risk. The second section contains additional information in notecard format for each of the risks provided in the first section.





RISK ASSESSMENT CHECKLIST



Assessment Ratings	Risk Impact	Assessment Criteria
1	Low	Criterion is on schedule to complete on or before the preferred milestone date.
2	Medium-Low	Criterion has passed the preferred milestone date but is on schedule to complete by a less preferred but acceptable milestone, or the finish date has been extended one time.
3	Medium	Criterion has extended the finish date two times.
4	Medium-High	Criterion has extended the finish date three times.
5	High	Criterion has missed both preferred and alternate milestone dates, or has extended the target milestone four or more times.

Project Name:		Assessment Date:				
Project Readiness Criteria	Current Status	Begin Date	Target Completion Date	Risk Rating	Completion Date <sup>1</sup>	
1 Environmental Status	•					
Summary:						
2 Schematic Development	•					
Summary:						
3 Right-of-Way (% of Parcels Acquired)	•					
Summary:						
4 Utility Investigations (SUE)	•					
Percent Complete:						
Summary:						
5 Geotechnical Investigations (% Complete)	•					
Summary:						
6 Risk Assessment	•					
Summary:						
7 Funding Status	•					
Summary:						
8 Additional Comments on Project Readiness That Could Affect Procurement Schedule						
Summary:						
Notes:						
1. Actual or anticipated completion date						

**Overview**

Impacts to the project development schedule resulting from delay in achieving project development target milestones are reported in the Risk Assessment Checklist. Project readiness criteria include activities that typically need higher scrutiny from the project team in order to be ready to advance the project. Target milestones are defined in the project schedule and the progress and percent complete are reported in the Risk Assessment Checklist as part of the routine reporting in order to make the project team aware of current status and milestones needing to be achieved.

**Instructions**

Complete the Risk Assessment Checklist populating values within blue columns for each of the project readiness criteria. Determine a risk rating for each criteria based on the assessment rating criteria provided in the top table.