Introduction

Every project has risks, regardless of size or complexity. Project risk is an uncertain event or condition that, if it occurs, will have an effect on project success. These risks can lead to significant costs and schedule delay. Risk management is a systematic process to help project teams identify risks, analyze and prioritize them based on their expected impacts and probability, develop response strategies, monitor the risks, and track the response implementation. It can also help identify potential budget and schedule issues early in a project's development process.

This chapter outlines general information about risk management that can be applied to any project. For risk management on Major Projects, refer to ***PMG 405***.

Risk Management Defined - Risk can be characterized by probability of occurrence and level of impact on a project. Throughout the project life cycle, an uncertain future event that may occur at any time in a project's lifecycle is a risk. It has a probability of occurrence and an uncertain impact if it does occur. Each risk will have a negative or positive effect on at least one project objective. Risks that have a positive outcome are opportunities while risks with a negative outcome are threats. The Project Manager is responsible for identifying and managing all project risks; increasing the probability and/or impact of opportunities and minimizing the probability and/or impact of threats. *Probability* describes the likelihood of an event or condition actually occurring on a project and is expressed as a percent (e.g., 40% probability of this risk occurring). *Impact* describes the consequence of the event or condition occurring and is expressed in cost (e.g., if this risk does occur it will cost us $100,000) or schedule (e.g., if this risk does occur it will cause two weeks of construction delay). Risk Management involves processes, tools and techniques that will help the Project Manager maximize opportunities and minimize threats to project performance in terms of cost and schedule.

A formal risk management approach helps to optimize project performance (i.e., cost and schedule) in planning, design and construction phases. Through risk management, FDOT can better address the questions of "How much will it cost?" and "How long will it take?" Risk management enables FDOT to anticipate threats and opportunities and subsequently evaluate and plan for them. This includes (e.g., negative float, delays and missed let dates).

Risk management is an ongoing process, beginning at the conception of a project and continuing through construction and facility operation. Risk management is most effective when first performed early in the life of a project and is a continuing responsibility throughout the project. The process has basic features as summarized below. Each component has a corresponding simple question that can help identify options for how to address that component.

Risk Management Feature	Simple Question
Risk Management Scalability	What's the **appropriate level of risk management which can be cost-effectively applied** for this project?
Risk Identification	What risks might **negatively or positively** affect achieving the project objectives?
Qualitative Risk Analysis	What is the **likelihood** of risk occurrence and level of **impact** of a risk occurring in descriptive or qualitative terms of high, medium, and low?
Quantitative Risk Analysis	**How** could a risk affect the project in terms of **cost and schedule**?
Planning and Response	**What** can be done to mitigate the risk?
Ownership and Communication	**Who** will be responsible to manage risk, follow up on mitigation actions and coordinate and communicate?

Risk Management Objectives - The risk management process addresses project performance in terms of cost and schedule. The assessment especially helps project teams focus on high severity risk with a mitigation approach that considers the cost-benefit. While risks are typically discussed throughout FDOT projects, generally documentation and management of those risks is informal. The process of risk management involves formal documentation of risks, assessing likelihood and impact of each risk, establishing the proactive actions to accommodate the threat or opportunity, and monitoring and updating status of the list of risks throughout all phases of a project. This documentation is readily captured in what is called a *Risk Register* that is created early in the project development process. The Risk Register should be maintained and monitored throughout the project's life.

Benefits - The risk management process provides enhanced fiscal management for the planning, design, construction, and system operations programs. Through this process, FDOT can better predict cash flow needs, balance let dates, maintain the TIP effectively, and manage and preserve the system. Additionally, important project delivery benefits, such as reducing the potential for cost overruns and increasing the likelihood of on-time delivery through better management, will generally result in fewer surprises.

The FDOT risk management process optimizes project performance and ensures that the process becomes a foundation for successful project management. Through its execution, risk management will be a foundation for successful project management and team collaboration. This collaboration of the various disciplines on the project team is essential so that potential risks are not overlooked, and experienced team members provide an appropriate assessment of risk probability and impact.

It is also important to note another intangible (and likely tangible) benefit of the risk management approach. Setting appropriate contingency and float respectively for cost and schedule can help to reduce some of the "guess work" often associated with each.

FDOT's Risk Management approach features and benefits are summarized below:

Feature	Benefit
Scalable Approach	The appropriate level of risk management including the level of risk analysis and mitigation is applied based on project size and complexity.
Project Team	Risk management is based on a prioritization of risks. The expertise of team members is leveraged by having the team identify and assess the risks, as well as identify mitigation strategies within the functional area of their expertise (e.g., design, construction, right of way, permits, drainage, utilities, hydraulics, geotechnical, etc.)
District Risk Expert(s)	Each District has staff that may be more experienced in Risk Management. These individuals can assist the Project Manager in the development and implementation of the project risk management plan.
Ownership of Risks and Responsibilities	A risk owner is a person or entity (e.g., work unit) that has been given the authority, responsibility, and resources to manage a particular risk and is accountable for doing so**.** This assignment should be made based on who is best able to manage that risk. Risk owners support the Project Manager in risk monitoring and implementation of a selected response. It should not be assumed that Project Manager does all the work to manage the risk; but rather serve as a process facilitator.
Risk-Based Decision-Making	Project values such as cost, schedule, and quality should be balanced when making decisions. This practical focus results in a need to have a formal risk management program with objectives to improve project performance (cost, schedule, disruption and longevity).

Risk Management Ranges - FDOT's risk management process is inherently scalable based on project cost ranges. The project costs help determine the depth of risk assessment and the appropriate level of risk management in terms of both the number of potential risks captured on a risk register as well as the amount of assessment and analysis required.

The FDOT risk management process includes three ranges of risk management based on project cost. The following table details the ranges of risk management along with the strategies and types of tools that facilitate each range. All projects have risks, and the level of effort should be commensurate with the appropriate risk management strategy.

Range	Description
LOW RANGE	**Total Project Cost up to $20 Million** • Use qualitative risk-based analysis • Review of risks by internal design team • Project manager takes the lead on risk updates • Project manager conducts self-modeling (Risk Based Graded Approach) • Quantify risks and update risk mitigation strategies in regular project meetings • Mainly applied to projects < $20 million, however may be used on projects up to $50 million based on technical complexities and risk modeling opportunities
MID RANGE	**Total Project Cost $20 Million to $100 Million** • Use quantitative risk-based modeling • Internal project design team takes the lead on cost and schedule risk updates • Quantify risks within a 1-day to 2-day workshop (led by internal risk team) • Update risk register as needed (at least once prior to the Work Program update) • Mainly applied to projects from $50 million to $100 million, but may be used on projects < $50 million based on technical complexities and risk modeling opportunities
HIGH RANGE	**Total Project Cost greater than $100 Million and FHWA Major Projects (greater than $500 million or as designated by FHWA)** • Use quantitative risk-based modeling with workshop (CO Consultant Contract) • Internal and external team takes the lead on risk updates • Base cost and schedule is validated by external team • Quantify cost and schedule risks within a 2-to-4-day workshop led by external risk team (Projects not designated as a FHWA Major Project may be handled by internal risk team as required) • Annual updates just prior to Work Program update and as needed • Mainly applied to Major Projects and projects > $100 million (may be used on projects < $100 million based on technical complexities and risk modeling opportunities)

Roles and Responsibilities - Risk management requires effort, teamwork, and forward-thinking. It must be planned, resourced, and facilitated to provide accurate analyses and defendable decisions. Project Risk Management is typically the responsibility of the Project Manager. District Risk Experts can be a resource in sorting out roles and responsibilities. The following table details the project level roles and responsibilities associated with risk management.

Position	Roles and Responsibilities
Project Manager	• Lead and facilitator for risk management on the project. • Develop and manage the project's risk register. • Develop and implement the Risk Management Plan. • Assign risks and response actions to risk owners • Track, monitor & update risks and the effectiveness of risk response actions. • Produce risk management reports for Department management. • Incorporate risk management into project meetings. • Incorporate risk management into Value Engineering Study. • Elevate issues to district management for resolution as necessary.
Risk Owner	• May be a project team member, district discipline lead, or other stakeholders. • Assess & suggest risk response strategies & action plans for assigned risks. • Provide updates for the identified risk strategy. • Inform the PM if the risk materializes (or if potential risks is no longer risks).
Project Team	• Includes Project Manager, Risk Owners, and other team members. • Assist PM with the identification, assessment, review & monitoring of risks. • Suggest appropriate risk response strategies. • Assist in identifying risk owners and developing risk response strategies. • Identify, analyze, and plan responses for new risks, & add to risk register. • "Retire" risks whose opportunity has passed. • Perform risk response actions when appropriate. • Identify & share risk management lessons learned after project completion.

Project Integration - Risk management is an integral component of project management and a recognized project management technique that will help the Project Manager to better assess and manage key project performance factors. In some cases, risk management should help to even speed up design while maintaining a sharp focus on critical risks.

While the formalized approach requires development and maintenance of a risk register, the register becomes a key communication tool to efficiently focus attention on individual risks. Through this sharp focus, risks are controlled so that informed decision making can be provided in a timely manner.

Although risks can and should be discussed with project team members and management at any time during the duration of a project, it is desirable to have "checkpoints" to ensure the project does not unnecessarily proceed on a course of action that may not be feasible and may be changed later by a decision-maker. Thus, integrating risk management into the project development process becomes critical, valuable, and time saving.

Integrating risk management requires developing an initial risk register as early in the project as feasible, monitoring and developing mitigation strategies for each risk by the assigned risk owner, and discussing the risks at project meetings and when project discipline leads can most effectively discuss and address risk coordination.

The following table provides opportunities within FDOT's project development process phases where risk management should be incorporated.

Project Phase	Risk Integration
Planning	If project complexity is unknown, consider qualitative risk analysis and consider risk mitigation strategies. Communication with Metropolitan Planning Organizations and local municipalities may help to identify unforeseen risks. Risk management enhances stakeholder focus and interaction.
Programming Development	Risk management (especially quantitative analysis) can help project team validate the project cost and schedule
Scoping	Risk management can be used to evaluate and support the alternatives analysis
Design Field Review	Look to integrate potential risks that are identified in design field reviews.
Final Design	Look to integrate potential risks that are identified in the design phase.
PS&E	Many of the risks that would occur in the design phase should be retired by this phase.
Construction	The construction team should take a fresh look at any risks that were identified during the design phase and were categorized for occurring during the construction phase. Likewise, risks could be identified and categorized for potential occurrence during the maintenance phase.

The following are a few best practices for integrating risk management:

- Create the initial risk register through a team brainstorming discussion during or immediately after the Scoping field review. Planning partners may have developed a planning level risk register. This list should be incorporated into the initial design risk register.
- Include project risks as a regular agenda item for project meetings so that mitigation strategies can be incorporated into the project holistically. Remember that the risk register is a living document where risks can be added, along with the appropriate risk owner, and retired as necessary.
- Perform a formal review of the risks as part of the Design Field Review, Constructability Review, and the Final Design Office Meeting. The expectation is that functional disciplines are already in attendance at these major milestone meetings and can provide input and perspective for discussions involving risk. This could include a short team brainstorming to make sure there are no new risks or to retire those risks that did not occur.
- Components of risk management should be included in other FDOT project processes such as cost estimation, scheduling, constructability reviews, and value engineering.
- Risk management can be performed by external experts or internal staff.

Risk Management Tools - The key to successful risk management implementation is the ability to utilize tools that are easy to understand and can be applied to highway projects of varying sizes and types to help proactively identify, plan for, assess, and manage project risks to meet schedule and budget goals. The cost values for risk management should be generally similar to developing costs for delivering a project. The key is for the project team and subject matter experts to help advise as to those potential costs associated with risks. This results in orders of magnitude when reviewing the entire list of risks and impacts in terms of both cost and schedule. Over time, appropriate levels of risk management investment costs should be more than offset in terms of better bids, fewer surprises (work orders), and helping to limit supplements in design.

The recommended ranges are to be understood as minimum requirements. The project team may choose to work at a higher scalability range than required. However, the project team should consider other factors to determine what level of risk management effort is needed. These factors may include: project type, project location, project duration, project stakeholders, and political sensitivity. Any of these factors may warrant employing a higher scalability range.