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Guide for Managing NEPA-Related and Other Risks in Project Delivery

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Executive Summary

Project development is a core function of state DOTs, yet as a discipline project management is too often ignored. DOT executive leaders are understandably preoccupied with myriad other management priorities, such as funding, labor issues, maintenance and constituent relations.

At the same time, there are specific institutional challenges to effective project management by state DOTs, such as ever-changing state and federal regulations, the attrition of experienced senior staff, and the financial lure of private sector employment for the most effective DOT project managers. All of these in themselves are risks to be managed by DOT executive leadership!

It is time for DOTs to understand and embrace risk management, because it is elemental to a DOT's core function, and risk management can avoid mistakes which cost agencies time, money and credibility.

Risk management is good project management, and FHWA has been promoting risk management for number of years. As indicated earlier, formal guidance was provided by FHWA through a memorandum to Division Administrators in 2007 and many FHWA project management guidance documents include risk management principles. The National Highway Institute offers a course in risk management (FHWA-NHI-134065) and private sector guides, such as the Project Management Institute's *Project Management Body of Knowledge* (PMBOK®) *Guide,* offer very good resources for project management in any field.

Perhaps the biggest misconception is that risk management is only suited for "mega projects," such as those exceeding $500 million, or unique programs such as the development of a new aircraft. But every highway project is unique in its own right, regardless of cost, and while the risks involved in developing an $80 million project may indeed be less involved than the risks involved in a "mega project," the consequences to schedule, budget, quality and agency credibility are every bit as real.

Project risk management is not a new field of study, and the complexities of federal-aid project development beg for risk management solutions. DOT executive leaders are encouraged to embrace risk management as part of their overall program delivery processes, and use the guidance in this report to examine their own programs and processes for risk management opportunities, as part of improving overall service to the public.

Case in Point: $4.2 Million in Design Costs and Six Years Lost

Why Should DOT Leaders Embrace Risk Management?

The subject of managing risk in project development can be abstract. The following actual case from a state department of transportation (DOT) is meant to provide a real-world example of decisions made during the NEPA process which had serious budget and schedule consequences. The anonymity of the DOT was protected in this narrative.

The case involved a project to replace a bridge over a large river in the Midwestern United States. The project was not particularly unique, with an estimated construction cost of $80 million, but issues during

project development resulted in a complete redesign of the structure, at a cost of $4.2 million in design fees and a schedule delay of six years.

During the NEPA phase of project development, there were a series of decisions which affected the project's design:

- The communities on either side of the river did not agree on the optimum alignment for the new structure, which led to an alignment with a 20 degree skew over the river.
- A navigable barge channel was a controlling factor in the structure design. Clearing the shipping channel, at the skew dictated by the alignment decision, required a bridge span of 900 feet.
- There was political concern raised about dislocating a business on the south side of the river, so a decision was made to avoid a property take of that business. This decision created additional complications for the structure design due to the lack of space available for the structure's back span.

These issues and decisions, made as part of the NEPA process, introduced risks which eventually led to the project's cancellation and redesign. First, the skewed alignment and length of the clear span dictated the selection of a cable stay bridge type. Then, designers were forced to develop a solution with a single tower. The resulting design was a cable stay structure, with a single tower of over 500 feet in height.

The project went to bid in 2006 with an engineer's estimate of $80 million; however, the apparent low bid was $110 million. The reason for this $30 million difference was that the ultimate bridge design, dictated by seemingly minor decisions made during the NEPA process, introduced significant risks to the project's construction. A key determinant of the construction schedule—and hence the contractor's bid—was the height of the single tower and the delays the contractor would incur when high winds prevented the tower crane from working. The lowest bidder responded to this risk by lengthening the construction schedule and increasing the bid price to account for the time and productivity that would be lost when high winds disrupted construction.

Executive managers of the DOT were surprised by the cost from the apparent low bidder. But more importantly, the bid reflected the risk inherent in the project's design. DOT engineers and managers were so concerned about the constructability of the design, they made the decision to redesign the structure rather than bid the single tower cable-stay bridge.

During the redesign, project managers revisited a few critical design constraints. The DOT decided on a partial property take of the business on the south side of the river, which resolved the problem of limited space for the structure's back span, and allowed for designing a cable stay bridge with two towers. Also, the DOT worked with the Coast Guard to model the placement of a second pier in the river, and simulate the impact on barge navigation. This effort demonstrated not only that the second pier location would not be a hindrance to navigation, but that there was greater flexibility in locating a second pier than was originally assumed.

Today, the DOT is in the final design phase of a two tower, cable stay structure which is estimated to cost $100 million, and slated for bid in 2012.

A failure to identify risks and quantify their impacts led to a bridge design which the DOT considered too costly to build. But it is also important to note that decisions made during the NEPA process seemed innocuous at the time, and technical specialists (bridge designers) were able to offer solutions to every design constraint posed by a planning or environmental concern. Had there been a risk management process in place, however, project developers could have identified risks, quantified their likelihood and impact, and made better decisions which would have avoided the costs experienced by the original design.

This case study illustrates that risks are inherent to all sizes of projects, not just the "mega" projects that receive such prominent media attention when cost overruns or schedule delays are reported.

1 Introduction

The planning, design, and construction of highway projects is complex and subject to considerable uncertainty. These uncertainties stem primarily from a lack of information about the conditions assumed for developing project estimates and from unforeseen changes or problems that arise as a project develops. These uncertainties lead to difficulty in accurately predicting project performance, including cost and schedule. A study[1] of 167 roadway projects over the last 70 years shows that most such projects are initially underestimated by an average of about 20 percent, although there is a wide range of underestimation and even some significant overestimation. These difficulties in delivering projects as planned have, in turn, often led to various other problems, such as public dissatisfaction, loss of agency credibility, and funding issues.

The National Environmental Policy Act (NEPA) has been a fixture of transportation project development for decades. When NEPA regulations first came to the fore in the 1970s, state departments of transportation (DOTs) generally managed the NEPA process and documentation separately from planning and preliminary development. Over time, DOTs have become proficient in NEPA and to various degrees, have integrated NEPA with some or all preliminary development activities.

A DOT's proficiency in the NEPA process does not necessarily mean that transportation project development is simple or free of delay. Indeed, NEPA issues and their context for implementation is often cited as a reason for project development delays, which can in turn lead to construction cost increases due to inflation, and in some cases, cancellation of projects.

A review of NEPA process timelines provides an indication of how environmental review can impact project development. Figure 1 below shows the mean length of time in years to complete the NEPA process, from the 1970s through 2003.

In 1999, FHWA estimated that it took an average of 1.5 years to complete an Environmental Assessment (EA). A survey by AASHTO in 2000 estimated that EAs for projects that were not delayed took about 14 months (1.2 years), but when projects were delayed the EA took an average of 41 months (3.4 years). Similarly for and Environmental Impact Statement (EIS), the median time for completion of an EIS stood at 60 months in 2000, 80 months in 2002, and 63.5 months in 2008.

Risk Management

Some State Departments of Transportation (DOTs) have applied risk management principles to identify and assess the potential of NEPA-related risks and other issues to disrupt project development. FHWA has provided formal guidance on the use of risk management in major projects through FHWA's memorandum (January 19, 2007), which included guidance for FHWA division administrators to apply to every major project under development, addressing a range of risks and risk management actions.

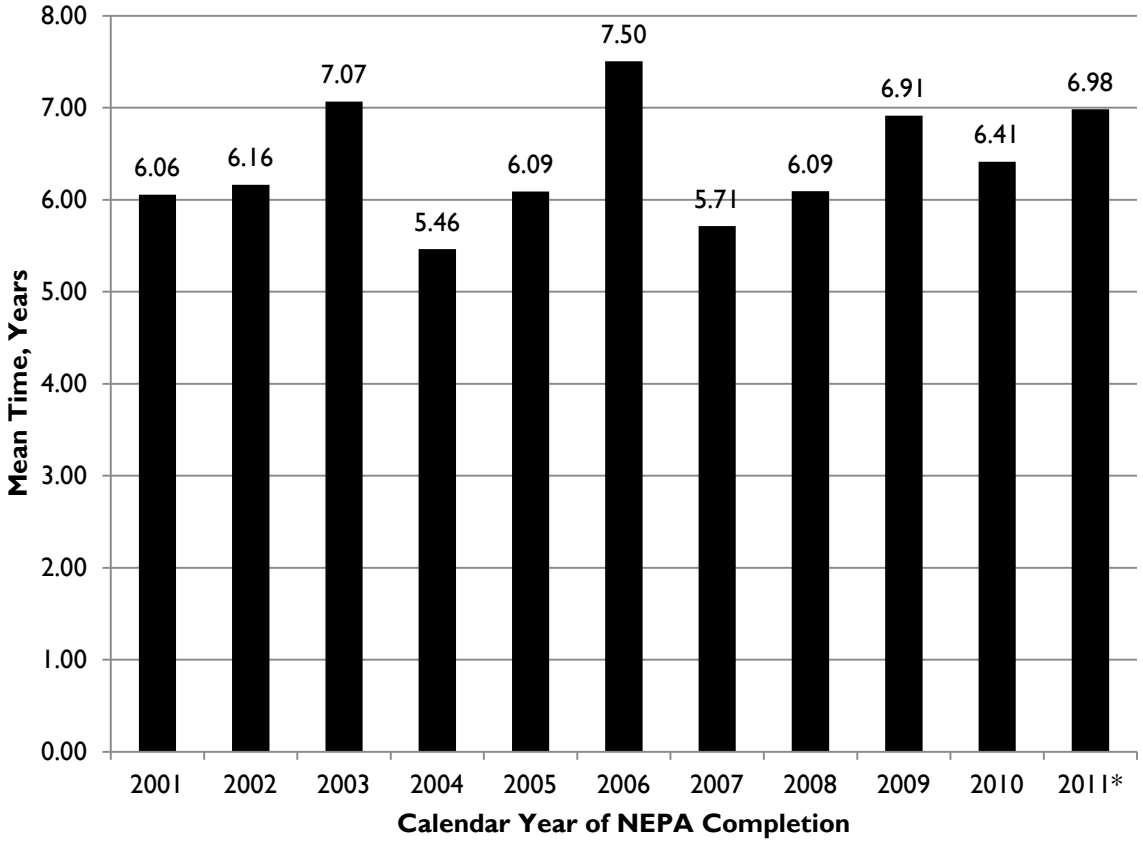
NEPA process improvement is the subject of a great body of research and guidance documents, but NEPA in a risk management context offers a relatively new perspective that facilitates pro-active

[1] Flyvbjerg, B., M.S. Holm, and S. Buhl. Underestimating Costs in Public Works Projects. Error or Lie? *Journal of the American Planning Association*, Vol. 68, No. 3, Summer 2002.

interventions which can reduce the likelihood of unforeseen interruptions in the process as well as improve the way in which such events are managed. With risk management principles and practices resulting in significant benefits to many areas of complex systems development and delivery, risk management as applied to NEPA potentially offers similar benefits.

Risk management is broadly applicable to infrastructure development projects, across a complete category of risks beyond NEPA risks. After considering the contents of this guidance, there is no reason that practitioners should not apply risk management principles during all stages of project development. If agencies can successfully apply these concepts to NEPA risks, expanding its application to all risks in project development should be straightforward and beneficial.

Figure 1: Mean Time to Complete NEPA Process (years)



* 2011 data through April 30, 2011
Source: FHWA Office of Project Development and Environmental Review, 2011

Definition of Risk

For the purposes of this guidance, "risks" are defined as events that might occur in the course of project development, and lead to consequences in project performance. In order to manage risk, it first has to

be identified and evaluated for its potential impact. This requires definition in terms of the likelihood that risk will happen, and if it happens, the likely consequences to project performance. For risks which have negative impacts, there are two dimensions which capture the essence of *probable loss:* the potential for occurrence, and the impact if the event does occur.

Risk Examples

Risks should be stated as consequential events; a risk cannot just be a statement, or just a cause, but rather, it needs to imply a measureable consequence. Some examples of NEPA risks are:

- Time allocated for review by State Historic Preservation Office
- Turnover in resource agency staff, such as US Army Corps of Engineers
- Inability to secure stream mitigation within the project watershed

Consequences of Risk

Project managers might mistakenly refer to a "cost risk" or "schedule risk" to a project, but costs and schedules are consequences of risk, not risks in and of themselves. The consequences of risk involve the measureable impact on project performance. There are four primary categories of project performance:

1. Budget: relationship between the cost of construction, and the estimated cost of the project at various phases of development.
2. Schedule: the deviation between the date of construction completion, versus the estimated schedule at various phases or project development.
3. Quality: refers to the suitability of the project to meet its stated purpose, in terms of functionality and sensitivity to context.
4. Agency reputation: the public perception of an agency's ability to deliver a project or program of projects on schedule and on budget. When an agency's reputation for project delivery suffers, there can be consequences in terms of increased legislative oversight or staff changes.

"Risk Management is not risk aversion. Rather, it involves the appropriate identification of risks and consequences so that project managers can move project development forward.

"Too often, projects are managed to avoid risks, regardless of their likelihood or impact. This increases the alternatives studied, engineering cost, and development time."

- NCHRP 20-24(71) Workshop Participant

Objective of this Guidance

The objective of this document is to provide a guide for practitioners on the use of risk management to support:

1. Early identification of key issues that must be addressed
2. Effective application of management action and other resources to avoid or mitigate schedule delays, cost escalation, and quality problems, and
3. Better decision making in project planning, programming and development.

"Project delivery" can refer to all stages of project development, from initial planning to final commissioning. The primary focus of this research, however, is on NEPA process and related activities occurring prior to construction.

Organization of this Guidance

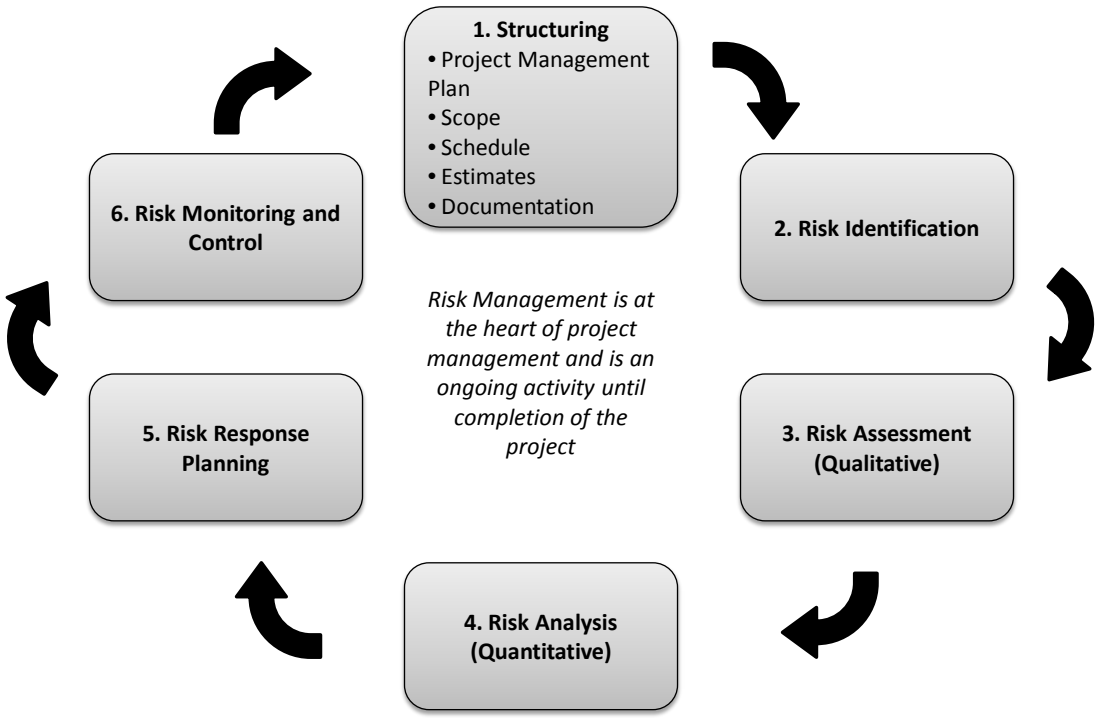
This guidance on using risk management to address NEPA risks in project delivery is organized around the following chapters:

1. Introduction (this chapter), which describes the purpose of this guidance and provides definitions of risk;
2. Risk Management Framework, which lays out a structured approach to risk management and shows how it will be applied to NEPA risks;
3. Identifying and Developing Strategies to Address NEPA Risks, which presents the results of the Practitioner Workshop on NEPA risk management, and provides potential risk management actions for each;
4. Recommendations for Implementing Risk Management, which focuses on NEPA risk management actions which are the province of DOT executive leadership.

2 Risk Management Framework

While a variety of approaches can be used to reasonably identify, assess, and manage project risks, some approaches work better than others for highway projects. However, these approaches, which range from completely ad-hoc to very formal, all share a few fundamentals. Most importantly, the primary objective for any of these risk management approaches is to improve the performance of either individual projects or programs of projects. Each approach also seeks to anticipate risks and opportunities and then develop management strategies to minimize undesirable performance.

Figure 2: Risk Management Framework

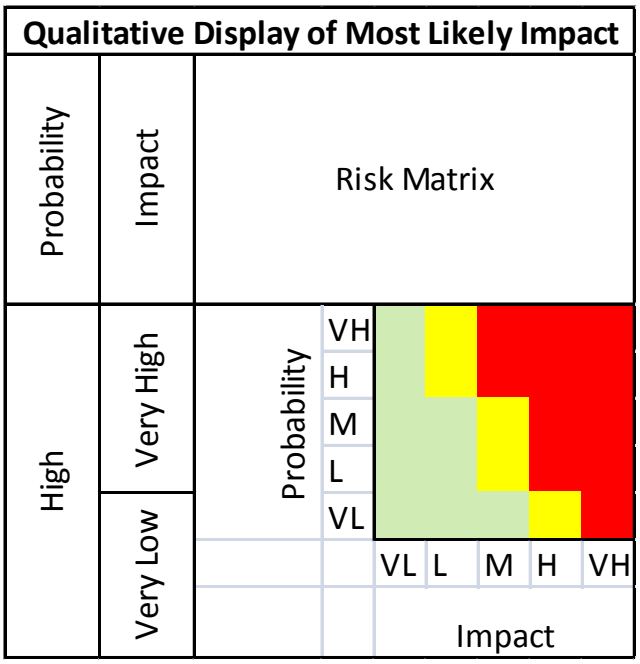


While ad hoc risk management can provide some value, a formal framework with multiple participants providing different perspectives can maximize the benefits of risk management by leaving less to chance and simply improving the likelihood that all significant occurrences will be considered at various times throughout a project or program. A summary of these steps is shown in Figure 2 and provided below:

1. Structuring: Before risks can even be identified, much less managed, the agency must adequately define the "base" project. This base consists of the planned project scope, strategy, and key conditions, as well as a set of assumptions regarding those aspects that are not yet known for certain. Generally, this base project description is developed at a relatively broad level of detail simply via facilitated discussions with the project team.

2. Risk Identification: Once the base assumptions have been established and the project has been "structured" (in Step 1), the agency must adequately identify the risks and opportunities relative to that base. The intent is to identify a comprehensive and non-overlapping set of risks and opportunities. To help accomplish this, the risks are often categorized (e.g., in terms of the project phase in which they generally might occur). Generally, a combination of techniques, ranging from facilitated group brainstorming to "risk checklists" is used, considering all readily available information. As the project develops and conditions change, additional risks might be identified, while some existing risks will be retired. The updated list of risks is maintained in a project risk register.

Figure 3: Example of a Qualitative Risk Assessment Matrix



3. Risk Assessment: Once the agency has identified risks and opportunities (in Step 2), it should adequately assess the relative severity of the risks and opportunities so that they can be prioritized for subsequent management (Step 5). If the agency chooses to quantify uncertainty in project performance through risk analysis (Step 4), then the risk factors must also be adequately quantified, from which their severity and prioritization can be determined. The risk factors (i.e., the impacts if the event occurs and the probability of that event occurring) are assessed, either qualitatively or quantitatively, using a variety of techniques, ranging from statistical analysis to facilitated expert group opinion, considering all readily available information. As the project develops and conditions change, the risk factors for previously identified risks might change and need to be reassessed, while the factors for any new risks must be assessed. The updated assessments of factors describing the severity of each risk are maintained in the project risk register.

4. Risk Analysis: If the risk factors have been assessed quantitatively (in Step 3), the agency can use the risk factors in conjunction with the base performance to determine total project performance. For some performance measures, such as un-inflated costs that are additive, this is a relatively simple analysis. However, for other performance measures, such as schedule that are not simply additive, this is a relatively complex analysis. Typically, numerical models are developed to adequately calculate each performance measure as a function of various input factors (e.g., the "base" and "risk"). The overall "mean value" (i.e., probability weighted average value) of the performance measure can then be approximated by using the mean value of each input factor, which for one risk would simply be its probability times its impact. The uncertainty (which is expressed by a probability distribution) in a performance measure can be approximated (e.g., typically by Monte Carlo simulation) by using the uncertainty for each input factor appropriately considering any relationships (correlations) among those input factors. This can be done at various levels of detail and complexity, considering risks explicitly or implicitly. If risks are treated explicitly, their severity can be calculated and used to meaningfully prioritize the risks. As the project (or program) develops and the risks (and their factors) change, the project (or program) performance must be reanalyzed.

Figure 1: Example of a Quantitative Risk Assessment Matrix

Quantitative Analysis				
Type	Probability	Risk Impact ($M or Months)		Estimated Expected Risk Impact ($M) ([min + (4 X ML) + max] X [probability])/6
Cost	70%	MIN	$1.0M	$4.8M
		MAX	$12.0M	
		Most Likely	$7.0M	
Schedule		MIN	0.0 Mo.	1.9 Mo.
		MAX	4.0 Mo.	
		Most Likely	3.0 Mo.	

5. Risk Response Planning: Once the agency has evaluated and prioritized the risks (in Step 3 and possibly more definitively in Step 4), the agency should identify and adequately evaluate proactive ways to manage those risks and select those that will be cost-effective.

   This is a crucial step in project risk management.

   The agency should then develop adequate plans to accomplish those activities. Budgets and milestones that adequately account for the remaining residual risks must then be established (e.g., through use of contingency), based on agency policy regarding the appropriate level of conservatism. Adequate procedures must be established to control expenditure of that contingency, so that the project does not automatically "consume" the allocated contingency. Ways to meet budget or milestones if that contingency turns out to be insufficient (e.g., reduction in scope) at various milestones must be identified and adequately evaluated to select those that will be implemented if necessary. Adequate plans and decision criteria must be

developed to accomplish those actions. As the project develops and the risks (and their factors) change, these plans must be reviewed and revised as necessary to optimize remaining project performance. The updated plans are maintained in the project Risk Management Plan.

6. Risk Monitoring and Control: Once the agency has developed the Risk Management Plan (in Step 5), it must be adequately implemented. This involves the following:
   - Implementing and monitoring progress on proactive risk reduction activities;
   - Monitoring risks and updating the risk register, partly in response to proactive risk reduction activities but also due to other changes in conditions (e.g., changes in the base);
   - Periodically reanalyzing risks, especially at major milestones or major changes in conditions;
   - Periodically reviewing and updating the Risk Management Plan;
   - Monitoring, controlling, and periodically revising contingency/float as necessary; and
   - Deciding on whether to implement established contingency plans at various milestones.

   Hence, as the project develops and the related Risk Management Plan changes, the plan must continue to be effectively implemented.

The process described above can be applied at the project or program level. However, the focus and level of detail are different between the two. For example, a project-level risk assessment might consider the risk of a delay to completion of the project's Environmental Impact Statement (e.g., due to newly-discovered resources). A program-level risk assessment might consider the risk to completion of one project's EIS due to challenges received on a related project's EIS. In other words, program-level risk management introduces program-level and multi-project risks into the equation. In addition, the program-level assessment might consider particular issues in less detail (i.e., at a higher-level view) than would be addressed in individual project assessments, and might not specifically address smaller project issues at all. In that sense, a program-level analysis should be viewed as an adjunct to, and not a substitute for project level analyses.

"Risk management is not a one-time event. A risk management plan is reviewed and updated throughout the life of the project as some risks are retired or new risks are identified. A risk management plan that is developed at the start of a project, but not referred to thereafter, is not a risk management plan at all"

- NCHRP 20-24(71) Workshop Participant

The process can also be applied to specific elements of a project (scoping; design; the NEPA process as in this guidance; contract procurement; and construction). In practice, *informal* risk management efforts often occur as plans and specifications are finalized, focusing on risks to cost and schedule during construction. While important in their own right, these preconstruction assessments are unlikely to provide benefits for the NEPA phase. In addition, their 'informality" represents a risk in and of itself, in terms of omitting or underestimating the likelihood or significance of risk factors. Formal risk management efforts tend to take a more comprehensive view and evaluate the overall project, which provides the benefit of identifying and managing what are often significant pre-construction risks.

It is imperative to emphasize that risk management is a cyclical process, and the reanalysis of risk (and subsequent response planning, monitoring and control) must occur regularly, perhaps at major decision points in the project development process. This is because:

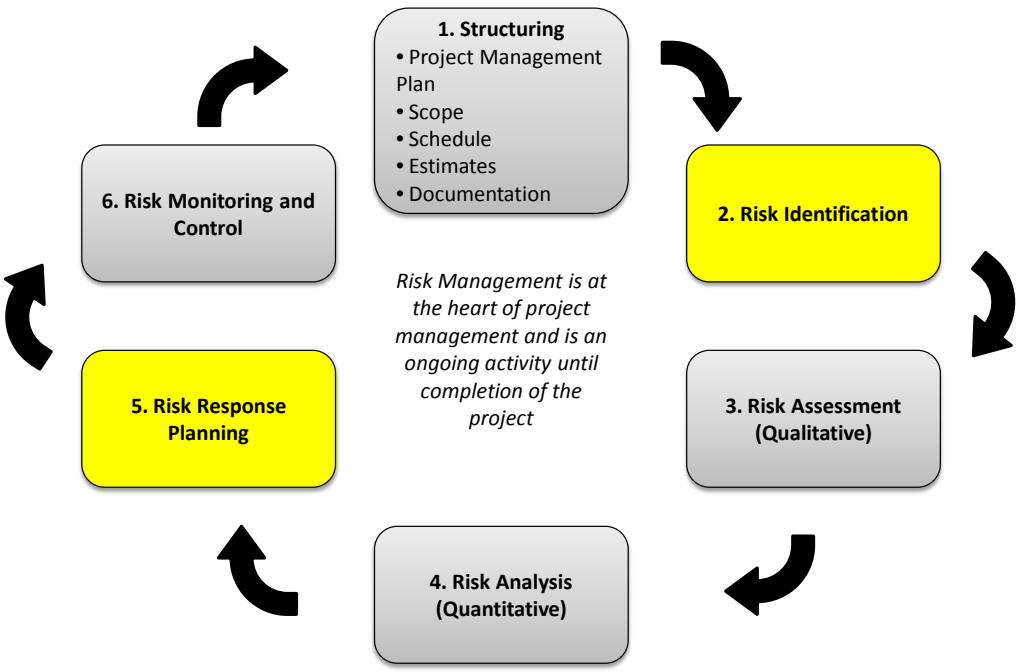
- Old risks and opportunities might be dismissed.
- New risks and opportunities might be identified.
- For existing or new risks, project managers must reevaluate their likelihood of occurrence and potential impacts.

While formal risk management processes have been around for some time, especially in the private sector, and in other fields and industries, its adoption by US-based highway agencies is only now beginning to gain momentum. Most highway agencies still do not have formal programs or policies related to risk assessment or risk management.

Focusing on NEPA Risks

In developing this guidance document, the research team did not have a specific project to evaluate through the six-step risk management framework outlined in this section. Instead, the research focused on the potential universe of NEPA risks, and potential actions to manage those risks. Since the research focuses on all NEPA risks, rather than a specific project, there is no qualitative or quantitative risk analysis. Instead, the focus is on steps 2 and 5 of the risk management framework: (NEPA) Risk Identification and (NEPA) Risk Response Planning, in a generic sense. The risk management framework graphic in Figure 5 below highlights this focus, with elaboration in the next chapter.

Figure 5: Risk Management Framework, Highlighting the Focus Areas for NEPA Risk Identification and NEPA Response Planning



3 Identifying and Developing Strategies to Address NEPA Risks

As part of this research effort, a "practitioner workshop" was developed and held in Washington, DC on March 15, 2011, to validate NEPA risks catalogued in a literature review, and receive input on how effective risk management strategies could be developed and implemented. See Appendix A for a summary of the workshop proceedings.

To organize risk identification and management strategies, this research developed a project lifecycle "template" that is typical for most DOTs. The template, enumerated below, consists of nine phases of project development, which run more or less consecutively, though some phases significantly overlap others.

Typical DOT Project Development Phases

1. Planning: The planning process provides an assessment of transportation deficiencies, or "needs," which the DOT can convert into project candidates. Transportation planning at the corridor or subarea level of analysis will provide key information for the NEPA process, such as project purpose and need, preliminary screening of alternatives, and preliminary screening of environmental impacts.

2. Priority Setting and Programming: refers to a DOT's formal or informal process of ranking "needs" derived from the planning process, and initiating project development.

3. Preliminary Design: sometimes called preliminary engineering (PE), includes the definition of the project's basic design parameters, such as typical sections, horizontal and vertical alignments, and design speeds, to evaluate the feasibility of an option or alternative. While definitions of this phase varies between agencies, specifically excluded from preliminary design activities is advancing the level of engineering to the point that it would prejudice the selection of the NEPA "preferred alternative." It should also be noted that preliminary design activities are to be conducted concurrently with NEPA activities.

   This phase is typically an excellent time to apply risk management in earnest, as scope of work, size and cost of project, and location decisions begin to emerge.

4. NEPA: while not a project "phase" unto itself, every DOT has a work unit of NEPA specialists, who aid in the project development process by obtaining NEPA approval through various levels of analysis and documentation.

5. Final Design: defined by 23 CFR 636.103, final design follows preliminary design and "expressly includes the preparation of final construction plans and detailed specifications for the performance of construction work."

6. Environmental Permitting: begins as part of the NEPA process, wherein all known or reasonably anticipated permit actions are addressed as part of the NEPA document. However, many permit details must wait until sufficient design is complete, for example, Section 404 of the Clean Water Act.

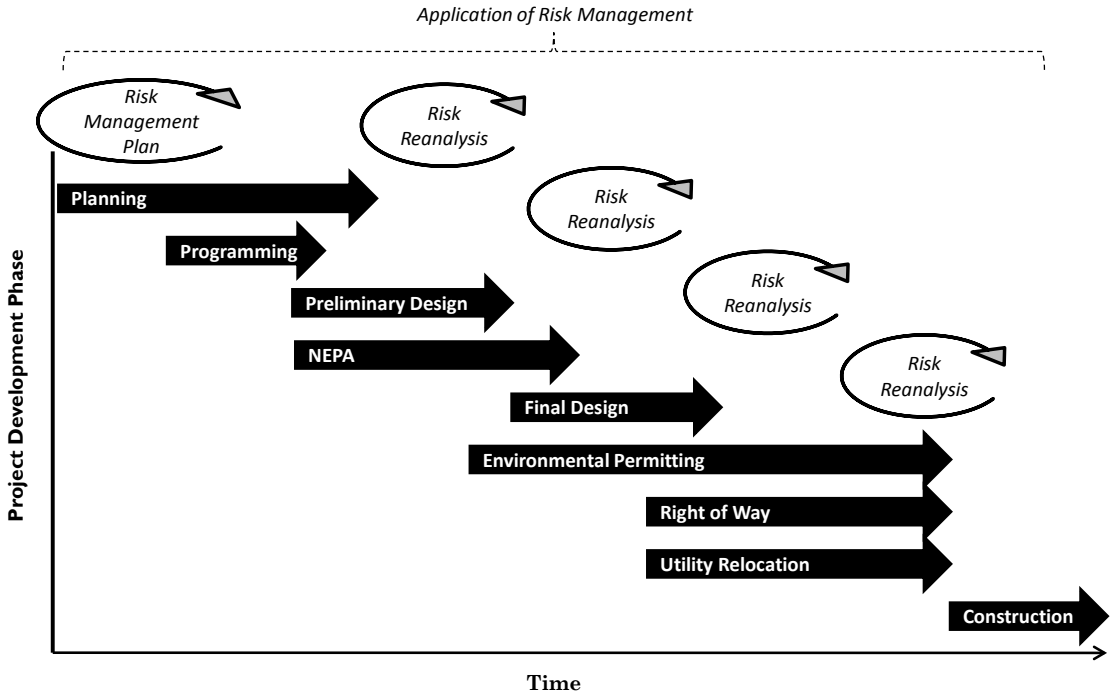
7. Right-of-Way (ROW): the identification and acquisition of ROW necessary for project construction.

8. Utility Relocation: are considered in the design phase, and relocated as part of the construction phase. Some level of utility identification must be performed during project development, and appropriate decisions must be made regarding the highway location, design, and utility relocation, in order to balance utility relocation costs against highway construction cost and selection of the preferred alternative.

9. Construction: begins after the project is let to bid and a contractor is selected. This is of course where the physical impacts occur, both to the transportation facility itself and to the surrounding environment.

Figure 6 below illustrates these nine project development phases in context with development schedule, and emphasizes the application of risk management throughout the project lifecycle, including periodic reevaluations.

Figure 6: Project Lifecycle Phases and the Application of Risk Management



In addition to these nine phases of project development, there were some overarching NEPA risks identified, which fell under a general category of "project management."

Brainstorming Process of Risk Identification

Brainstorming is a widely-accepted procedure for identifying risks, and one that was replicated in the practitioner workshop, which specifically used a "structured brainstorming" process. The goal of brainstorming is to generate ideas, solicited from the broadest possible cross-section of experienced people involved in a project's development. A facilitator runs the brainstorming session, and all participants hold judgment on the ideas generated until after the session is complete.

Structured brainstorming solicits one response from each participant, in a round robin sequence. Each participant has an equal chance to participate, which reduces the natural biases of "rank" in the organization or the vagaries of an individual's personality and willingness to speak in a group setting.

Brainstorming generates a variety of ideas in a very short time, and often produces new and creative ideas. In the context of risk management, the brainstorming process is the best process to reveal and categorize a complete list of risks, which can then be analyzed for probability and impact, and appropriate risk management actions identified.

The next section presents the results of a brainstorming session held in the practitioner workshop as part of the development of this guidance document. In practice, identifying risks would involve the following two steps:

1. Brainstorming exercise, to generate as many ideas of potential risks as possible, based on the input of a multidisciplinary working group.
2. After brainstorming ideas are documented, refer to risk checklists, like the ones in the tables that follow, to see if additional risks or ideas can be generated. It is important not to refer to checklists before brainstorming sessions, so as not to prejudice the opinions of the working group or stifle innovative ideas.

To reemphasize, the NEPA risk examples presented in this guidance document are helpful, but the reader should refer to them only as examples of a risk management exercise and not a checklist of all possible NEPA risks. Brainstorming for a specific project could identify different or more specific risks.

NEPA Risks Identified in the Practitioner Workshop

To develop this guidance document, researchers convened a "practitioner workshop" to review NEPA risks and potential response actions (see Appendix B for a list of participants and agenda for this workshop). The participants in the workshop followed a structured brainstorming exercise to identify potential NEPA risks and risk management actions. Table 1 through Table 10 below presents a list of NEPA risks organized by project phase, with 1) data and methods for risk analysis, 2) potential risk management actions, and 3) suggestions for allocation of this risk.

Table 1
NEPA Risks in the Planning Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Purpose and need defined too narrowly, which can lead to an improper narrowing of reasonable alternatives	• Consultation with FHWA officials	• Practicing Planning and Environmental Linkage (PEL): bring environmental specialists into the planning process, to aid in evaluating the purpose and need statement for the project • Early involvement of attorneys in a legal sufficiency review will help to mitigate problems with the purpose and need statement	• Project manager, in consultation with environmental specialist
Uncertainties in travel demand model	• Data from modeling and forecasting specialists • MPO • Consultants assigned to traffic forecasting	• Update travel demand model as MPOs release model updates • Coordinate to ensure that project traffic model is in line with latest MPO model • Use "backcasting" and/or other methods for calibrating model and as part of the QA/QC review for the model.	• Project manager • Traffic modeling and forecasting specialists (DOT) • Traffic modeling and forecasting specialists (consultant)

Table 1
NEPA Risks in the Planning Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Project goals that are too vague or too broad, creating risk of preferred alternative not meeting goals	• Consultation with FHWA officials	• Practicing Planning and Environmental Linkage (PEL): bring environmental specialists into the planning process, to aid in evaluating the purpose and need statement for the project	• Project manager, in consultation with environmental specialist
Not addressing local agencies' policies and plans	• Use risk management checklist to identify risk	• Ensure that there is an adequate compilation of local/regional plans and policies that relate to the proposed action • Review proposed action—does it adequately reflect local policies and plans and if not, has there been adequate interaction with local officials to address, and is there a good explanation provided?	• Project manager • Environmental specialist • Planning leader in charge of purpose and need document
Disconnect between disciplines with respect to land-use needs and aspirations	• Use risk management checklist to identify risk	• Consider the use of teaming agreements to identify the key project goals and address issues such as land use; get resource and partner agency buy-in	• Project manager • Environmental specialist • Planning leader in charge of purpose and need document

Table 1
NEPA Risks in the Planning Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
The segmentation and logical termini of the project excludes related transportation problems; **The segmentation/logical termini of the project creates a project that is overly complex and/or too expensive to build**	• Consultation with FHWA • Quantify with planning-level cost estimate tools	• Document the use FHWA criteria in choosing logical termini during the purpose and need formulation • Use early cost estimate tools to avoid the creation of "mega" projects which are difficult to develop, or too expensive to develop	• Project manager, in consultation with DOT executive leadership
Using known environmental issues to eliminate alternatives, which could unfairly bias the eventual preferred alternative	• Consultation with FHWA	• Practicing Planning and Environmental Linkage (PEL): bring environmental specialists into the planning process, to aid in the development and evaluation of proposed alternatives • Develop "red flag" summaries of environmental issues during the planning phase, at a level of detail equal for all potential alignments and/or project area	• Project manager, in consultation with environmental specialist

Table 1
NEPA Risks in the Planning Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Having too narrow a range of alternatives to evaluate	• Consultation with FHWA	• Practicing Planning and Environmental Linkage (PEL): bring environmental specialists into the planning process, to aid in the development and evaluation of proposed alternatives	• Project manager, in consultation with environmental specialist

Table 2
NEPA Risks in the Priority Setting and Programming Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Inaccurate cost estimates provide a public "benchmark" of project cost, and perceptions of cost overruns	• Estimating software (e.g., Transport Estimator®) to provide cost estimates in the planning phase	• Provide more confidence in planning-level cost estimates by utilizing estimating software (e.g., Transport Estimator®) and appropriate contingencies to estimate costs • Use risk-based design estimates such as WSDOT Cost Estimate Validation Process (CEVP®) • Develop a communication plan that includes public declaration of cost estimates; declarations of estimated costs should be placed in context, communicated in terms of "year-of-expenditure" dollars and expressed as a range not a single number.	• Project manager, in consultation with DOT executive leadership
Inadequate DOT capacity for delivery of the project	• Internal staffing plans for individual projects or programs	• Outsource program management for select groups of projects, such as projects of a certain size, delivery of certain complex projects, or to manage "spikes" in the DOT program	• DOT executive leadership

Table 2
NEPA Risks in the Priority Setting and Programming Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
		• Bifurcate planning/development program from construction program; and do not program construction funding until an environmental document is cleared (Maryland State Highway Administration example)	
Viability, especially with complex projects: "Do we have a viable project?" **This was also expressed in the Workshop as a "lack of accountability" for poor programming decisions**	• Early screening and involvement of engineering and environmental specialists in the programming phase • Estimating software (e.g., Transport Estimator®) to provide cost estimates in the planning phase	• Create a rigorous process or institution for programming complex and/or high cost projects o Create, publish, and follow a process for programming "major" projects, as defined by scope, cost or complexity o Some State DOTs have major programming decisions governed by a commission or board, which can filter out highly-parochial	• DOT executive leadership

Table 2
NEPA Risks in the Priority Setting and Programming Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
		projects which might not be viable. MPOs and other planning organizations have a role in priority setting and programming as well	

Table 3
Risks in the Preliminary Design Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Inadequate level of preliminary design activities can lead to proposed actions which have unknown engineering complexity	• Use risk management checklist to identify risk	• Ensure that there is collaboration between NEPA specialists and technical/engineering specialists. Neither should dominate project development decision making. o Project management offices can promote this type of collaborative process o Provide resources for adequate preliminary design.	• Project manager

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Organized opposition to the project, including significant grassroots, funding, and/or legal resources **Lack of Political and Stakeholder Consensus**	• Use risk management checklist to identify risk	• Aid political and stakeholder consensus by using the following tools and techniques: o Stakeholder teaming and partnering agreements o Public involvement planning, implementation, and documentation • Multi-disciplinary team to effectively address stakeholder issues with a strong project manager o Include assigned project support staff	• Project manager • DOT executive leadership

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Lack of understanding of NEPA process by project stakeholders **Giving too much authority, or perceived authority, to stakeholder groups such as Citizen Advisory Committees** **State or local governments attempting to "legislate over" NEPA**	• Use risk management checklist to identify risk	• Adopt adequate processes and procedures as part of project development manuals o Include example guidelines and models o Convey clear understanding of "what" project development is and "how" it is carried out o Clearly convey what the role of stakeholders is in project development and decision making	• Project manager and environmental specialists
Failure to consider public transit or other modes	• Use risk management checklist to identify risk • Travel demand modeling to quantify modal alternatives	• Ensure adequacy of the purpose and need statement for the project • Include public transit agencies (and other modal agencies) as stakeholders in the project development process • Adequately consider and document modal alternatives analysis and rationale for exclusion	• Project manager and environmental specialists

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Study area and boundaries which create a project too large to fund	• Estimating software (e.g., Transport Estimator®) to provide cost estimates in the planning phase	• Consider the risks of the study/planning area resulting in a project or group of projects which are financially infeasible. Document decisions on the study area, especially in terms of the financial resources • Where appropriate, consider a tiered EIS document, where individual projects can be disaggregated and developed as funding allows • Consider segmentation and innovative funding mechanisms	• Project manager • DOT executive leadership
Deficient screening which prematurely eliminates alternatives, or eliminates alternatives which should be carried forward or conversely carrying forward unreasonable alternatives	• Consultation with FHWA	• Have procedures in place for NEPA compliance • Early involvement of attorneys in a legal sufficiency review will help to ensure that the screening process is adequate • Early and close coordination with lead agency and in some cases cooperating agencies	• Project manager and environmental specialists

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Inadequate compliance with NEPA procedures	• Use risk management checklist to identify risk	• Document project management plans which address NEPA compliance process and schedule • Develop a project-specific plan for the administrative record of the NEPA decision	• Project manager and environmental specialists
Maintaining an adequate record of, and responding to, public comments	• Use risk management checklist to identify risk	• Create and maintain an electronic record of public comments and responses • Develop standard response templates for responding to public comments • Categorize public comments to classify the subject matter and strength of public opinion about certain issues • Consider/respond or develop plan to address concerns raised	• Project manager and environmental specialists • Project public involvement coordinator (DOT or consultant)

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Addressing resource agency comments	• Use risk management checklist to identify risk	• Programmatic agreements with resource agencies for specific issues can decrease the volume of comments received for each project • Early coordination with resource agencies particularly cooperating and participating • Advance technical studies to address agency concerns early	• DOT executive leadership should be involved in programmatic agreements with resource agencies as an overall streamlining and risk management tool • Project manager and environmental specialists

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Being overly responsive to resource agency comments; or **Being overly agreeable—making any commitment to advance the project**	• Use risk management checklist to identify risk	• Develop the ability to defend decisions without creating conflicts o Refer to previously-developed agreements with the resource agency(ies), such as programmatic agreements; partnering agreements o Commitments should be developed in close coordination with cross-functional staff and only made by those with the authority to make them	• Project manager and environmental specialists

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Differences in NEPA processes and interpretations between federal agencies such as FHWA, FTA, and FRA	• Consultation with FHWA	• Develop procedures that clearly define these different interpretations and how to manage them • Develop partnering agreements among all stakeholders and federal agencies early in the project development process • Request and establish the "lead federal agency" which is most appropriate and/or advantageous for project development • Clearly establish appropriate cooperating and participating agencies	• Project manager and environmental specialists

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Legal and regulatory changes during the life of project development, leading to • **need to account for new information** • **risk of resource studies growing outdated**	• Use risk management checklist to identify risk	• Environmental management systems can aid in and streamline permit and document reviews, and "automate" compliance activities to the degree practical • Project management offices and teams can effectively manage the workload and changes in regulatory requirements, which apply to a portfolio of projects • Identify necessary reevaluation activities to address regulatory changes	• Project manager and environmental specialists • DOT executive leadership should be aware of this risk, and their role in program delivery, so that projects do not languish in the DOT "pipeline"

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
The capacity of resource agencies to provide a timely review of environmental, especially if there are large, temporary expansions of a DOT's program **New resource agency staff require time to understand the transportation process** **Resource agency staff unavailable to attend meetings, due to low staffing levels or lack of travel funding**	• Use risk management checklist to identify risk	• Programmatic agreements with resource agencies for specific issues can decrease the volume of comments received for each project • The State DOT can fund positions in resource agencies (e.g., State Department of Environmental Protection; US Army Corps of Engineers; US Fish and Wildlife), which increases their institutional capacity to review environmental documents	• DOT executive leadership needs to identify and support resource agency partnerships

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Adversarial relationship with resource agencies **"Passive-aggressive" behavior to delay DOT progress in project development**	• Use risk management checklist to identify risk	There are several strategies which can improve the relationship between State DOTs and resource agencies: • Funding positions in resource agencies develops a collaborative relationship in review of environmental documents • Help fund improvements—such as GIS resource databases—which provide benefits resource agencies and eases administrative burdens associated with NEPA review; this action can also build goodwill between the DOT and resource agency • Specific teaming agreements, on a project or program basis, help to reinforce the relationship between the State DOT and resource agencies, and reinforce resource agency boundaries • Be responsive, rationally and collaboratively address agency concerns early • Work with the lead agency to address agency commentary and place it in context	• DOT executive leadership • Project manager and environmental specialists

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Difficulty in weighing different types of impacts, e.g., agencies not agreeing on which impacts are more important	• Use risk management checklist to identify risk	• Create matrices to compare resource impacts and weigh against project purpose and need • Allow resource agency leadership to coordinate among each other to resolve conflicts • Involve the lead agency as the ultimate decision maker	• Project manager and environmental specialists

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Growing intolerance for <u>any</u> project impacts	• Use risk management checklist to identify risk	• Develop the ability to defend decisions without creating conflicts o Refer to previously-developed agreements with the resource agency(ies), such as programmatic agreements; partnering agreements o Focus agency commentary by improving project information they are seeing o Involve lead agency in coordinating with agencies and addressing their concerns	• Project manager and environmental specialists

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Poor readability of the environmental document	• Use risk management checklist to identify risk	• Follow guidelines for "user friendly" environmental documents • Use templates for certain documents, such as Categorical Exclusions • Exercise quality control, hold the preparers accountable for a quality product	• Project manager and environmental specialists • Consultant involved in document preparation
Inadequate decision rationale or recordkeeping	• Use risk management checklist to identify risk	• Train staff and implement process to create and maintain administrative record for projects • Use environmental management systems to automate and streamline recordkeeping • A strong project manager responsible for assuring adequate record keeping of decision making documentation	• Project manager and environmental specialists • Consultant involved in administrative record

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Need for new analysis, including the identification of new alternatives • **Something was "missed" in original evaluation** • **Unanticipated issues affect alternatives analysis** • **Post-ROD changes in project design** • **Politically-motivated alternatives arise**	• Use risk management checklist to identify risk • Calculate the cost and time delay of considering new alternative	• Practicing Planning and Environmental Linkage (PEL): bring environmental specialists and engineers into the planning process, to ensure a robust evaluation and inclusion of all reasonable alternatives and documented elimination of unreasonable alternatives • Demonstrate the cost and time delay from considering a new alternative (perhaps via quantitative risk analysis)	• Project manager and environmental specialists

Table 4
Risks in the NEPA Phase of Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Developing projects "at risk," prior to approval of environmental document: **Where agencies decide to proceed with detailed design, right-of-way, utility and construction activity prior to the ROD (with non-FHWA funds), they do so "at risk," meaning the project's eligibility for federal funding is at risk, should there be changes made to the environmental document**	• Use risk management checklist to identify risk	• Use qualitative analysis and management judgment to determine when to proceed at risk • Quantify the risk decision by assigning dollar value to variables such as time, cost of design, cost of potential revisit of environmental document, etc. • Coordinate with lead agency and present rationale	• Project manager and environmental specialists
Insufficient understanding of legal standards that apply to the NEPA process	• Use risk management checklist to identify risk	• Use legal sufficiency reviews, and include attorneys at earlier stages of project development • Create and maintain an "administrative record" for use in potential legal challenges in the future	• Project manager and environmental specialists • Outside counsel involved in legal sufficiency review

Table 5
NEPA Risks in the Final Design Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
"Hand-off" of preliminary design to final design team: **Where there is separation between the preliminary design team and final design team (which is possible due to the time required for NEPA approval), some environmental decisions or commitments might get "lost" between the project development phases**	• Use risk management checklist to identify risk	• Cultivate project management leadership and teams which transcend all phases of project development, to ensure follow through of environmental commitments and acquiring internal concurrence and approval • Develop a process for communicating project commitments • Project management offices within a State DOT might encourage such collaboration and follow through	• Project manager

Table 5
NEPA Risks in the Final Design Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Identifying new technical constraints: **The final design phase identifies engineering issues with more precision and can uncover new constraints, which impact the preferred alternative and possibly require revisiting the NEPA decision**	• Use risk management checklist to identify risk	• The best way to address this risk is in early phases of project development, with adequate level of preliminary design to compliment NEPA decisions • Develop a clear reevaluation process to ensure timely management of potential issues • Environmental specialists have continued coordination with Final Design and Permitting team	• Project manager and environmental specialists

Table 5
NEPA Risks in the Final Design Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Value Engineering: **The value engineering (VE) exercise which occurs in the final design phase has great potential as a cost-savings measure, but carries the risk of VE proposals violating the NEPA document, or identifying an alternative that was dismissed in the alternatives analysis**	• Use risk management checklist to identify risk • Calculate the cost of VE proposal in design fee and schedule, including construction escalation	• Value engineering sessions should be conducted in the context of all other project development activities, and not as a "stand-alone" activity which is more or less equal to other project development phases • As with other project development activities, NEPA specialists should be active in VE sessions • VE should be considered prior to the selection of the preferred alternative and completion of the NEPA document • Consider using VE as a tool for developing risk responses for major project risks. • Consider the consequences of change	• Environmental specialists

Table 6
NEPA Risks in the Environmental Permitting Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Regulatory Loop: **401/404 permitting process can identify impacts which require mitigation outside of the project footprint, thus requiring additional environmental analysis**	• Use risk management checklist to identify risk	• Coordinate permitting requirements early in the environmental process • Develop agreements with resource agencies for the merger of the NEPA and 401/404 process	• Project manager and environmental specialists • DOT executive leadership need to be aware of the benefits of NEPA-401/404 process merger and use their executive position with their resource agency counterparts to effectuate change

Table 6
NEPA Risks in the Environmental Permitting Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Uncertainty of Resource Requirements **Agencies require development of a mitigation plan at the time a permit is submitted, meaning that DOTs have to identify land to be acquired, without certainty they can actually acquire it** **During the right-of-way acquisition process, owners can reject an offer from the DOT for any reason (many states do not have authority for imminent domain for environmental mitigation). If a potential mitigation site falls through, the DOT has to start all over with the mitigation and sometimes must also resubmit the permit**	• Use risk management checklist to identify risk	• Coordinate permitting requirements early in the environmental process • Develop "in-lieu fee" programs, which compensate for stream and wetland impacts on a linear foot and acreage basis, respectively. Such programs eliminate the need for specific identification of mitigation areas for a permit • Develop mitigation banks as encouraged by the US Army Corps of Engineers • Early consideration of mitigation including coordination with permitting agencies and the development of a conceptual mitigation plan during NEPA • Early contamination assessments of R/W parcels	• Project manager and environmental specialists • Developing in-lieu fee programs requires the attention and energy of DOT executive leadership

Table 6
NEPA Risks in the Environmental Permitting Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Resource agencies requiring their own "resource specific" mitigation, rather than having one site (e.g., wetland) for multiple projects. The resource agencies sometimes claim that DOTs are "double dipping" to buy one mitigation site that could serve for several different resource areas	• Use risk management checklist to identify risk	• Programmatic agreements with resource agencies for specific issues can reduce or eliminate the uncertainty revolving around this risk category • Programmatic agreements with resource agencies for specific issues can decrease the volume of comments received for each project and possibly avoid this particular risk • Coordinate mitigation early and bring multiple agencies together • Early identification of wetland site locations	• Project manager and environmental specialists • DOT executive leadership

Table 6
NEPA Risks in the Environmental Permitting Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Environmental Resource Conflicts: **Some permits can directly contradict the decisions made in the NEPA process**	• Use risk management checklist to identify risk	• Coordinate permitting requirements early in the environmental process • Develop agreements with resource agencies for the merger of the NEPA and 401/404 process • Involve permitting agencies in NEPA – coordinate, consult and seek concurrence • Carry agency decisions made in project development into design and permitting – documents are viewed as a continuum • Some risks can be avoided by additional preliminary design (now allowed by FHWA) in conjunction with close coordination with the federal resource agencies during the NEPA phase. This is required through the use of cooperating / participating agencies status under SAFETEA-LU	• Project manager and environmental specialists • DOT executive leadership need to be aware of the benefits of NEPA-401/404 process merger and use their executive position with their resource agency counterparts to effectuate change

Table 7
NEPA Risks in the Right-of-Way Acquisition (ROW) Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Failure to Consider ROW during NEPA process	• Use risk management checklist to identify risk	• Include ROW specialists in the NEPA process • Develop project management offices or develop project development teams comprised of all disciplines • Develop clear scoping procedures	• Project manager and ROW specialist
Unknown alignment and ROW impacts in the NEPA phase of project development	• Use risk management checklist to identify risk	• Include ROW specialists in the NEPA process • Budget for "worst case" ROW cost impacts during project development • Continue to refine R/W until NEPA document is approved	• Project manager and ROW specialist

Table 7
NEPA Risks in the Right-of-Way Acquisition (ROW) Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Uncertain schedule for NEPA approval, which affects the ability to acquire ROW on schedule	• Use risk management checklist to identify risk	• Use project management offices or develop project development teams comprised of all disciplines • Include ROW specialists in the NEPA process • Strong project manager in charge of schedule and communication	• Project manager and ROW specialist
Workload Balancing: **NEPA and environmental permitting requirements for a project are speculative until the preferred alternative is approved; while ROW coordination with NEPA is helpful to mitigate schedule delays, unforeseen permit requirements can greatly impact the workload of agency staff**	• Use risk management checklist to identify risk	• Use project management offices or develop project development teams comprised of all disciplines • Include ROW specialists in the NEPA process • Identify consultant ROW specialists to balance unforeseen workload fluctuations • Exercise advance ROW acquisition when able (e.g., protective buying, corridor preservation, etc.)	• Project manager and ROW specialist

Table 8
NEPA Risks in Utilities Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Unknown Utility Impacts: **Where there is an underinvestment of utility identification and engineering, including relocation cost estimating, there is a risk that an alternative with inordinate utility relocation costs will advance as the preferred alternative, all other things being relatively equal**	• Use risk management checklist to identify risk	• Scope utility impacts into preliminary design activities and consultant contracts • Involve utility companies at major concurrence points in the project development process • Enhance NEPA phase survey requirements	• Project manager and utilities specialist
Utility Relocation not cleared in Environmental Document: **There are consequences to budget and schedule if utility relocation was not considered or cleared in the NEPA document**	• Use risk management checklist to identify risk	• Involve utility companies at major concurrence points in the project development process • Document utility placement better, so it is available during earlier stages in development	• Project manager and utilities specialist

Table 9
NEPA Risks in the Construction Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Executing NEPA commitments: **Depending on the complexity of the project, there can be numerous environmental constraints placed on the contractor, such as seasonal restrictions, restrictions on work in environmentally sensitive areas, and habitat protection**	• Use risk management checklist to identify risk	• Separate out critical NEPA commitments and permit conditions in a section of the construction plans and notes • Insert a plan note for the contractor to assign a specific person for environmental compliance issues or to contact appropriate DOT personnel • Ensure mechanisms are in place to transmit commitments from NEPA to future phases	• Project manager and DOT construction work unit (e.g., office, division) • DOT construction project manager (assuming construction manager is different from DOT project development manager)
Maintenance of traffic restrictions can eliminate less costly alternatives; or make preferred alternative more costly	• Use risk management checklist to identify risk • Calculate the cost of MOT alternatives	• Analyze maintenance of traffic as a consideration of alternatives selection – coordinate with appropriate team members • Resist local preferences in project scoping to dictate expensive maintenance of traffic schemes	• Project manager in consultation with DOT construction management specialists

Table 9
NEPA Risks in the Construction Phase

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Constructability issues with the preferred alternative; failure to consider temporary construction impacts	• Use third-party constructability specialists to review impacts	• Perform constructability reviews at appropriate stages of project development to evaluate constructability impacts	• Project manager in consultation with DOT construction management and environmental specialists
Risk Related to Contractor Productivity: **NEPA commitments can place restrictions on a contractor's ability to efficiently build projects, with attendant schedule and cost risks. For example, restrictions on working in streams at certain times of the year or restrictions on construction means and methods can present an unknown risk to the project's construction schedule and budget**	• Use third-party constructability specialists to review impacts	• Conduct constructability reviews earlier in the project development process, to identify risks and plan for schedule contingencies • Schedules need to be created recognizing project issues – those critical issues must be identified and carried forward to ensure commitments are met and complied with	• Project manager in consultation with DOT construction management and environmental specialists

Table 10
NEPA Risks in Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Project Manager's Experience and Competency: **Many good transportation project managers have honed their skills over a number of years, perhaps as an understudy on various project management assignments**	• Use risk management checklist to identify risk	• Establish and commit to a project manager training program within the DOT, with various competencies required depending on the construction value of the project • Recruitment and selection of project managers based on people and project management skills in addition to technical skills	• DOT executive leadership
Project Manager's Workload: **Even with competent project managers, individuals might not be dedicated to a specific assignments, and instead might have time diverted to other projects or administrative duties**	• Use risk management checklist to identify risk	• Establish project management offices for the most complex project development efforts, and promote knowledge transfer among DOT colleagues in the office	• DOT executive leadership

Table 10
NEPA Risks in Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Turnover in Project Management: **Project managers can turnover due to changes in agency leadership or attrition. The lack of continuity in project management creates a risk that NEPA decisions will not carry through subsequent phases of project development**	• Use risk management checklist to identify risk	• Establish project management offices for the most complex project development efforts, and promote knowledge transfer among DOT colleagues in the office	• DOT executive leadership

Table 10
NEPA Risks in Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Cumulative Risk Effects of Poor Project Management: **If project management is deficient, a variety of NEPA risks—and other project management risks—can compound to detrimental cumulative effect**	• Use risk management checklist to identify risk	• Establish and commit to a project manager training program within the DOT, with various competencies required depending on the construction value of the project • Establish project management offices for the most complex project development efforts, and promote knowledge transfer among DOT colleagues in the office • Strong training and mentoring programs	• DOT executive leadership

Table 10
NEPA Risks in Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Lack of effective conflict resolution process	• Use risk management checklist to identify risk	• Develop in-house conflict resolution training program to build staff capacity and competency • Hire neutral third parties to resolve conflicts that surround an individual project or set of issues with a resource agency • Early involvement of the lead agency	• DOT executive leadership • Project manager
Perception of risk, and risk averse behavior **Fear of deploying non-standard solutions, e.g., design exceptions**	• Use risk management checklist to identify risk	• Develop project management processes that include risk management protocols	• DOT executive leadership

Table 10
NEPA Risks in Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
Lack of uniform project management and risk management tools	• Use risk management checklist to identify risk	• Develop project management guidance • Training and certification of project managers • Implement a project management system to aid and automate project management activities	• DOT executive leadership

Table 10
NEPA Risks in Project Development

Title of NEPA Risk	Data and Methods for Risk Analysis	Potential Risk Management Actions	Risk Allocation: Who should Address Risk?
History of contentiousness with the project: if there is organized opposition, and/or if the project has had a history of controversy, it is more likely to face litigation. **"Degree and Bounds" of public controversy: involves whether the project faces controversy based on environmental issues, or more parochial (e.g., "not in my back yard") concerns.** **Complexity of resource or regulatory issues: by their nature, some environmental issues involve more technical analysis and judgment, such as Endangered Species Act consultation, 4(f) issues, and projects located in environmentally sensitive settings such as public lands or scenic rivers.**	• Use risk management checklist to identify risk	• Project management offices and training to ensure effective project management staff • Stakeholder and partnering agreements • Legal sufficiency reviews • Public involvement plans – well established communication protocols	• DOT executive leadership • Project manager

4 Recommendations for Implementing NEPA Risk Management

There is a growing body of knowledge of risk management as applied to highway development by State DOTs. In addition to this guide on NEPA risk management, two other guides are under development or recently published:

- NCHRP 8-60, which produced a *Guidebook on Risk Analysis Tools and Management Practices to Control Transportation Project Costs*. This project focuses on managing risk in the cost-estimating process.
- SHRP2 R09, which is finalizing a *Guide for the Process of Managing Risk for Rapid Renewal Projects*. This project addresses risk during all phases of highway projects (pre-construction, construction, operations, and maintenance), but provides particular focus on rapid-renewal project elements.

FHWA includes risk management principles as part of many program manuals, including its guidance for the development of Project Management Plans for major projects. The National Highway Institute offers a course in risk management (FHWA-NHI-134065), which provides a two-and-a-half-day instruction program on risk management concepts and practices. And there are many private sector guides as well, such as the Project Management Institute's *Project Management Body of Knowledge* (PMBOK®) *Guide.* In short, State DOTs which want to develop risk management practices, on a project or program level, have a number of resources to draw on.

To further the development of risk management practices in DOTs, this section classifies NEPA risks by their origin (for example, internal or external) and in turn suggests the roles the executive leaders can play in advancing policies and programs to address NEPA risk.

Executive Leadership Support to Address NEPA Risks

Applying the risk management framework described in Section 2 of this guidance will reduce the consequences of NEPA risks and improve overall project delivery. Implementing risk management processes will require a new focus from various parts of a DOT organization (e.g., project managers, technical staff, etc.), but there are a number of important actions by an agency's executive leadership which are necessary precursors to providing project managers and technical staff the knowledge and tools they need to practice project risk management on a daily basis. Such "programmatic" risk management strategies—which necessarily require the sponsorship of the executive leaders—are discussed below.

Origins of NEPA Risks

Section 3 of this guidance provides a broad registry of NEPA risks and potential risk management actions for each. In addressing NEPA-related risks in project development, the origins of those risks can be characterized as either internal or external.

Internal Risks

Internal NEPA risks are those related to an agency's program, staffing or project management processes. They range from how projects are managed on a program-level as a whole, including processes for ensuring that projects are viable (i.e., they can be built), to the agency's commitment to a high level of program delivery. Other sources of internal NEPA risk include staffing issues—the people responsible for managing the NEPA process, and the tools and technology used as part of the project development process.

External Risks

External NEPA risks are those which originate from outside the DOT, especially from resource agencies and project stakeholder groups.

The NEPA process involves coordination with various resource agencies throughout the process. These agencies can be great partners in working through the NEPA process, however, depending upon the resource agency's ability to dedicate personnel to the project, the personnel's understanding of the project, and the consistency of the personnel throughout the project, numerous delays can occur.

Policy and regulatory change can also be an impediment to the efficient development of NEPA documentation. While the direction these changes may take is largely beyond the control of State DOTs, remaining abreast of the changes and their potential impacts to the NEPA process can be a key to minimizing the risks posed by policy and regulatory changes.

The tables below describe these broad categories of internal and external risks, along with examples of how those risks are manifested in project development, and specific program-level strategies that DOTs can implement to address them.

Table 11:
Program-level Strategies to Address Internal NEPA Risks

Internal Origins of NEPA Risk	Manifestation of Risks	Program-level NEPA Risk Management Strategies
Program Risks	**Over-programming:** DOT does not have the staff to deliver its program; Projects in the program which cannot be built, due to financial or environmental issues; Shifting priorities mean that DOT staff start and stop project development, multiple times Some projects in the program for inordinate amount of time without NEPA approval	The DOT should have clear and defensible guidance and criteria for project selection. Sometimes this can take the form of a project selection board or commission, or even legislative oversight panel, which can: • Ensure the program is calibrated to available staff resources • dissuade sponsors from developing projects which are not viable • Prioritize locally if not statewide
	Commitment to Program Delivery Do the public and resource agencies have confidence that the DOT will deliver its program?	Establish and publish metrics for program delivery, such as WSDOT Grey Book; Missouri DOT Tracker; or Virginia DOT Dashboard: • Demonstrates the agency's commitment to delivering projects • Highlights projects which are behind schedule and/or difficult to deliver, which perhaps illustrates some projects which should be cancelled

Table 11:
Program-level Strategies to Address Internal NEPA Risks

Internal Origins of NEPA Risk	Manifestation of Risks	Program-level NEPA Risk Management Strategies
Staff Risks	Problems with NEPA processes can occur when the DOT has • insufficient staffing capacity for program delivery; • lack of specialty skills in technical disciplines and project management • high turnover in staff, either through retirement, moves to the private sector, or shifts within the DOT	• Create project management offices composed of all technical disciplines to manage large or complex projects • Perform long-range assessment of internal staffing against o Program forecast o Core competencies of internal staff o Rates of attrition in staff areas of critical technical skill • Implement training programs and certifications for staff, in the fields of project management and other technical disciplines • Assign strong, responsible project managers
Project Management	The internal processes involved in managing projects can create risks in complying with NEPA processes • Organization structure with silos that are build around technical disciplines instead of interdisciplinary project development • Processes that inhibit collaboration in project development—e.g., handoffs from one step in project development to another • Lack of management systems to aid critical functions, including project schedule and budget tracking; and systems to support technical disciplines like NEPA commitment tracking	• Create project management offices composed of all technical disciplines to manage large or complex projects o Addresses technical discipline silos o Fosters collaborative project development • Review existing project development process to eliminate redundancy and streamline parallel processes o Is there a published process? o Do resource agencies understand and buy-in to the process? • Assess the value added from management systems • Project management and risk management training programs • Strong/clear, responsible project manager expert in each phase of development; hand-off to next phase project manager

Table 12:
Program-level Strategies to Address External NEPA Risks

External Origins of NEPA Risk	Manifestation of Risks	Program-level NEPA Risk Management Strategies
Resource Agency People and Process	There are a large number of NEPA risks which derive from a DOTs relationship with external resource agencies, and in turn those agencies': • Capacity to review NEPA documents • Understanding of the project and/or its NEPA issues • Consistency in agency decision making, including different units of the same organization (e.g., US Army Corps of Engineers) or the same organization over time • Resource agency staff turnover • DOT-resource agency relationships	• State DOT leadership develops and cultivates ongoing relationships with resource agency leaders • Establish formal MOUs or teaming agreements with resource agencies o Possibly include conflict resolution processes • Joint training exercises with the DOT and resource agencies, in NEPA law and process, project management, and conflict resolution • Develop programmatic agreements to address a specific category of resources (e.g., endangered flora or fauna), with prescribed mitigation • DOT-funded positions in resources agencies, to address o Capacity to review documents o Develop consistency in project reviews o Resource agency turnover • DOT funding for resource agency databases or management systems, which would be of mutual benefit to both parties o GIS mapping of environmental resources o Inventories of historic sites and resources
Legal and Regulatory Issues	The interpretation of NEPA laws and regulations, and changes in those laws and regulations themselves, is a consistent category of external risk across all projects	• Joint training exercises with the DOT and resource agencies, in NEPA law and process • Institute a process of legal sufficiency reviews on all projects of a certain size or level of NEPA documentation (e.g., certain levels of categorical exclusions)

Table 12:
Program-level Strategies to Address External NEPA Risks

External Origins of NEPA Risk	Manifestation of Risks	Program-level NEPA Risk Management Strategies
	Quality of the "administrative record" associated with the project	• Provide staff training on creating and maintaining an administrative record of the project development/NEPA process
	Federal agency being named as a defendant in NEPA litigation, rather than the state DOT which developed the project	• Intervention by the project sponsor, to participate in the defense of the NEPA decision with the federal agency
	•FHWA and FTA seek to minimize litigation risks by conducting legal sufficiency reviews for all EISs and Section 4(f) evaluations; legal reviews also occur on a case by case basis for other types of environmental documents. While these reviews are intended to minimize risks, they can also become a source of risk in the project development process – in particular, schedule risk – because of the time needed to conduct the reviews and because of the tendency for federal agencies to have lower tolerance for litigation risk and thus a greater reluctance to move forward with a project in the face of such a risk.	• Project sponsors can mitigate this risk by building strong relationships between their own counsel and the federal agency's counsel during the NEPA process.

5 Summary

A project management plan is not complete if it does not include project risk management. Project risk management is an important tool to manage the broad spectrum of NEPA risks; project managers must use the tool wisely to focus on those risks that are most significant to meeting project objectives. In reviewing the framework for NEPA risk management provided in this guidance, it is clear that implementation of risk management principles requires skill and dedication from DOT project management staff.

Risk management requires support at the DOT executive leadership level as well. Executive leaders need to understand the sources of NEPA risk in project management, and the specific strategies they can employ to manage those risks. For internal risks, executive leadership should understand the size of its program compared to financial and technical resources for delivery, and develop processes for the DOT to avoid pursuing projects which are not viable. It is also helpful to have a performance-based approach to program management, to track project delivery, improve processes, and communicate to stakeholders.

Staffing and project development issues also play heavily as internal sources of NEPA risks. A variety of staff development strategies can address these risks, including assessment of core competencies and training. Project management can benefit from streamlining and the elimination of silos in management processes. The creation of project management offices helps to foster collaboration among different disciplines, and reduce the impact of staff turnover on project development.

Executive leadership should also be mindful of external sources of NEPA risks, especially with resource agencies. While there are a number of tools that executive leaders can pursue, such as memoranda of understanding with resource agencies, partnering agreements, and the like, all such tools seek to foster an atmosphere of collaboration in NEPA process management, so that projects can be developed in a timely manner while resource issues are fully addressed to the letter and spirit of NEPA.

Why Should DOT Leadership Adopt Risk Management Practices?

Project development is a core function of state DOTs, yet as a discipline project management is too often ignored. DOT executive leaders are understandably preoccupied with myriad other management priorities, such as funding, labor issues, maintenance and constituent relations.

With the number of competing priorities vying for a DOT leader's attention, why should the DOT leader care about risk management? The answer can be summarized by the major points below:

- Transportation project development carries a number of risks, including an ever-expanding portfolio of NEPA-related risks
- Project management is a core function of state DOTs, and risk management is inherent in good project management processes
- In any given year, DOTs at the local and state levels of government spend more than $1 billion on project development activities, from planning to final design. With this amount of funding in play, risks could easily total hundreds of millions of dollars annually.

- Risk management offers proven tools to identify and manage project development risks, which can ultimately benefit the public through avoiding
    - costly fees for redesigning projects because a risk was not identified or adequately managed
    - schedule delays, which can lead to construction cost escalation, and delay of the public benefits (safety, congestion relief) offered by the project
    - cost overruns in the construction phase of a project
    - impacts to the quality of the project, due to design compromises caused by unforeseen risks
    - damage to the agency's credibility and public perception of the agency's ability to deliver projects on time and on budget

In summary, project risk management is not a new field of study, and the complexities of federal-aid project development beg for risk management solutions. DOT executive leaders are encouraged to embrace risk management as part of their overall program delivery processes, and use the guidance in herein to examine their own programs and processes for risk management opportunities, as part of improving overall service to the public.

6 Additional References and Resources

This guidance document focused on risk management principles in their relationship to expediting NEPA decisions. As such, the guidance provided an overview of risk management principles, rather than a detailed treatment of the subject. Readers of this guide are encouraged to research the topic of risk management more thoroughly through the resources listed below, which focus on risk management for the development of transportation projects.

- FHWA-NHI-134065, Risk Management (National Highway Institute Training Course)
- Florida Department of Transportation Project Risk Management Handbook, Chapter 19, Risk Management, Revised 03/04/2008.
- Guide for the Process of Managing Risk on Rapid Renewal Contracts, Strategic Highway Research Program, R09, publication pending.
- ISO 30001 Risk Management – Principles and Guidelines, International Organization for Standardization, 2009.
- NCHRP Scan 07-01, Best Practices in Project Delivery Management, Washington, DC, October 2009.
- NCHRP-20-24(74), Executive Strategies for Risk Management by State Departments of Transportation, Washington, DC, May 2011.
- NCHRP Report 658, Guidebook on Risk Analysis Tools and Management Practices o Control Transportation Project Costs, Washington, DC, 2010.
- Project Risk Management, Guidance for WSDOT Projects, Washington State Department of Transportation, July 2010.
- Project Risk Management Handbook, Threats and Opportunities, Second Edition, California Department of Transportation, Office of Statewide Project Management Improvement, May 2, 2007.
- Risk Analysis Methodologies and Procedures, Federal Transit Administration, June 2004.
- Risk Assessment and Allocation for Highway Construction Management, Federal Highway Administration, October 2006.
- Risk Management for Project Development (Draft), New York State Department of Transportation, Office of Design, April 9, 2009.