

PROJECT R09

Guide for Managing Risk on Rapid Renewal Projects

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Faster delivery of highway renewal projects yields benefits to both project owners and the traveling public. For example, faster delivery improves safety for the owner by reducing the time workers are in the roadway and reduces costs for the traveling public by reducing the period of restriction and disruptions.

“Rapid renewal” transportation design and construction projects are specifically intended to minimize both delivery schedule and disruption during construction, while not adversely affecting project cost and longevity. The innovative approaches and compressed schedules involved in rapid renewal often lead to different risk/reward allocations than those experienced in more traditional construction methods. A formal and structured risk management approach in which potential problems can be anticipated, evaluated, and addressed can significantly improve the chance of project success.

To support a systematic approach to the practice of risk management for rapid renewal projects SHRP 2 undertook a research project titled *Guide for the Process of Managing Risk on Rapid Renewal Contracts* (Project R09). The resulting Guide explains risk and how it can impact projects and defines a systematic approach to risk management. The Guide identifies six steps necessary to a formal risk management approach, provides case study examples for each step of the process, and includes extensive checklists and supplemental materials for conducting risk management on relatively simple rapid renewal projects. The supplements include annotated training materials, an animated presentation introducing the risk management process, forms for documenting the process, and a Microsoft Excel template (with User’s Guide) that presents a hypothetical project using sample data to provide an example of how to document the process and automatically conduct the necessary analyses for successful rapid renewal risk management. The Guide and its supporting materials were successfully pilot tested in conjunction with a project in North Carolina and a risk assessment workshop in Washington state.

The Process

A formal risk management approach is intended to optimize project performance. The approach needs to be efficient and defensible, as well as adequate (as opposed to perfect), and it must be compatible with the DOT organization and its projects. The approach generally consists of the following two sequential and iterative actions:

1. “Diagnosis” – Identification of all the significant potential problems (and opportunities) that could affect project performance, and an adequate assessment of their current severity in terms of the potential impacts and likelihood of occurrence in each case. Such

“problems” (including opportunities) are relative to an assumed “base” scenario, which must first be defined, and are documented in a project-specific Risk Register. This might include an analysis of ultimate project performance, including quantification of uncertainty in that performance.

2. “Treatment” - Identification of feasible ways to manage the potential problems, evaluate the cost-effectiveness of the treatment and develop appropriate “contingencies.” The treatment plans are documented in a project-specific Risk Management Plan. Implementation of the plan includes monitoring, updating (re-diagnosis), and decision making throughout project development and contract management.

The general process of successful risk management consists of a series of steps applied at various times throughout a project. The steps are shown in figure 1 and briefly described in the list that follows.

Iterative Risk Management Process

1. “Structuring” - Define the “base” project scenario against which risk and opportunity can subsequently be identified, assessed, and eventually managed. Project performance measures of cost, schedule and disruption, post-construction longevity, and the tradeoffs among these factors are included.

2. Risk Identification – Identify a comprehensive set of risks and opportunities. This is accomplished by brainstorming scenarios that might change the base project performance. Consult lists of common risks included in the guide. Document the set of risks and opportunities to start the project risk register.
3. Risk Assessment – Assess the “severity” of each of the risks and opportunities in the risk register, and then prioritize them on that basis. Generally this is done by subjectively assessing the risk factors (i.e., the probability of the scenario occurring and what are the impacts if it does), and then analytically combining the risk factors to determine changes in performance measures and thereby severity. Document the risk factor assessments in the project risk register.
4. Risk Analysis – Analytically combine the base and risk factors to determine the project performance measures (e.g., ultimate project escalated cost), as well as changes in measures associated with each risk. This can include quantification of the uncertainty in those performance measures, as a function of subjectively assessed uncertainties in the base and risk factors. Note that this step requires specialized skills.
5. Risk Management Planning – Identify and evaluate possible ways to proactively reduce risks, focusing on the most severe. Evaluate each possible action in terms of its cost-effectiveness, considering changes in both base factors (e.g., additional cost) and risk factors (e.g., reduced probability), and select those that are cost-effective. Consider subsequently re-analyzing the project performance measures for this risk reduction program, including quantification of uncertainty, based on which budgets and milestones can be established. As part of these budgets and milestones, contingencies (in the form of additional funds and time, as well as recovery plans) and procedures to control their use would be established. Document in the Risk Management Plan.
6. Risk Management Implementation – Implement the Risk Management Plan as the project proceeds by monitoring the status of risk reduction activities and changes in risk, and monitoring budget and milestones, especially with respect to contingencies. This might involve periodic updates at regular intervals or at major milestones or changes. For example, contingencies might be reduced as engineering reports or designs are completed and risks are avoided or reduced.

Figure 1. Iterative Risk Management Process



The Guide

The Guide outlines an efficient method for initiating the risk management process, preparing for and conducting the necessary meetings and workshops, documenting the process and results, and implementing the risk management plan. When following the Guide, users develop a Risk Register that helps identify and assess risks. The Risk Register documents the likelihood of each risk occurring during project phases and identifies a set of possible performance “impacts” if the risk occurs.

In the example below, the Risk Register entry is qualitatively assessing a risk related to rapid embankment construction. The probability of the risk occurring is medium and impacts to the three performance measures—cost, duration (completion date), and disruption (hours lost to the public)—are assessed. The components of the risk, the bulleted items in the table, could then be itemized to develop mitigation strategies that reduce risks to improve total performance and conduct further analysis to allocate/determine contingencies.



Rapid renewal methods include bridge slide techniques used on the Dingle Ridge Road Bridge project on I-84 in New York, which replaced the bridge in two weekend nights. (photo from HNTB)

The Training

A two-day course was developed to train DOT facilitators to conduct vital parts of the risk management process on relatively simple projects. This training is also useful for DOT management, key project team members, and independent experts, to help them better understand the process. However, this training is not required for everyone who participates in the risk management process. Course materials

include forms and an MS Excel workbook template and an overview presentation.

A hypothetical (but realistic) DOT rapid renewal project is evaluated for illustration and concept reinforcement. While the Guide discusses what a risk management plan is and why it is useful, the training course focuses on how to implement a plan using simple exercises and examples. The emphasis is on structuring, risk identification, risk assessment (including risk severity analysis and prioritization),

Sample Risk Register

		FOR A MEAN-RATING RISK ASSESSMENT			
ITEM	RISK OR OPPORTUNITY	PROBABILITY OF OCCURRENCE (%)	COST CHANGE TO ACTIVITY (CURRENT \$ MILLION)	DURATION CHANGE TO ACTIVITY (MONTHS)	DISRUPTION CHANGE TO ACTIVITY (MILLION PERSON-HOURS LOST)
CN4	<p>Unable to construct interchange embankments as rapidly as assumed</p> <p>For the SH 111 overcrossing at the interchange with US 555. The performance of this planned rapid renewal method (rapid embankment construction) is difficult to predict for the following reasons (see <i>Guide</i>, Appendix D-2, or Table D-4c):</p> <ul style="list-style-type: none"> • Uncertainty in subsurface conditions (soft soils are suspected); • Uncertainty in what method the contractor will choose • Uncertainty in performance of the selected method for actual subsurface conditions 	M	+L to D/B Construction	+M to D/B Construction	+L to D/B Construction

risk analysis, risk management planning, and plan implementation, especially for relatively simple projects that a DOT can evaluate in-house, which will help to optimize the performance of those projects.

Benefits and Limitations

A formal risk management process can optimize project performance and increase agency understanding of how and when risks can become opportunities. The process reduces potential for cost overruns; is scalable to projects

of any size; increases the likelihood of on-time delivery by anticipating and managing risks; reduces costs through better management of budget and schedules, and generally results in fewer surprises.

The risk management process can require significant effort and is analogous to a value engineering study in both its initial conduct and subsequent implementation. It must be planned, resourced, and facilitated to provide accurate analyses and defensible decisions as efficiently as possible.

The Risk Management Guide and its supporting materials are available at <http://www.trb.org/Main/Blurbs/168369.aspx>.

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