Best Risks International

RISK MANAGEMENT TASK GROUP

Project Risk Management Handbook: A Scalable Approach

Version 1 (June 2012)

The management of risks requires establishing and nurturing a culture of risk management. In such an environment, project teams work together through each phase of project delivery to manage risks. The intent is to bring focus to the understanding that the project teams are not only designing roads, bridges, drainage systems, etc., but are developing plans, specifications, and estimates for construction contracts. Project risk management is everyone's responsibility, and there are accountability check points to ensure that project risks are being managed.

The new *Project Risk Management Handbook: A Scalable Approach* is your guide to implementing project risk management. It is written as a handbook for all project team members to use during all phases of delivery. Training and subject matter experts are available to help project teams effectively implement project risk management.

It is our expectation that Project Delivery Directive PD-09 is to be implemented using the *Project Risk Management Handbook: A Scalable Approach*. If you have any questions about it or how to implement it for your project, please contact your District Risk Management Coordinator.

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Preface

The Project Risk Management Process, described herein, is intended to result in the effective management of project risks and opportunities during the entire project life cycle – **from project inception to completion of construction.** The project manager, project sponsor, and project team members jointly develop a risk register that enables them to identify, assess, quantify, prepare a response to, monitor, and control project risks.

This document provides information to project managers and project teams that will help with their risk management efforts in the following ways:

- Provide a consistent methodology for performing project risk management activities.
- Provide techniques and tools for project risk management.
- Identify data requirements for risk analysis input and output.
- Provide information on how project risk management fits into the overall project management process at Caltrans.
- Provide guidance on how to proactively respond to risks.

Project risk management is a scalable activity commensurate with the size and complexity of the project under consideration. Simpler projects may use simple analysis, whereas larger more complex projects may use more robust analysis techniques.

This *Scalable Project Risk Management Handbook*, which may be revised and updated from time to time, is applicable to all projects. The level of project risk management depends on the total cost of the project, as well as other considerations (see Chapter 1, Section 1-4).

Chapter 1 gives an overview of project risk management, the three levels of project risk management, and the process, roles, and responsibilities.

Chapter 2 is designed to help the project manager plan the risk management process, form the project risk management team, and prepare a budget for project risk management activities.

Chapter 3 provides instruction about risk identification and starting the risk register. It is applicable to all scalability levels.

Proceed to the risk analysis chapter for the level of your project:

Level 1	Chapter 4
Level 2	Chapter 5
Level 3	Chapter 6

Chapters 7 through 9 are common to all projects. Chapter 7 details risk response, and Chapter 8 is about risk monitoring.

Chapter 9 addresses the required communication checkpoints for all projects and explains the required accountability checkpoints where deputies must sign off on the risk register. It also includes the Risk Management Performance Measure requirements.

Chapter 1 Introduction

1-1 Objectives and Benefits

Project Risk Management Objectives

The Project Risk Management Handbook has been designed to:

- Be simple and easy to use
- Be scalable to project size and complexity
- Pull communication of risks across project milestones and phases
- Actively manage risk to enhance project success
- Integrate into the current project delivery process, and
- Involve all functional units in the management of risks.

Project Risk Management Values

Identifying, communicating, and managing project risks requires a *risk management* culture. This culture is defined by the *values* in which we operate. The following attributes depict PRM values required for the development of a successful risk management culture.

- Risk decision-making based on balancing project values such as cost, schedule, and quality
- Stewardship
- Efficiency
- Teamwork
- Joint ownership of risks and responsibilities
- Accountability

Benefits to the Project Team

Our project risk management helps the project manager and the other project members to manage project risks over the life of each project, enlisting the support and effort of all of the functional units as the project moves along the delivery cycle. This includes:

- Better ability for the project team to focus time and effort on highest rated risks
- A scalable approach, consistent with existing processes
- Enhanced coordination and transparency with functional units, which facilitates early identification of critical risks
- Bridging of functional stovepipes to maintain focus on project success by all functional units
- Support of the project manager's mission through the management accountability process

1-2 What is meant by "Risk"

The meaning of the term "risk" must be unc oject risk management. In the context of a project, we are concerned about potential impacts on project objectives such as cost and time. A general definition of "risk" in this context is:

> Risk is an uncertainty that matters; it can affect project objectives negatively or positively.

The uncertainty may be about a future event that may or may not happen and the unknown magnitude of the impact on project objectives if it does happen. Thus, a "risk" is characterized by its probability of occurrence and its uncertain impact on project objectives.

The kinds of risks appearing in a risk register are shown below based on when they might occur during the life cycle of a project.

- Throughout the project life cycle, a future event that may occur at any time in a project's lifecycle is a risk. It has a probability of occurrence and an uncertain impact if it does occur.
- During Planning and Design, uncertainty in the total cost estimate, due to uncertain quantities and unit prices is a risk. In this case the probability is 100% (the estimate and its uncertainties exist), and the uncertainties impact the project cost.
- During construction, a Notice of Potential Claim (NOPC) has a probability of becoming a Contract Change Order (CCO) and an uncertain cost/time impact if this happens. This risk is retired from the register if the claim is dismissed or if it is replaced by a CCO.
- During construction, a CCO which has occurred (100% probability) is a risk, but its cost/time impact may be uncertain. If there is an estimate in the CCO Log of the project, the uncertainty is expressed as a range around the estimate. This risk is retired from the register when the CCO is executed with the contractor.

> ***Risk and issue*** *are two words that are often confused when it comes to their usage. Actually there is some difference between them.*
>
> *A risk is an uncertain event that has a probability associated with it. An issue does not have this attribute. Issues are problems right now that the project team has to do something about.*
>
> *Think of risk management as a proactive activity, while issue management is reactive.*

These examples are collectively referred to as "risks" in this Handbook, and would all be included, when applicable, in the project's risk register because they contain uncertainty that affects project objectives.

Specifics about identifying risks are in Chapter 3, including examples of risk statements.

1-3 The Project Risk Management Process

The Basic Process

All approaches to project risk management strive to maximize both efficiency and effectiveness. Although the details of risk processes may differ depending on the project, risk management has three important parts: identification, analysis, and action. Before risk can be properly managed, it must first be identified, described, understood, and assessed. Analysis is a necessary step, but it is not sufficient; it must be followed by action. A risk process which does not lead to implementation of actions to deal with identified risks is incomplete and useless. The ultimate aim is to manage risk, not simply to analyze it.

FIGURE 1 – PROJECT RISK MANAGEMENT PROCESS

The project risk management process (Figure 1) is not difficult. It simply offers a structured way to think about risk and how to deal with it. A full project risk management endeavor includes these processes:

1. *Risk Management Planning* – Deciding how to approach, plan, and execute the risk management activities for a project.
2. *Risk Identification* – Determining which risks might affect the project and documenting their characteristics.
3. *Qualitative Risk Analysis* – Prioritizing risks for subsequent further analysis or action by assessing and combining their probability of occurrence and impact.
4. *Quantitative Risk Analysis* – Analyzing probabilistically the effect of identified risks on overall project objectives.
5. *Risk Response* – Developing options and actions to enhance opportunities and to reduce threats to project objectives.
6. *Risk Monitoring* – Tracking identified risks, monitoring residual risks, identifying new risks, executing risk response plans, and evaluating their effectiveness throughout the project life cycle.

At its foundation, project risk management involves asking and answering a few simple questions:

- What risks might negatively (threats) or positively (opportunities) affect achieving the project objectives? (***Risk identification***)
- Which of these are most important? (***Qualitative risk analysis***)
- How could these affect the overall outcome of the project in probabilistic terms of cost and schedule? (***Quantitative risk analysis***)
- What can be done about it? (***Risk response***)
- Having taken action, how did the responses effect change, and where is the project now? (***Risk monitoring***)
- Who needs to know about this? (***Communication***)

While these questions are listed sequentially and are usually conducted in this order, they are often combined, repeated as the project progresses, or may even be performed out of sequence.

The questions constitute a process, shown in Figure 1, indicating how the different elements of project risk management interact and describing how risk management can be implemented. The process has a circular form to highlight that it is a continuous process throughout the life cycle of a project.

The arrows signify the logical flow of information between the elements of the process. Communication is the core of this process. It is the means by which all the information flows and the project team continuously evaluates the consistency and reasonableness of risk assessments and their underlying assumptions.

1-4 Three-Tiered Scalability

A recent analysis of the total cost (capital and support) of the Department's current contracts revealed the following breakdown. Sixty-seven percent of contracts are under $5 million, 30 percent are in the range of $5 - $100 million, and 3 percent are over $100 million. Accordingly, three ranges were selected for the scalability levels of Project Risk Management. The risk management requirements are listed in Table 1.

TABLE 1 – RISK MANAGEMENT REQUIREMENTS BY SCALABILITY LEVEL

Scalability Level	Estimated Cost (Capital and Support)	Risk Management Requirements
	Minor A, Minor B, and other projects less than $1 million	Risk register encouraged
1	Less than $5 million	Risk register
2	$5 million to $100 million	Risk register with qualitative analysis
3	Greater than $100 million	Risk register with quantitative analysis

The requirements per scalability levels are minimum requirements. The project team may choose to work at a higher scalability level than required or *work at a lower level if approved by the SFP.* However, the project team should consider other factors to determine what level of risk management effort is needed. These factors may include:

- Political sensitivity
- The type of the project
- Location of the project and the community it serves
- Duration of the project
- Stakeholders of the project
- The sponsor's sensitivity to the primary objectives of the project (cost and schedule).

Any of these factors may warrant employing a higher scalability level.

The activities for each Scalability Level are shown in Table 2.

TABLE 2 – LEVELS OF PROJECT RISK MANAGEMENT SCALABILITY

Risk Management Process	Level 1 Cost to $5 M	Level 2 Cost $5-100 M	Level 3 Cost over $100 M
Risk Identification	Yes	Yes	Yes
Qualitative Analysis	Risk Rating	Probability/Impact Matrix	n/a
Quantitative Analysis	n/a	n/a	Yes
Risk Response	Yes	Yes	Yes
Risk Monitoring	Yes	Yes	Yes
Communication	Yes	Yes	Yes

The levels differ in the Qualitative and Quantitative Analysis processes. All levels perform the other processes. Level 3 quantifies risks in probabilistic forecast terms of cost and time, whereas Levels 1 and 2 do not.

Irrespective of the project's total cost, Level 3 might be used if any of the following activities are contemplated for the project:

- Validating the project's contingency allowance
- Justifying and requesting additional contingency above 5%
- During construction, checking the adequacy of the remaining contingency
- During construction, requesting supplemental funds
- Allocating risks of a design-build project
- Establishing the budget and/or completion target date to a desired level of confidence

More complex projects might request exemptions depending on the Level 3 probabilistic cost. Level 3 analysis may be used in support of revisions to the project's programming dollar amount.

Need more Contingency?

According to PD-04, there is a process to request more contingency:

> "Contingency Approval Process -- When the 5 percent project contingency must be increased or decreased, the project engineer must prepare a memorandum justifying the need and requested percentage for contingencies. A fully developed risk management plan with a quantitative risk assessment would be an acceptable document to help justify an exception to the 5 percent contingency."
>
> Source: *PD-04 Project Contingencies and Supplemental Work, Appendix A*

According to the RTL Guide, the memorandum to request more contingency must have the approval of the District Director.

1-5 Organization

The Project Risk Management Team (PRMT) is the core group performing, updating, and reviewing risk management activities under the direction of the Project Risk Manager (PRM), who has been trained in the processes. The PRMT will include members of the PDT, but not necessarily all members. The PRMT risk management meetings may be scheduled to follow the PDT meeting.

The PRMT comprises Caltrans project personnel from Design, Construction, Project Management, and the Functional Units involved in the project. The members of the PRMT should collectively have all of the expertise required to identify, assess, and respond to risks of the project. However, they should not hesitate to draw on the extensive talent pool available to the project for assistance. Representatives from other agencies, if any, may be invited to participate at PRMT meetings to ensure that all parties are fully informed, and thus avoid surprises.

The PRMT is directed by the PRM. The project manager generally acts as the PRM for Level 1 and 2 projects.

In scheduling PDT meetings, the project manager should indicate when risk discussions will be on the agenda so that PRMT members can plan to attend for risk discussions as well as other agenda items.

Discussing Risks as a Team has Value

Conducting risk management meetings as a team has value. The team listens to its members discuss risks, and the team can provide input from different perspectives. This cannot occur in one-on-one discussions of risk. In discussing risks, the work of individual team members can have an impact on the work of the rest of the team. Listening to team members, and discussing their challenges, provides a greater likelihood that the impact of a risk will be assessed properly.

1-6 Roles and Responsibilities

TABLE 3 –PROJECT RISK MANAGEMENT ROLES AND RESPONSIBILITIES

Role	Responsibilities
Project Managers	• With input from the Project Development Team (PDT), determine the project's risk register requirements based on project estimate and complexity, and the need for a written project Risk Management Plan. • Promote and direct risk management for the project. • Request project-specific changes to minimum risk management requirements. • Populate and maintain the project risk register with risks developed by functional units and the PRMT. • Ensure proactive response to all risks and opportunities that will impact the successful delivery of the project. • Produce risk management reports for sponsors. • Inform Department management about risk management results, major issues, and concerns. • Schedule and conduct project risk meetings. • Monitor and update risks. • Ensure quality of the risk data in the risk register. • Track and monitor the effectiveness of risk response actions. • Elevate issues to district management for resolution as necessary. • Take lead role in obtaining signoffs at accountability check points.
District Risk Management Coordinator	• Assist project managers with the implementation of PRM requirements. • Provide expertise, direction, and assistance. • Obtain expert services as needed. • Liaise with Headquarters risk management.
Project Delivery Team Member	• Identify and assess risks. • Develop responses to risks. • Document risk response actions and report to project manager for inclusion in risk management updates. • Communicate with project manager about newly-identified risks, risk assessments, and retirement of risks.
Project Risk Manager **(Generally the project manager for Level 1 and 2 projects)**	• Promote and direct risk management for the project. • Schedule and conduct project risk meetings. • Perform risk monitoring and updating. • Ensure quality of the risk data in the Risk Register. • Document risk response actions. • Track and monitor the effectiveness of risk response actions. • Report to the project manager on all matters related to risk management. • Compile the lessons learned in the area of risk management. • Produce risk management reports for the project manager. • Populate the project risk register with risks developed by functional areas.
Project Delivery Team Members and Task Managers	• Identify and assess risks and determine the risk owners. • Develop responses to risks. • Document risk response actions and report to project managers for inclusion in risk management updates. • Communicate new risks to project managers. • Retire risks.

1-7 Managing the Risk Register

The project's project risk manager facilitates the risk management process, ensures that the PRMT fully vets the risk register, and makes sure that disputes are resolved.

Communication with Functional Units

The project manager initiates the project risk management process and "owns" it until the project is completed. The project manager should involve all functional units and Construction in the risk management process from inception to project completion.

Communication and Accountability Checkpoints

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

The communication and accountability checkpoints are detailed in Chapter 2. They are relative to the existing standard milestones in the Caltrans Work Breakdown Structure. The latest risk register is communicated at each checkpoint. The risk register is to be approved and signed-off by the Deputies at the accountability checkpoints.

1-8 Communication in General

Communication and consultation with project stakeholders are a crucial factor in undertaking good risk management and in achieving project outcomes that are broadly accepted. It helps everyone to understand the risks and trade-offs that must be made in a project. Communication ensures that all parties are fully informed, and thus avoids unpleasant surprises.

Regular reporting is an important component of communication. Reports on the current status of risks and risk management are required for managers and other parties to understand the risks. They complement other management reports in developing this understanding. The project risk manager will prepare and issue periodic risk management reports as required by the project manager

To ensure a clear audit trail, the project risk manager will ensure that the risk management process is documented in such a way that it can be reviewed, the structure and assumptions can be examined, and the reasons for particular judgments and decisions can be identified.

Chapter 2 Planning Project Risk Management

2-1 Creating the Project's Risk Management Plan

A written Risk Management Plan is not required for all projects. It depends on the project size and complexity and the amount of risk management effort that will be required. The project manager and the PDT may decide if it is necessary.

The Risk Management Plan (RMP) defines the level at which risk management will be performed for the project and the frequency of risk management meetings and risk register updates. It lists the members of the Project Risk Management Team by the various disciplines involved in the project and sets a budget for the risk management activities. The RMP should be completed early in project planning, since it is crucial to successfully performing the other processes described herein.

A Project Risk Management Plan template is shown in Appendix B and may be downloaded from: http://onramp/riskmanagement

This step will ensure that the level, type, and visibility of risk management are commensurate with both the risk and importance of the project to the organization, provide sufficient resources and time for risk management activities, and establish an agreed-upon basis for evaluating risks.

First steps:

- Determine the scalability level for the project.
- Download the risk register for the scalability level from: http://onramp/riskmanagement.
- Determine the frequency of risk meetings for the project and the applicable communication and accountability checkpoints.
- Decide who will be on the Project Risk Management Team.
- If significant effort or outside consultants will be involved, include estimates for project risk management activities in work plans.
- If applicable, obtain the necessary approvals for the written RMP.

2-2 The Project Risk Management Team

The Project Risk Management Team (PRMT) is the core group performing, updating, and reviewing risk management activities under the direction of the project risk manager. The PRMT will include members of the PDT, but not necessarily all members.

The PDT may not continue regular meetings after RTL. Emphasize that the PRMT is expected to stay together to manage risks until project completion.

2-3 Incorporating Project Risk Management Activities into the Project Schedule

The project schedule (work plan) should incorporate the following:

- Dates for project risk management meetings
- Time to allow team members to prepare for review of the risk register and risk responses
- Milestones for communication and accountability checkpoints (see Chapter 2)

2-4 The First Project Risk Management Meeting

The first time that the PRMT meets, the project manager should brief the team about the following:

- The importance and objectives of the project risk management process
- The process itself
- The roles and responsibilities
- The risk register
- The communication and accountability check points
- Risk management activities in the project schedule
- Time charge codes for risk management activities
- The expectation that risk will be managed, documented, and reported

At this first meeting, elicit risks from the team members. If working to Level 2 scalability, determine the impact and probability definitions so that the team has the same understanding of the meaning of the word descriptions. (See Table 5 on page 20 for guidance.)

The PDT may include external stakeholders and agencies in addition to Caltrans personnel. At PDT meetings, after regular PDT business is concluded, the PRMT members from the PDT can remain to conduct a project risk management meeting.

Chapter 3 Risk Identification

Risk identification determines what might happen that could affect the objectives of the project and how those things might happen. It produces a deliverable — the project risk register – that documents the risks and their characteristics. The risk register is subsequently amended by the qualitative or quantitative risk analysis, risk response, and risk monitoring processes. Risk identification is an iterative process because new risks may become known as the project progresses through its life cycle, previously-identified risks may drop out, and other risks may be updated.

"Risk" Includes Threats and Opportunities

The concept of risk can include positive and negative impacts. This means that the word "risk" can be used to describe uncertainties that, if they occurred, would have a negative or harmful effect. The same word can also describe uncertainties that, if they occurred, would be helpful. In short, there are two sides to risk: threats and opportunities.

Projects in design have the greatest potential for opportunities because the project is still open to changes. Risk reduction and avoidance are opportunities, as are value analyses, constructability reviews, and innovations in design, construction methods, and materials.

Once a project enters construction, the project objectives (scope, time, and cost) are fixed contractually, so opportunities to save money and time are fewer. Any changes must be made using a contract change order (CCO), and only a negative CCO such as one resulting from a Value Engineering Change Proposal by the contractor would still afford an opportunity to save money and time. Otherwise, CCOs add cost and/or time to the project. So, the risk management focus during construction is on reducing or eliminating risks.

3-1 The Risk Register

What it is

A risk register is a tool that project teams can use to address and document project risks throughout the project life cycle. It is a living document – a comprehensive listing of risks and the manner in which they are being addressed as part of the project risk management process. The risk register is maintained as part of the project file that also includes information related to uncertainties in the cost estimate and schedule.

Risk register templates for each scalability level can be downloaded from:
http://onramp/riskmanagement

Why use it

A new project team is formed for every project and disbanded when the project is complete. Although not desirable, project team members sometimes change, and the project experiences change over the course of the project. Communication among project team members about the project objectives, costs, risks, etc., is vital. The risk register communicates project risks and helps the team members understand the status of the risks as a project moves from inception toward completion.

Managers should view the risk register as a management tool through a review and updating process that identifies, assesses, manages, and reduces risks to acceptable levels.

When to use it

A risk register is required to be prepared in conjunction with the first published cost and schedule estimate of a project (at the PID phase). Thereafter, a full review and update of the risk register should be undertaken at the beginning of each subsequent phase of the project. The register will be updated at least quarterly during the construction phase of the project.

How to use it

A risk register is best used as a living document throughout the project's entire life cycle, from PID through construction, to record the evolution of project risks. There is no prescription for how extensive a project's risk register should be. The project team decides the most beneficial use of the risk register, with the objective of minimizing the risk impact.

Resolving Disputes

Successful implementation of a risk mitigation measure is one of the most important aspects of project risk management. When PRMT members are at odds on whether or not these measures can be implemented, the dispute should be elevated to assist in its resolution. The team should have a Dispute Resolution Ladder (DRL) that outlines when and how disputes will be elevated and subsequently resolved. The DRL should be created in the initial PRMT meeting and used throughout the life of the project.

Disputes should be elevated once all relevant information is known, and agreement is not reached or a decision cannot be made.

Example Dispute Resolution Ladder *PM facilitates resolution and elevation*		
If unresolved among PRMT members	➔	Elevate to Functional Manager(s)
If unresolved by Functional Manager(s)	➔	Elevate to Deputies

It is important to note that the dispute may be resolved by the Department accepting the risk and not implementing the mitigation measure.

3-2 Identifying Project Risks

The first time that risk management is applied to a project, the project risk manager convenes the PRMT to identify and assess risks. Risk identification documents risks that might affect the project and their characteristics of probability and impact.

A common challenge in risk identification is avoiding confusion between *causes* of risk, genuine *risks*, and the *effects* of risks. A risk may have one or more causes and, if it occurs, one or more effects.

- *Causes* are definite events or sets of circumstances which exist in the project or its environment, and which give rise to uncertainty. Examples include the need to use an unproven new technology, the lack of skilled personnel, or the fact that the organization has never done a similar project before. Causes themselves are not uncertain since they

are facts or requirements, so they are not the main focus of the risk management process.

- *Risks* are uncertainties which, if they occur, would affect the project objectives either negatively (threats) or positively (opportunities). Examples include the possibility that planned completion targets might not be met, escalation rates might fluctuate, or the chance that requirements may be misunderstood. These uncertainties should be managed proactively through the risk management process.
- *Effects* are unplanned variations from project objectives, either positive or negative, which would arise as a result of risks occurring. Examples include early milestone completion, exceeding the authorized budget, or failing to meet agreed quality targets. Effects are contingent events, unplanned potential future variations which will not occur unless risks happen. As effects do not yet exist, and they may never exist, they cannot be managed directly through the risk management process.

Including causes or effects in a list of identified risks obscures genuine risks, which may not receive the appropriate degree of attention they deserve. One way to clearly separate risks from their causes and effects is to use a description with required elements to provide a three-part structured "risk statement": "As a result of *<definite cause>*, *<uncertain event>* may occur, which would lead to *<effect on objective(s)>*."

Examples include:

- "As a result of using a new technology (a definite requirement), unexpected design problems may occur (an uncertain risk), which would lead to overspending on the project (an effect on the budget objective)."
- "Because our organization has never done a project like this before (fact = cause), we might misunderstand the requirements (uncertainty = risk), and our project would not meet the performance criteria (contingent possibility = effect on objective)."

At the risk identification stage, the impacts on cost and time are not analyzed – that happens in the qualitative risk analysis (Chapter 4) or quantitative risk analysis (Chapter 5) processes.

The team members identify the potential risks (threats and opportunities) using any combination of:

- Brainstorming,
- Challenging of assumptions,
- Looking for "newness" (e.g. new materials, technology, or processes),
- Their knowledge of the project or similar projects,
- Consultation with others who have significant knowledge of the project or its environment,
- Consultation with others who have significant knowledge of similar projects, and
- The experience of project stakeholders or others in the organization.

A list of typical risks from the previous Caltrans risk management handbook may be downloaded from:

http://onramp/riskmanagement

The list is for guidance only. It is not intended as an exhaustive list, nor is it a substitute for other methods of identifying risks. Some of the items are issues and not risks (The difference is explained in the sidebar on page 4).

In identifying risks, the team considers and documents:

- What may happen or not go according to plan,
- What the impacts to the project objectives would be should the risk arise,
- What the assumptions and current status are that support the assessment of the risk,
- What action, if any, has been taken to respond to the risk, and
- What further options might be available for responding to the risk?

The information is entered into the risk register. Each risk is assigned to a member of the PRMT who becomes its Risk Owner. The risk register is reviewed and updated throughout the project.

The project manager, at his option, may elicit initial risk registers from the functional units and consolidate the contributions into a single project risk register. Alternatively, the project risk register may be developed during a PRMT meeting.

DIFFERING SITE CONDITIONS

Access to all areas of a project site may not be available prior to construction. This makes it difficult to determine environmentally sensitive areas or subsurface information needed to design roadways and foundations. The team needs to recognize the uncertainty that arises from this lack of information and provide the means to address it in the construction phase.

Some options for addressing the risks from unknown conditions:

1. Execute a service contract to determine the information during the design phase, and revise contract documents accordingly.
2. Provide language in the Special Provisions for the contractor to provide access to the job site for the Department's personnel as a first order of work.
3. Provide language in the Special Provisions for the contractor to hold off on ordering materials whose quantity may be impacted by this new information.
4. Provide resources for design personnel to perform a timely design/assessment using the new information.

3-3 Examples of Risk Statements

TABLE 4 – EXAMPLE RISK STATEMENTS FROM CALTRANS PROJECTS

	Risk Statement
Design	Inaccuracies or incomplete information in the survey file could lead to rework of the design.
	A design change that is outside the parameters contemplated in the Environmental Document triggers a supplemental EIR which causes a delay due to the public comment period.
Environmental	Potential lawsuits may challenge the environmental report, delaying the start of construction or threatening loss of funding.
	Nesting birds, protected from harassment under the Migratory Bird Treaty Act, may delay construction during the nesting season.
R/W	Due to the complex nature of the staging, additional right of way or construction easements may be required to complete the work as contemplated, resulting in additional cost to the project.
	Due to the large number of parcels and businesses, the condemnation process may have to be used to acquire R/W, which could delay start of construction by up to one year, increasing construction costs and extending the time for COS.
Construction	Hazardous materials encountered during construction will require an on-site storage area and potential additional costs to dispose.
	Unanticipated buried man-made objects uncovered during construction require removal and disposal, resulting in additional costs.

IMPORTANCE OF SITE VISITS

Site visits during the design phase are an effective risk management step. Not visiting the site creates uncertainties about conditions, which must be recognized as risks.

For example, a project in South San Francisco used the as-builts for the contract to determine the existing conditions. The project team was unaware that the work was part of a corridor project constructed under several contracts. The plans neglected to show the alignment of several ramps in the previously-constructed interchange. This risk could have been prevented with a site visit. In this instance, the design was performed by another district, and travel to the job site was deemed impractical. Consequently, risks stemming from site conditions were not identified. Fortunately, the impact of omitting as-built conditions was quickly identified and mitigated in construction. While this timely action reduced delays to the project, significant contingency funds were expended, necessitating a request for supplemental funds.

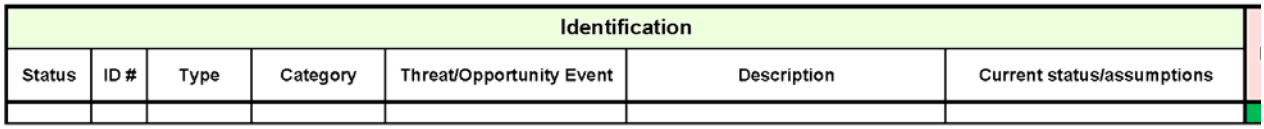
3-4 Entering Data into the Risk Register

The images herein are from the **spreadsheet version of the risk register** for each scalability level.

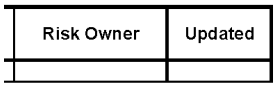
A workbook containing a sheet for each scalability level risk register may be downloaded from:

http://onramp/riskmanagement

At this stage, complete the information in the following risk register columns:



Identification						
Status	ID #	Type	Category	Threat/Opportunity Event	Description	Current status/assumptions



Risk Owner	Updated

Column	Contents
Status	Select "Active" or "Retired." A risk is retired when it has no further possibility of impacting the project.
ID #	Enter a unique identifying number for the risk.
Risk Type (Levels 1 and 2 only)	Enter either a "Threat" or an "Opportunity,"
Category	Select one of the categories for the risk. (Environmental, Design, R/W, DES, Construction, External, Organizational, or PM)
Threat/Opportunity Event	Provide a descriptive title for the risk.
Description	Write a complete description of the event and its potential impacts on the project if this risk were to occur. See Section 3-2 for the structure of the risk statement.
Current Status/Assumptions	If applicable, describe what we currently know about the risk and any assumptions made.
Risk Owner	Enter the name of the PRMT member responsible for this risk.
Updated	Enter the date the risk was created.

Other columns in the risk register will be completed or updated by the qualitative (Chapter 4) or quantitative (Chapter 5) risk analysis and risk response processes in Chapter 7.

Previous editions of risk registers used in the Department have a column for the risk "trigger," but not many risks have a clear trigger. So as not to take space from a crowded risk register, if a trigger is identified for a risk, it should be described in relation to the risk response.

Chapter 4 Qualitative Risk Analysis – Level 1

Qualitative risk analysis includes methods for prioritizing the identified risks for further action, such as risk response. The PRMT can improve the project's performance effectively by focusing on high-priority risks.

Team members revisit qualitative risk analysis during the project's lifecycle. When the team repeats qualitative analysis for individual risks, trends may emerge in the results. These trends can indicate the need for more or less risk management action on particular risks or even show whether a risk mitigation plan is working.

4-1 Risk Assessment

Qualitative risk analysis for Level 1 projects assigns a Risk Rating to each risk in the risk register. The risk ratings determine where the greatest effort should be focused in responding to the risks. They facilitate structured risk response action and resource allocation.

The three ratings for Level 1 projects are:

- "High" – First priority for risk response.
- "Medium" – Risk response as time and resources permit.
- "Low" – No risk response required at this time.

4-2 Entering Assessment into Risk Register Columns

The qualitative risk analysis of each risk is entered into the following columns of the Level 1 risk register.

Column	Contents
Risk Rating	Select "High", "Medium", or "Low" as a measure of the importance of this risk for response action.
Rationale	Describe the reasons the PRMT selected this risk rating.

Other columns in the risk register will be completed or updated by the risk response process in Chapter 7.

Chapter 5 Qualitative Risk Analysis – Level 2

Qualitative risk analysis includes methods for prioritizing the identified risks for further action, such as risk response. The PRMT can improve the project's performance effectively by focusing on high-priority risks.

Team members revisit qualitative risk analysis during the project's lifecycle. When the team repeats qualitative analysis for individual risks, trends may emerge in the results. These trends can indicate the need for more or less risk management action on particular risks or even show whether a risk mitigation plan is working.

Qualitative risk analysis for Level 2 projects assesses the priority of identified risks using their probability of occurring and the corresponding impact on project objectives if the risks occur.

5-1 Probability and Impact Ratings for Level 2 Projects

Table 5 lists the Caltrans standard definition of risk probability and impact ratings. The cost impact ratings may be easier to apply if expressed in terms of dollars. The ratings for the project serve as a consistent frame of reference for the PRMT in assessing the risks during the life of the project.

The table is intended as a guide – the PRMT may define dollar and time ranges as appropriate for the project. The impacts are to the overall project. Schedule delay applies to risks that are on the critical path (the longest path). During the Planning and Design phase, delay impacts to RTL may be of primary interest. During construction, delays impact project completion.

Cost impacts are based on the sum of Capital Outlay (CO) and Capital Outlay Support (COS) costs.

TABLE 5 –DEFINITIONS OF IMPACT AND PROBABILITY RATINGS

Rating -->	Very Low	Low	Moderate	High	Very High
Cost Impact of Threat (CO + COS)	Insignificant cost increase	<5% cost increase	5-10% cost increase	10-20% cost increase	>20% cost increase
Cost Impact of Opportunity (CO + COS)	Insignificant cost reduction	<1% cost decrease	1-3% cost decrease	3-5% cost decrease	>5% cost decrease
Schedule Impact of Threat	Insignificant slippage	<1 month slippage	1-3 months slippage	3-6 months slippage	>6 months slippage
Schedule Impact of Opportunity	Insignificant improvement	<1 month improvement	1-2 months improvement	2-3 months improvement	>3 months improvement
Probability	1–9%	10–19%	20–39%	40–59%	60–99%

5-2 Performing Qualitative Risk Analysis

The PRMT assesses each identified risk in turn and assesses:

- The rating for the probability of the risk occurring, and
- The rating of cost and time impact of each risk, should it occur.

The risk matrix in Figure 2 is used to determine the importance of each risk impact based on the probability and impact ratings. Each word descriptor of the rating has an associated number; the product of the probability number and impact number defines the risk score.

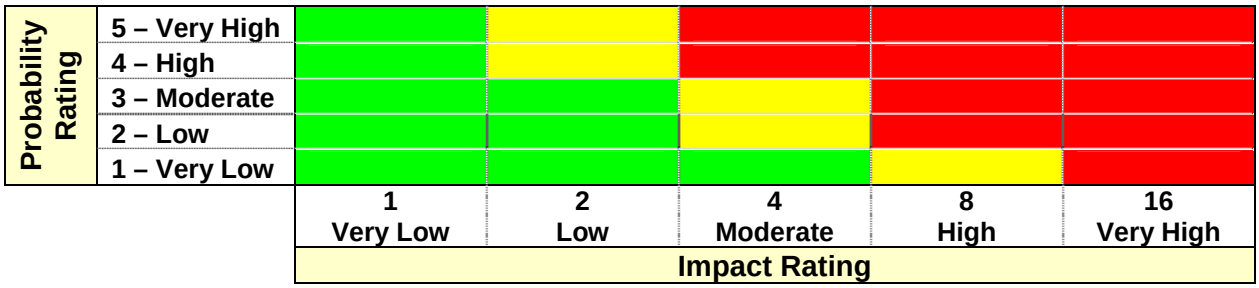


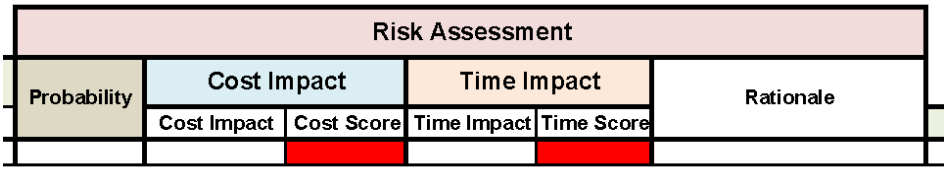
FIGURE 2 – CALTRANS RISK MATRIX

For a particular impact, the combination of the probability rating of the risk occurring and the impact rating positions the risk into one of the three colored zones in the risk matrix. The color of the zone indicates the priority of the risk for risk response: red zone signifies high importance, yellow is medium importance, and green is low importance.

For example, a risk having a "Moderate" probability and a "High" impact falls into the red zone. Its impact score is 3 x 8 =24.

5-3 Entering Assessments into the Risk Register

The qualitative risk analysis of each risk is entered into the following columns of the Level 2 risk register.



Column	Contents
Probability	Select the probability level from the drop-down list.
Cost Impact	Select the cost impact level from the drop-down list.
Time Impact	Select the time impact level from the drop-down list.
Rationale	Describe the rationale for these assessments.

The "Cost Score" is equal to the Probability number times the Cost Impact number.

The "Time Score" is equal to the Probability number times the Time Impact number.

The risks in a colored zone may be further prioritized for risk response according to their Cost and Time Scores. The higher the score, the higher the priority for risk response and monitoring.

Other columns in the risk register will be completed or updated by the risk response process in Chapter 7.

Chapter 6 Quantitative Risk Analysis – Level 3

Level 3 will require expertise and training. Please see the District Risk Management Coordinator for guidance.

Quantitative risk analysis is a way of numerically estimating the probability that a project will meet its cost and time objectives. Quantitative analysis is based on a simultaneous evaluation of the impact of all identified and quantified risks, using Monte Carlo simulation by *@Risk*, *Crystal Ball,* or *Primavera Risk Analysis* software. The result is a probability distribution of the project's cost and completion date based on the identified risks in the project.

Quantitative risk analysis simulation starts with the model of the project and either its project schedule or its cost estimate, depending on the objective. The degree of uncertainty in each schedule activity and each line-item cost element is represented by a probability distribution. The probability distribution is usually specified by determining the optimistic, the most likely, and the pessimistic values for the activity or cost element. This is typically called the "3-point estimate." The three points are estimated by the project team or other subject matter experts who focus on the schedule or cost elements one at a time.

Specialized simulation software runs (iterates) the project schedule or cost estimate model many times, drawing duration or cost values for each iteration at random from the probability distribution derived from the 3-point estimates for each element. The software produces a probability distribution of possible completion dates and project costs. From this distribution, it is possible to answer such questions as:

- How likely is the current plan to come in on schedule or on budget?
- How much contingency reserve of time or money is needed to provide a sufficient degree of confidence?

Which activities or line-item cost elements contribute the most to the possibility of overrunning schedule or cost targets can be determined by performing sensitivity analysis with the software.

6-1 Quantifying the Risks

The project risk manager leads the PRMT in quantifying cost and schedule risks.

- The probability of the risk occurring is expressed by two values: "Low" and "High" that cover the range.
- Three-point estimates are used for cost and schedule impacts. The three-point estimate consists of determining the "Low" (optimistic), "High" (pessimistic) and "Most Likely" values for the cost and time. The most likely value may be omitted if it cannot be established credibly.

The cost impacts include direct costs only; they exclude any cost of delay (determined from the output of a schedule risk analysis – see "Schedule Risk Analysis" on page 25). Schedule impacts are expressed in days of potential delay due to the risk. Some risks may not have both cost and schedule impacts.

Potential project delivery schedule delays can impact RTL and construction duration. The cost of potential delay to RTL may be a risk item in the risk register.

The potential delay during construction is converted to cost using a daily rate that includes time-related overhead and the direct costs associated with time (equipment, etc.). It is carried in the risk register separately from the RTL delay risk.

6-2 Entering Quantifications into the Risk Register

The qualitative risk analysis of each risk is entered into the following columns of the Level 2 risk register.

Risk Assessment											
Probability		Cost Impact ($)				Time Impact (days)				Rationale
Low	High	Low	Most likely	High	Probable	Low	Most likely	High	Probable	
10%	30%	$ 1,000		$ 3,000	$ 400	10		30	$ 4	

Column(s)	Contents
Probability	Enter the "Low" to "High" values.
Cost Impact	If there is a cost impact, enter a "Low" and "High" cost. If there is reason for a credible "Most Likely" cost, enter it; otherwise, leave this entry blank. If no cost impact, leave these cells blank.
Time Impact	If there is a time impact, enter a "Low" and "High" time in days. If there is reason for a credible "Most Likely" time, enter it; otherwise, leave this entry blank. If there is no time impact, leave these cells blank.
Rationale	Enter the rationale for these assessments.

"Probable Cost" is calculated from the average value of the Probability range multiplied by the average value of the Cost Impact range.
"Probable Time" is calculated from the average value of the Probability range multiplied by the average value of the Time Impact range.

The risks are prioritized for risk response in descending order of their "Probable Cost" and/or "Probable Time".

Other columns in the risk register will be completed or updated by the risk response process in Chapter 7.

6-3 Producing the Risk Probability Curves

The quantifications in the risk register should be combined to produce probability curves of the total cost of the risks and the total delay to the project. This requires knowledge of special risk modeling tools such as *@Risk, Crystal Ball*, or *Primavera Risk Analysis* for schedule risk modeling. The project risk manager may perform these risk analysis tasks, if trained, or they may be performed by a Department specialist. The District Risk Management Coordinator can obtain expert services as needed.

Cost Risk Curve

The Risk Cost (RC) is the probability distribution of the total cost of all risks in the project risk register.

Figure 3 is an example of a project's Risk Cost probability distribution.

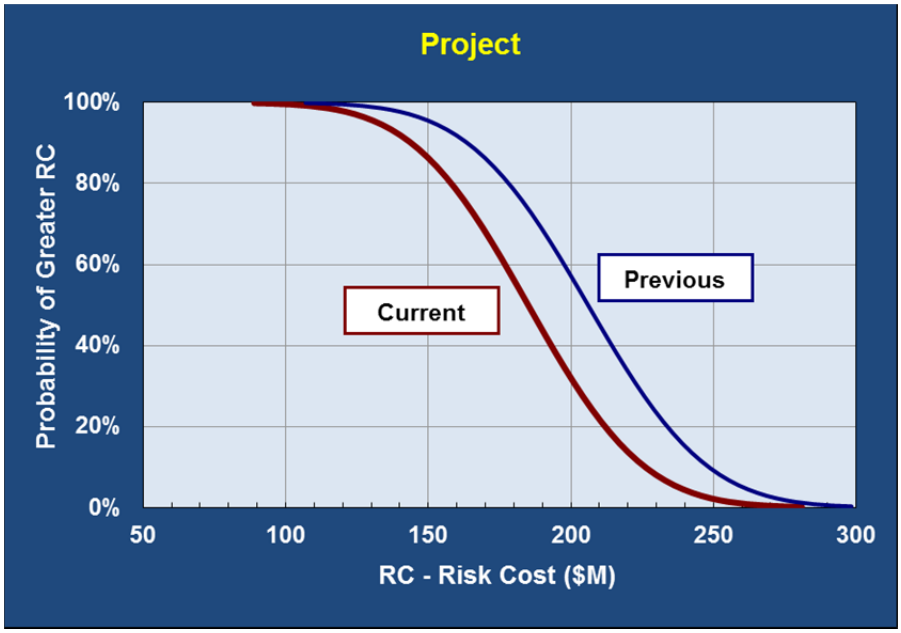


FIGURE 3 – RISK COST PROBABILITY DISTRIBUTION

The chart shows the curves for the current assessment and the previous assessment, if available. Selected values of RC at 90%, 50%, and 10% probability levels accompany the chart. For the example above, the table would indicate:

		Current	Previous
90%	chance RC is greater than	$ 144 M	$ 164 M
50%	chance RC is greater than	$ 185 M	$ 206 M
10%	chance RC is greater than	$ 226 M	$ 248 M

Schedule Risk Analysis

Schedule risk analysis may be performed using a simple model that combines delay risks on the critical path to RTL and project completion. This simple version can be modeled using @*Risk*. This approach is satisfactory if a Critical Path Method (CPM) schedule is not available.

If a CPM schedule is available, the schedule is imported into *Primavera Risk Analysis,* and the delay risks are inserted. This tool runs the simulation and produces output probability curves for selected milestones. Expert knowledge is required to use this tool. The curve will look similar to Figure 3 except the horizontal axis will be a time scale.

If none of the above approaches are available, the PRMT can estimate the overall delay to RTL and project completion, and quantify them in the risk register.

The cost of the potential delay to RTL and project completion, determined by any of the above methods, should be captured in the risk register as two specific risks.

Using the Probability Curves

The probability distributions of cost and schedule may be used by Project Management to accomplish the following:

For a project in the Planning and Design phase:

- Set project cost and schedule targets
- Evaluate if cost estimates and schedules are realistic
- Evaluate the adequacy of contingency reserves
- Request a contingency exceeding the standard Caltrans allowance
- Evaluate the probability (risk) of exceeding specific cost and time targets
- Determine the sensitivity of the output probability distribution to input risks (Risk Sensitivity Diagram), highlighting the main risk drivers.

For a project in the Construction phase:

- Perform risk-based budget analyses and forecasting cost at completion
- Assess the adequacy of remaining contingency
- Request supplemental funds
- Evaluate the probability of meeting completion targets.

Chapter 7 Risk Response

Risk response is the process of developing strategic options, and determining actions, to enhance opportunities and reduce threats to the project's objectives. A project team member is assigned to take responsibility for each risk response. This process ensures that each risk requiring a response has an owner monitoring the responses, although the owner may delegate implementation of a response to someone else.

7-1 Risk Response Strategies

For Threats	For Opportunities
Avoid. Risk can be avoided by removing the cause of the risk or executing the project in a different way while still aiming to achieve project objectives. Not all risks can be avoided or eliminated, and for others, this approach may be too expensive or time-consuming. However, this should be the first strategy considered.	***Exploit***. The aim is to ensure that the opportunity is realized. This strategy seeks to eliminate the uncertainty associated with a particular upside risk by making the opportunity definitely happen. Exploit is an aggressive response strategy, best reserved for those "golden opportunities" having high probability and impacts.
Transfer. Transferring risk involves finding another party who is willing to take responsibility for its management, and who will bear the liability of the risk should it occur. The aim is to ensure that the risk is owned and managed by the party best able to deal with it effectively. Risk transfer usually involves payment of a premium, and the cost-effectiveness of this must be considered when deciding whether to adopt a transfer strategy.	***Share***. Allocate risk ownership of an opportunity to another party who is best able to maximize its probability of occurrence and increase the potential benefits if it does occur. Transferring threats and sharing opportunities are similar in that a third party is used. Those to whom threats are transferred take on the liability and those to whom opportunities are allocated should be allowed to share in the potential benefits.
Mitigate. Risk mitigation reduces the probability and/or impact of an adverse risk event to an acceptable threshold. Taking early action to reduce the probability and/or impact of a risk is often more effective than trying to repair the damage after the risk has occurred. Risk mitigation may require resources or time and thus presents a tradeoff between doing nothing versus the cost of mitigating the risk.	***Enhance***. This response aims to modify the "size" of the positive risk. The opportunity is enhanced by increasing its probability and/or impact, thereby maximizing benefits realized for the project. If the probability can be increased to 100 percent, this is effectively an exploit response.
Acceptance. This strategy is adopted when it is not possible or practical to respond to the risk by the other strategies, or a response is not warranted by the importance of the risk. When the project manager and the project team decide to accept a risk, they are agreeing to address the risk if and when it occurs. A contingency plan, workaround plan and/or contingency reserve may be developed for that eventuality.	

7-2 Examples of Risk Responses

Table 6 repeats the example risk statements from Table 4 and shows a risk response for each.

TABLE 6 –EXAMPLE RISK RESPONSES

	Risk Statement	Risk Response
Design	Inaccuracies or incomplete information in the survey file could lead to rework of the design.	Mitigate: Work with Surveys to verify that the survey file is accurate and complete. Perform additional surveys as needed.
	A design change that is outside of the parameters contemplated in the Environmental Document triggers a supplemental EIR which causes a delay due to the public comment period.	Avoid: Monitor design changes against ED to avoid reassessment of ED unless the opportunity outweighs the threat.
Environmental	Potential lawsuits may challenge the environmental report, delaying the start of construction or threatening loss of funding.	Mitigate: Address concerns of stakeholders and public during environmental process. Schedule additional public outreach.
	Nesting birds, protected from harassment under the Migratory Bird Treaty Act, may delay construction during the nesting season.	Mitigate: Schedule contract work to avoid the nesting season or remove nesting habitat before starting work.
R/W	Due to the complex nature of the staging, additional right of way or construction easements may be required to complete the work as contemplated, resulting in additional cost to the project.	Mitigate: Re-sequence the work to enable ROW Certification.
	Due to the large number of parcels and businesses, the condemnation process may have to be used to acquire R/W, which could delay start of construction by up to one year, increasing construction costs and extending the time for COS.	Mitigate: Work with Right-of-Way and Project Management to prioritize work and secure additional right-of-way resources to reduce impact.
Construction	Hazardous materials encountered during construction will require an on-site storage area and potential additional costs to dispose.	Accept: Ensure storage space will be available.
	Unanticipated buried man-made objects uncovered during construction require removal and disposal resulting in additional costs.	Accept: Include a Supplemental Work item to cover this risk.

7-3 Responding to Risks

Following identification and analysis of project risks, the PRMT takes action in response to the risks to improve the odds in favor of project success. Ultimately, it is not possible to eliminate all threats or take advantage of all opportunities – but they will be documented to provide awareness that they exist and have been identified. Successful risk response will change the risk profile through the project life cycle, and risk exposure will diminish.

Risk response involves:

- The PRMT determining which risks warrant a response and identifying which strategy is best for each risk.
- Assigning an action to the Risk Owner to identify options for reducing the probability or impacts of each risk. The Risk Owner takes the lead and can involve experts available to the project.
- Evaluating each option for potential reduction in the risk and cost of implementing the option.
- Selecting the best option for the project.
- Requesting additional contingency, if needed (for guidance, refer to Appendix "A" of Project Delivery Directive *PD-04 "Project Contingencies and Supplemental Work"*).
- Assigning an action to the Risk Owner to execute the selected response action. The Risk Owner is the lead and may assign specific tasks to other resources to have the response implemented and documented.

If the PRMT judges that a risk should be accepted, it may assign an action to the Risk Owner to prepare a contingency plan if deemed necessary.

A RISK PERSPECTIVE CAN ENHANCE DECISIONS

When considering risk mitigation methodology, it is important to recognize the impacts of the decision. The impact of responding to a risk may make sense in the short term (e.g. Saves design costs, allows team to meet schedule), but the impact of the risk needs to be taken as a whole.

For example, the impact of just a few unknown conditions can affect the construction schedule to the point where an environmental work window requires the project to be suspended. It is important to recognize how much of an impact there would be in making a decision. While the direct cost of resolving the unknown condition may be less than the cost of a site visit, the overall impact of the change may be a significant delay to the contract if not recognized.

7-4 Entering Risk Responses into the Risk Register

The risk response action for each risk is entered into the "Response Actions" column of the risk register.

Chapter 8 Risk Monitoring

Continuous monitoring by the project risk manager and the project team ensures that new and changing risks are detected and managed and that risk response actions are implemented and effective. Risk monitoring continues for the life of the project.

Risk monitoring and control keeps track of the identified risks, residual risks, and new risks. It also monitors the execution of planned strategies for the identified risks and evaluates their effectiveness.

Risk monitoring and control continues for the life of the project. The list of project risks changes as the project matures, new risks develop, or anticipated risks disappear. Risk ratings and prioritizations can also change during the project lifecycle.

Typically, during project execution, risk meetings should be held regularly to update the status of risks in the risk register, and add new risks. Periodic project risk reviews repeat the process of identification, analysis, and response planning.

If an unanticipated risk emerges, or a risk's impact is greater than expected, the planned response may not be adequate. The project manager and the PRMT should perform additional responses to control the risk.

Monitoring also determines whether:

- The PRMT is performing periodic risk review and updating
- Risk management policies and procedures are being followed
- The remaining contingency reserves for cost and schedule are adequate

And it may involve recommending:

- Alternative risk responses
- Implementing a contingency plan
- Taking corrective actions
- Changing the project objectives

1-1 Risk Review and Updating

Periodically, the PRMT will convene to review the project's risk register and risk response actions, and to update project risk information.

Before updating the register and recording changes, the project risk manager should make a copy of the risk register for the project files, noting its data date. The set of risk registers will document how risks have changed over the life of the project and provide an audit trail should it be required.

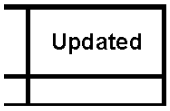
The review tasks of the PRMT include the following:

- Identify, analyze, and plan response actions for newly arising risks, and add them to the risk register.
- Review the execution of risk response actions, and evaluate their effectiveness.
- Re-assess existing risks, verify that the assumptions are still valid, and modify the previous assessments as necessary.
- Assign additional risk response actions to the Risk Owner.
- Retire risks whose opportunity to impact the project has elapsed, or whose residual impact on the project is deemed to have reached an acceptable level.

The PRMT should discuss any risks for which response actions are not being carried out effectively or whose risk impact is increasing. If these cannot be resolved within the PRMT, they should be escalated to the project manager with recommendations for action.

1-2 Updating the Risk Register

Make any changes and additions to the risks and enter the revision date into the "Updated" column.



1-3 Lessons Learned

When a risk is retired, the PRMT will review the history of the risk to record any lessons learned regarding the risk management processes used. The team is essentially asking itself: "What, if anything, would we have done differently and why?"

The project risk manager will conduct a periodic review of all lessons learned with the PRMT.

Chapter 2 Communication and Accountability

Communication and consultation with project stakeholders and sponsors are crucial factors in undertaking good risk management and in achieving project outcomes that are broadly accepted. This helps everyone to understand the risks and trade-offs that must be made in a project and supports the project manager's efforts.

Regular reporting is an important component of communication. Reports on the current status of risks and risk management ensure that all parties are fully informed and understand the risks, thus avoiding unpleasant surprises.

The project risk manager will ensure that the risk management process is documented to ensure a clear audit trail.

RE-FILE HAND-OFF – A VITAL COMMUNICATION

Communication is important in risk management. Resolving uncertainties is easier and has less impact than resolving surprises later. A discussion of the project between the design teams and the construction teams is imperative in the successful management of risk in a construction project. It is important that both teams agree on what risk remains and commit to managing it throughout the project.

A project in District 4 was on an accelerated delivery schedule. Discussions between Design and Construction identified several issues that needed to be addressed. Most of this information was provided in the RE Pending file in some form, but the construction team could not prioritize their efforts without detailed discussions with Design.

2-1 Communication and Accountability Checkpoints

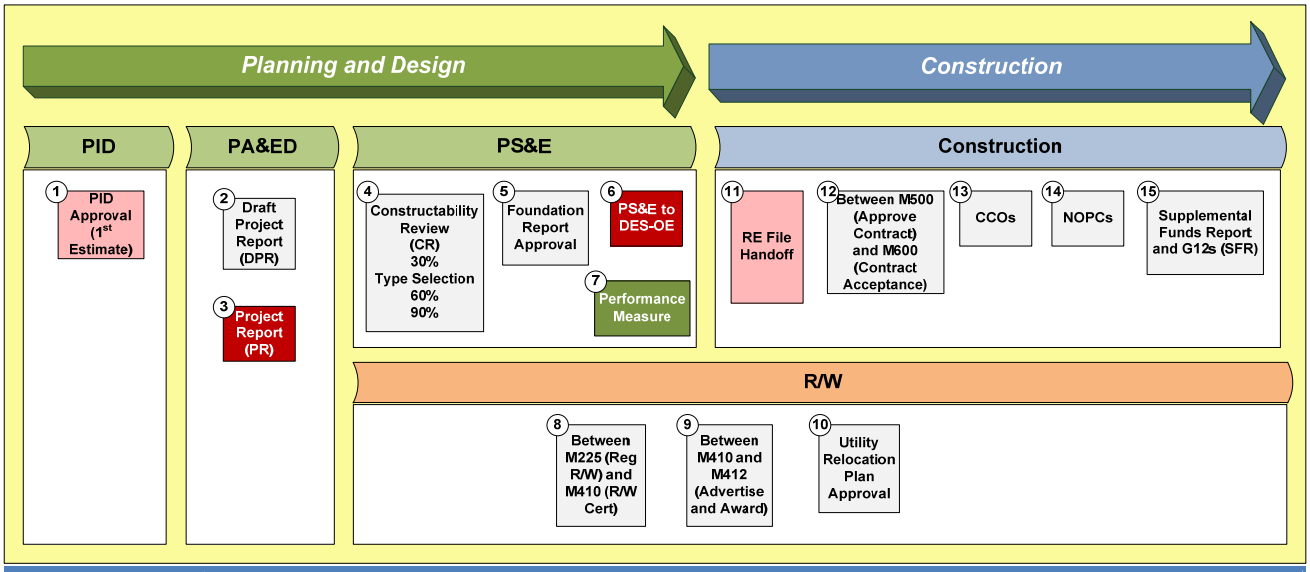
There are three kinds of checkpoints:

Communication – Where the current risk register is communicated to stakeholders, sponsors, and team members to make them aware of the current status of risks.

Accountability – Where the deputies sign off on the risks, indicating that they have reviewed the risks documented in the risk register and agree that they have been managed to the extent possible by the PRMT.

Performance Measure – Where the DES OE validates the required signatures and dates of the accountability checkpoints before RTL.

Figure 4 shows the checkpoints during the phases of a project's life cycle. Communication checkpoints are shaded gray and required accountability checkpoints are in red. PID Approval and RE File Handoff are recommended accountability checkpoints.



Project Phase	Checkpoint No.	Deliverable or Communication Checkpoint
PID	1	PID [Recommended Accountability Checkpoint]
PA&ED	2	Draft Project Report (DPR)
	3	Project Report (PR) [**Required Accountability Checkpoint**]
PS&E	4	30% Constructability Review (CR)
	4	Type Selection
	4	60% Constructability Review (CR)
	4	90% Constructability Review (CR)
	5	Foundation Report Approved (FR)
	6	PS&E to DES-OE [**Required Accountability Checkpoint**]
	7	Performance Measure
R/W	8	Between M225 (Regular R/W) and M410 (R/W Cert)
	9	Between M410 & M412 (Advertise and Award)
	10	Approved Utility Relocation Plan approval
Construction	11	RE File Handoff [Recommended Accountability Checkpoint]
	12	Between M500 (Approve Contract) and M600 (Contract Acceptance)
	13	CCOs
	14	NOPCs
	15	Supplemental Fund Request & G12's (SFR)

FIGURE 4 – COMMUNICATION AND ACCOUNTABILITY CHECKPOINTS

2-2 What Happens at a Communication Checkpoint

The current project risk register is submitted by the project manager at each checkpoint. The risk register with a cover sheet will serve as the risk communication medium for Level 1 and Level 2 projects. The cover sheet should summarize the changes to the risk register since the previous communication, such as:

- Changes in risk priorities,
- Risks that have been retired,
- New risks identified, and
- Risk response actions that have been completed.

Level 3 projects will require a more detailed report that includes the probability curves and their relation to project objectives and the risk outlook until the next review period.

2-3 What Happens at an Accountability Checkpoint

The project manager will schedule the meeting, or the Single Focal Point can arrange for multiple projects to be discussed in one meeting. The goal is for the deputies to review the project and its risks to ensure that the PRMT has managed the risks acceptably.

The project manager will create a Risk Register Certification Form to bring to the accountability checkpoint meetings for signature by the deputies. The signed form is kept in the project files for use at each accountability checkpoint and is submitted to the DES-OE at the performance measure checkpoint. The form is shown in Appendix B, and may be downloaded from: http://onramp/riskmanagement.

2-4 What Happens at the Performance Measure Checkpoint

The Design through Construction Subcommittee's Performance Measures Task Group developed a Performance Measure for Risk Management. It requires that at RTL, the DES-OE will validate the dates and signatures on the Risk Register Certification Form of the project.

Appendix A ACRONYMS AND DEFINITIONS

ACRONYMS

CCA	Construction Contract Acceptance
CCO	Contract Change Order
CCPSC	Caltrans Construction Partnering Steering Committee
CPM	Critical Path Method
CR	Constructability Review
DES	Division of Engineering Services
DOE	District Office Engineer
DPR	Draft Project Report
DRL	Dispute Resolution Ladder
EIR	Environmental Impact Report
EIS	Environmental Impact Study
ERM	Enterprise Risk Management
G12	General Delegation 12
HQ	Headquarters
NOPC	Notice of Potential Claim
OE	Office Engineer
PCR	Project Change Request
PDD	Project Delivery Directive
PDT	Project Development Team
PID	Project Initiation Document
PM	Project Manager
PMBOK	Project Management Body of Knowledge
PR	Project Report
PRM	Project Risk Manager
PRMT	Project Risk Management Team
PSR	Project Study Report
PA & ED	Project Approval and Environmental Document
PS & E	Plans, Specifications, and Estimates
RC	Risk Cost
RE	Resident Engineer
RMP	Risk Management Plan
R/W	Right of Way
RTL	Ready to List
SFP	Single Focal Point (PM District Deputy Director)
SFR	Supplemental Funds Report
TRO	Time Related Overhead

DEFINITIONS

Accountability Checkpoint	Points in time during the project life cycle where a formal sign-off will occur. Sign-off signifies that there is an understanding and acceptance of the risks moving forward into the next phase of the project.
Communication Checkpoint	A point in the project life cycle where risks are communicated to stakeholders, sponsors, and team members.
Dispute Resolution Ladder	Outlines when and how a dispute will be elevated and subsequently resolved.
Enterprise Risk Management	The methods and processes used by organizations to manage risks, identify threats, and seize opportunities related to the achievement of their objectives.
Project Life Cycle	All phases of project delivery from project initiation to project close-out.
Project Objectives	The agreed-upon delivery targets, such as cost, time, scope, or quality.
Project Risk	An uncertain event or condition that, if it occurs, has a positive or a negative effect on at least one project objective.
Project Risk Management	A process for identifying, communicating, and managing project risks through all phases of project delivery.
Project Risk Manager	Facilitates the risk management process and acts as gatekeeper for the risk register.
Qualitative Risk Analysis	The process of prioritizing risks.
Quantitative Risk Analysis	The process of probabilistically analyzing the cost and time effects of identified risks on overall project objectives.
Risk	An uncertain event or condition that, if it occurs, has a negative or positive effect on at least one project objective.
Risk Cost	The probability distribution of the total cost of all risks in the project risk register.
Risk Management Performance Measure	A checkpoint where the SPF reviews each project and its risks to ensure that the PDT has adequately responded to the highest priority risks.
Risk Owner	A member of the PRMT to which the risk is assigned.
Risk Register	A document (typically a spreadsheet) that contains the results of a qualitative risk analysis and/or a quantitative risk analysis and a risk response.
Risk Response	Actions taken to enhance opportunities and reduce threats to the achievement of project objectives.
Scalable Approach	Provides the minimum level of effort of project risk management that is appropriate to a particular project depending on its size and complexity.
Time Related Overhead	Overhead costs primarily proportional to the time to perform work.
Time Related Overhead Plus	The direct costs associated with time.

Appendix B RISK MANAGEMENT PLAN TEMPLATE

Download this template from: http://onramp/riskmanagement.

Risk Management Plan

Purpose

This document describes how Risk Management will be structured and performed on this project. The risk management plan includes methodology, roles and responsibilities, budgeting, timing, risk categories, definitions of risk probability and impact, probability and impact matrix, stakeholder tolerances, reporting formats, and tracking. The Caltrans' Project Risk Management Handbook: A Scalable Approach Handbook will be utilized as primary reference and guideline.

Project Name:	
Agency:	
Project ID/EA:	
District:	
County/Route/Post Mile:	
Project Sponsor:	
Project Manager:	
Date:	
Version:	

Risk Management Plan Approval

The undersigned acknowledge they have reviewed the Risk Management Plan for the above-mentioned project. Changes to this Risk Management Plan will be coordinated with and approved by the undersigned or their designated representatives. [List the individuals whose signatures are desired. Examples of such individuals are typically the Project Manager and the Project Sponsor. Add additional lines for signature as necessary. Although signatures are desired, they are not always required to move forward with the practices outlined within this document.]

Signature: _____ Date: _____
Print Name: _____
Title: _____
Role: _____

Signature: _____ Date: _____
Print Name: _____
Title: _____
Role: _____

Version History

[Provide information on how the development and distribution of the Risk Management Plan up to the final point of approval was controlled and tracked. Use the table below to provide the version number, the author implementing the version, the date of the version, the name of the person approving the version, the date that particular version was approved, and a brief description of the reason for creating the revised version.]

Version #	Implemented By	Revision Date	Approved By	Approval Date	Reason for Revision
1.0	*<Author name>*	*<mm/dd/yy>*	*<name>*	*<mm/dd/yy>*	Initial Risk Management Plan draft
1.1	*<Author name>*	*<mm/dd/yy>*	*<name>*	*<mm/dd/yy>*	*<reason>*

Methodology

This section defines how risk management will be performed for this particular project. This Risk Management Plan does not contain any identified risks or their related risk response strategies. It simply describes how to approach, plan, and execute all activities related to managing risks for a particular project. Per section 1-4 of the new **Caltrans Project Risk Management Handbook: A Scalable Approach**, referred to as the Risk Management Handbook henceforth, the planned scalable level can be referenced here.

Roles and Responsibilities

This section describes the roles and responsibilities of the project team regarding risk management planning, risk identification, analysis, response planning, and monitoring and control. Refer to section 1-7, Roles and Responsibilities, of the Risk Management Handbook for details. Any additions or deviations from that section can be documented here.

Budget

This section outlines the budget allocated to performing risk management by the entire project team. The following table outlines what roles should be considered for this budget determination.

PM	@	_____	Hrs
PMSU	@	_____	Hrs
District Risk Mgmt Coordinator	@	_____	Hrs
Project Risk Manager	@	_____	Hrs
Environmental	@	_____	Hrs
Design	@	_____	Hrs
R/W	@	_____	Hrs
DES/Structure	@	_____	Hrs
Construction	@	_____	Hrs
Traffic Operations	@	_____	Hrs
Maintenance	@	_____	Hrs
_____	@	_____	Hrs
_____	@	_____	Hrs
Total:		_____	Hrs

___Hrs. × $ ____ /Hr =

A total of $ _____ is allocated for Risk Management on this project.

Risk Management Schedule

Meetings for the purpose of discussing and making decisions on Project risk will be held:

Weekly _____ Bi-Weekly _____ Monthly _____ Other_____

The risk management identification, analysis and response planning process shall occur throughout the entire lifecycle of a project; from PID through Construction, including closeout.

Definitions of Probability and Impact

Refer to section 1-5 of the Risk Management Handbook for additional details on this subject. The table shown in this section can vary from project to project. Make sure to discuss the proposed changes to the probability and impact ratings definitions with the project sponsor and receive their concurrence. A modified copy of the table shown in section 1-5 can be actually inserted in this section of the Risk Management Plan.

Stakeholder tolerances for Risk

This section describes the tolerance level of the project sponsor(s), in terms of risk, to show those stakeholders based on their level of influence on the program in generating and responding to program risk. It also considers the organization's culture regarding risk management.

Risk Reporting and Formats

This section describes the risk related reports, and their format, that will be used to communicate the project risks to the interested project sponsors as well as stakeholders. Typically a copy of the Risk Register template can be attached to this Risk Management Plan. The timing of disseminations of such reports should also be contained in this section.

Risk Tracking

This section describes the process to follow to track identified risks and to recognize any new risks that may affect the program. It also describes how the program's risk management process will be audited and the frequency of the audits, as well as the process to document lessons learned based on the program's risk management activities.

Appendix A: References

The following table summarizes the documents referenced in this document.

Document Name and Version	Description	Location
<Document Name and Version Number>	*[Provide description of the document]*	*<URL or Network path where document is located>*

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Appendix C RISK REGISTER CERTIFICATION FORM

Download this form from: http://onramp/riskmanagement.

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

RISK REGISTER CERTIFICATION (ACCOUNTABILITY CHECKPOINTS)
Form PM-0001 (Rev. 03/03/2012)

The risk register is to be approved and signed-off by the deputies listed below for all scalability levels. By signing this form, you are certifying that you have reviewed the risks documented in the register and agree that they have been managed to the extent possible by the PDT.

Project Information

District-EA _____
Project Description _____
Project Risk Manager _____
(same as PM for Risk Level 1&2 Projects)
Project Manager (PM) _____

PID (Recommended)

Deputy Dist Director, Planning _____ Date: _____
Deputy Dist Director, Design _____ Date: _____
Deputy Dist Director, Proj. Management _____ Date: _____

PA&ED (Required)

Deputy Dist Director, Environmental _____ Date: _____
Deputy Dist Director, Design _____ Date: _____
Deputy Dist Director, Proj. Management _____ Date: _____

Prior to PS&E (Required)

Deputy Dist Director, Design _____ Date: _____
Deputy Dist Director, Construction _____ Date: _____
Deputy Dist Director, Right of Way _____ Date: _____
Deputy Dist Director, Environmental _____ Date: _____
Deputy Dist Director, Proj. Management _____ Date: _____
Project Manager _____ Date: _____

RE File Hand-off (Recommended)

Deputy Dist Director, Design _____ Date: _____
Deputy Dist Director, Construction _____ Date: _____
Deputy Dist Director, Proj. Management _____ Date: _____

Appendix D PD-09 PROJECT RISK MANAGEMENT

Download the directive from: http://onramp/riskmanagement.

California Department of Transportation

Project Delivery Directive

TITLE: Project Risk Management

To: *Project Delivery Employees*

Number: PD-09
References: Project Risk Management Manual: A Scalable Approach

Effective Date: July 1, 2012

Supersedes: Richard D. Land Memo May 2, 2007, Carlton L. Haack Memo April 7, 2004, J. Mike Leonardo March 30, 2004 Memo *Implementation of Project Risk Management in Project Delivery*

Review by: July 1, 2015

DIRECTIVE

Risk management shall be applied to all capital and major maintenance projects for which the Department has delivery responsibility. The minimum risk management requirements based solely on the total project cost are:

Estimated Cost (Capital and Support)	Risk Management Requirements
Minor A, Minor B and other projects less than $1 million	Risk register encouraged
<$5 million	Risk register
$5 million to $100 million	Risk register with qualitative analysis
>$100 million	Risk register with quantitative analysis

However, the project's overall complexity should determine the Risk Management Requirements for that project. Project-specific changes to the above minimums must be approved by the District Deputy Director for Program/Project Management. The risk register shall be maintained throughout the project's lifecycle. Each functional unit shall include the project risk management requirements into their guidance and manuals by July 1, 2013.

BACKGROUND

Every project has risks, regardless of project size or complexity. Risks have negative or positive effects on at least one project objective (cost, time, scope, and quality). Unfortunately, known risks are often not communicated to the next phase of project delivery. Project Risk Management (PRM) minimizes surprises that impede successful project delivery through effective communication of risks throughout the delivery process.

Project delivery success can be increased by establishing and maintaining a risk register over the project lifecycle. The risk register accountability checkpoints communicate project risks and responses forward through the project delivery phases such that risks are known, understood and managed.

The *Project Risk Management Handbook: A Scalable Approach* is the new user guide for implementing PRM: http://onramp/riskmanagement. It is a "how to" guide for all project team members to use across all phases of project delivery. In addition to the new handbook, risk management training and subject matter experts are available to assist project teams in successfully implementing project risk management.

DEFINITIONS

Project Risk Management (PRM) is a process for planning for, identifying, analyzing, communicating, managing and responding to project risks through all phases of project delivery.

Scalable Approach to project risk management provides the level of effort that is appropriate to a particular project depending on its size and complexity.

Risk is an uncertain event or condition that, if it occurs, has a negative (threat) or positive (opportunity) effect on at least one project objective.

Project Objectives are the agreed-upon delivery targets such as cost, time, scope and quality.

Risk Register is a document (typically a spreadsheet) that contains a list of identified risks, the results of a qualitative risk analysis and/or a quantitative risk analysis, the risk owners and an agreed-upon risk response strategy.

Qualitative Risk Analysis is the process of prioritizing risks.

Quantitative Risk Analysis is the process of numerically (costs or time) analyzing the effect of identified risks that have been prioritized by the Qualitative Risk Analysis process on overall project objectives.

Risk Response is the actions to be taken to enhance opportunities and/or reduce threats to the achievement of project objectives.

Accountability Check-Points are critical points during the project development phases where a formal sign-off (as described under *Responsibilities*) occurs. Sign-off signifies that there is an understanding and acceptance of the risks moving forward through the project

Project Lifecycle includes all of the phases of project delivery from project initiation to project close-out.

RESPONSIBILITIES

Chief Engineer:

- Issues Project Risk Management (PRM) policy.

Chief, Division of Project Management:

- Leads, champions, sponsors and implements PRM by developing and maintaining, policies, guidance (including the *Project Risk Management Handbook: A Scalable Approach*), procedures, practices, training and expertise.
- Provides Headquarters risk management coordination.
- Supports the District Risk Management Coordinators.
- Ensures consistent application of risk management practices.
- Facilitates procurement of risk management specialists as needed.

Chief, Divisions of Construction, Design, Engineering Services (DES), Environmental Analysis, Right of Way and Land Surveys, and Planning:

- Ensure that PRM requirements are inserted into their guidance and manuals.
- Work together to ensure that risks are communicated and signed-off across the entire project lifecycle.

District Directors:

- Ensure that PRM is followed.
- Appoint District Risk Management Coordinator.

Deputy District Directors and DES Deputy Division Chief Program/Project Management (Single Focal Points):

- Ensure PRM has the resources required to achieve the desired results.
- Ensure Project Managers comply with PRM.
- Ensure risks are communicated at the check points.
- Sign-off at accountability check points, accepting the disposition of risks.
- Approve exceptions to project risk management requirements.

Deputy District Directors, Project Delivery and Engineering Services Deputy Division Chiefs:

- Work together to ensure risks are being communicated and signed-off across the entire project lifecycle.
- Ensure functional units communicate and update their risks at the communication and accountability check points.
- Sign-off at communication and accountability check points, accepting the disposition of the risks.

Functional Managers:

- Review all risks designated "high risk."

Project Managers:

- With input from the Project Development Team (PDT), determine the project's risk register requirements based on project estimate and complexity.
- Promote and direct risk management for the project.
- Request project-specific changes to minimum risk management requirements.
- Populate and maintain the project risk register with risks developed by functional units and the PDT.
- Ensure proactive response to all risks and opportunities that will impact the successful delivery of the project.
- Produce risk management reports for sponsors.
- Inform Department management about risk management results, major issues and concerns.
- Schedule and conducts project risk meetings.
- Monitor and update risks.
- Ensure quality of the risk data in the risk register.
- Track and monitor the effectiveness of risk response actions.
- Elevate issues to district management for resolution as necessary.
- Take lead role in obtaining signoffs at accountability check points.

District Risk Management Coordinators:

- Assist Project Managers implementing PRM requirements.
- Provide expertise, direction and assistance.
- Obtain expert services as needed.
- Liaison with Headquarters risk management.

Project Risk Managers:

- Promote and direct risk management for the project.
- Schedule and conduct project risk meetings.
- Perform risk monitoring and updating.
- Ensure quality of the risk data in the Risk Register.
- Document risk response actions.
- Track and monitor the effectiveness of risk response actions.
- Report to the Project Manager on all matters related to risk management.

Project Risk Managers, continued:

- Accumulate the lessons learned in the area of risk management.
- Produce risk management reports for PM.
- Populate the project risk register with risks developed by functional areas.

Project Delivery Team Members and Task Managers:

- Identify and assess risks and determine the risk owners.
- Develop responses to risks.
- Document risk response actions and report to Project Managers for inclusion in risk management updates.
- Communicate new risks to Project Managers.
- Retire risks.

Appendix E PROJECT RISK MANAGEMENT STRUCTURE

Project Risk Management Elements

Project risk management includes the following program elements. Each element is important to developing effective project risk management on Caltrans projects.

- A scalable project risk management process - three levels of effort based on the size and complexity of the project
- Clear communication and accountability checkpoints so that project delivery is seen as one process across multiple functions
- A new updated "how-to" style handbook
- Incorporation of project risk management into the existing Functional Units' guidance
- Project Delivery Directive (PD-09) and policies for implementation
- Training and subject matter experts from Headquarters and Districts

Project Risk Management Overview

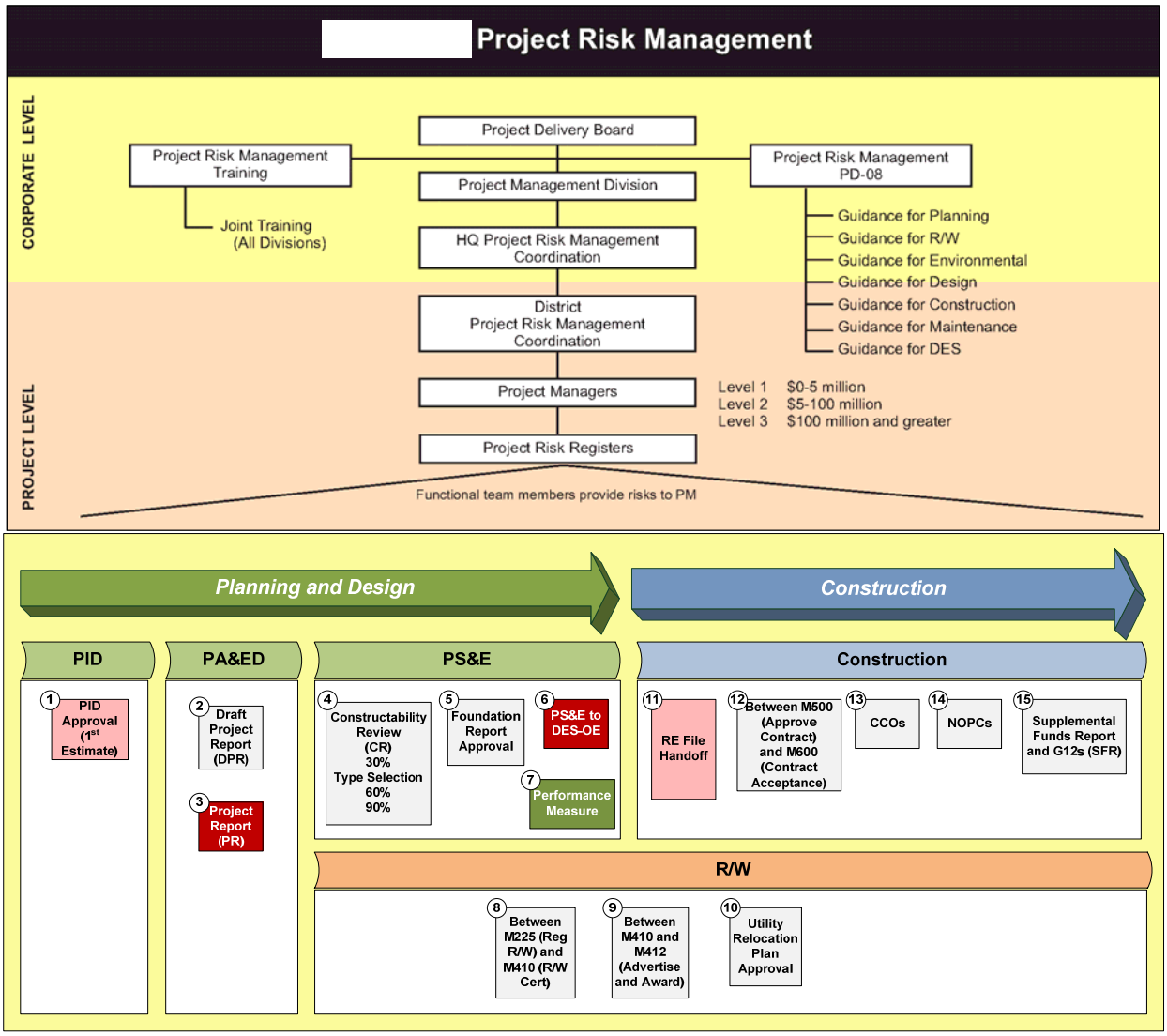

Figure 5 is an overview of the Project Risk Management structure. It is divided into two levels: Corporate and Project.

Corporate Level

The corporate level illustrates how project risk management is overseen by the Project Delivery Board, as they are responsible for the successful delivery of projects. The Project Delivery Board and the Chief Engineer have developed PD-09 as their project risk management policy that is to be carried out. All Guidance for Project Delivery Functions are expected to incorporate the project risk management policies and requirements as outlined in this handbook. Training in project risk management will be developed and made available to all of those affected by the new requirements.

The Project Management Division is responsible for facilitating the risk management process and ensuring that risks are managed on projects. Project Management Division is responsible for providing Headquarters Project Risk Management Coordination (expertise) to projects and District Project Risk Management Coordinators.

Project Level

Each District will provide risk management expertise through a District Risk Management Coordinator who will assist project teams in the implementation of the project risk management process. At the inception of risk management for a project, the project team will determine the project's scalability level as Level 1, 2, or 3. The requirements for each level are presented in Chapter 1, Section 1-4.

The project manager facilitates the development and management of a risk register from Planning and Design phases through the Construction phase. The gray boxes on the chart indicate where the communication points are to occur. The red boxes are accountability check points where a formal sign-off must occur. The green box indicates where the Design through Construction Performance Measure will occur. This measure ensures that the project risk management process has been followed for the project.

Project managers are not expected to identify all of the risks by themselves. The Project Risk Management Team (comprised of members of the PDT) will work together to identify the project risks, populate the risk register, and manage the risks until completion of construction. Managing risks in a workshop environment will ensure that all members of the team understand the risks and their potential impact on their functional areas.

The Project Risk Management Team is expected to stay together to manage risks until project completion.

NOTES:

NOTES: