

Current ODOT Risk Management Practices and Recommendations to Support Transportation Asset Management Plan Development

FINAL WHITE PAPER

**Prepared for the:
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1. Introduction

The Oregon Department of Transportation (ODOT) is in the process of preparing its Transportation Asset Management Plan (TAMP) in anticipation of the April 2018 deadline for submitting the TAMP to the Federal Highway Administration (FHWA). One required element of the TAMP is a description of the agency's risk management process. ODOT seeks to assess and improve its current process for managing asset-related risks. These improvements will help ODOT meet the federal requirements for TAMP development, as well as improve its business processes.

This white paper:

- Summarizes the current policies, procedures, and practices for asset management risk analysis, as well as major risks to ODOT assets identified by agency staff;
- Identifies gaps in ODOT's practices relative to the TAMP requirements; and
- Recommends approaches to address the gaps.

2. Background

Managing transportation assets entails managing risk. This includes day-to-day concerns, such as addressing the risk that assets will deteriorate faster than expected or the risk that projects will cost more than budgeted, as well as low-probability events that may trigger asset failure. Asset failures can be caused by: natural disasters, such as floods or earthquakes; accidents, such as oversize trucks or barges striking bridges; or intentional events, such as arson or terrorism. Climate change is a looming issue that tends to exacerbate other risks through sea level rise, increased temperatures, and increased frequency of extreme weather events.

This section provides definitions of risk and risk management, details on the federal requirements for risk management in the TAMP, and a brief overview of risk management concepts.

2.1 Definitions and Requirements

FHWA defines risk and risk management, in the context of transportation asset management, as follows:

RISK

“The positive or negative effects of uncertainty or variability upon agency objectives.” (23 C.F.R. 515.6)

RISK MANAGEMENT

“The processes and framework for managing potential risks, including identifying, analyzing, evaluating, and addressing the risks to assets and system performance.” (23 C.F.R. 515.6)

Note that risk is defined as both the positive and negative effects of uncertainty. While it is true that uncertainty can yield positive outcomes, the discussion that follows in this white paper is focused largely on identifying and mitigating the negative effects of uncertainty and variability.

FHWA requires that States establish a risk management process in developing their TAMP. Specific requirements for the process are:

Risk Management Process Requirements (23 C.F.R. 515.7)

- Identification of risks that can affect condition of National Highway System (NHS) pavements and bridges and NHS performance.
- Assessment of the identified risks in terms of the likelihood of their occurrence and their impact and consequence if they do occur.
- Evaluation and prioritization of the identified risks.
- Mitigation plan for addressing the top priority risks.
- Approach for monitoring the top priority risks.
- Summary, for NHS pavements and bridges, of the evaluations of facilities repeatedly damaged by emergency events.

Concerning what risks should be addressed in the process, the requirement states that the process should include “...risks associated with current and future environmental conditions, such as extreme weather events, climate change, seismic activity, and risks related to recurring damage and costs as identified through the evaluation of facilities repeatedly damaged by emergency events...Examples of other risk categories include financial risks such as budget uncertainty; operational risks such as asset failure; and strategic risks such as environmental compliance.” Note that the evaluation of facilities repeatedly damaged by emergency events is detailed under a separate regulation, 23 C.F.R. 667, and a summary of this evaluation should appear in the TAMP.

2.2 Risk Management Overview

Considering risk is important in developing a TAMP not simply because of the requirements described in the previous section, but also because transportation agencies often must spend significant resources responding to and/or mitigating risks. Reacting to the uncertainty presented by risks can be more expensive than proactive management. Risk management strengthens asset management by explicitly recognizing that any objective faces uncertainty, and identifying strategies to either reduce uncertainty or its effects. Being proactive rather than reactive in managing risk, and avoiding “management by crisis”, helps agencies to best use available resources to minimize and respond to risk, as well as to further build public trust.

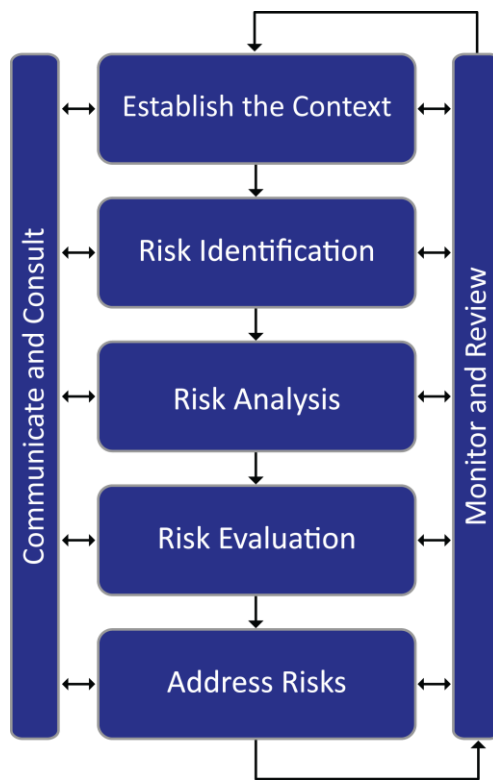
Given the importance of risk management for supporting asset management, ideally an asset owner should identify and manage risks at all organizational levels. Figure 1 shows four levels at which risks can be identified within an agency and the individuals who may be responsible for the risks at each level. (This figure is reproduced from the final report for National Cooperative Highway Research Program (NCHRP) Project 08-93, which is scheduled to be published as the American Association of State Highway and Transportation Officials (AASHTO) Guide for Enterprise Risk Management.) Typically, agencies are well-equipped to handle risks at the project and activity levels. It is the enterprise and program level risks that often need further management and attention.



Source: NCHRP Project 08-93 Final Report (2016)

Figure 1. Levels of Risk within an Organization

Figure 2 depicts an idealized risk management process. While it may not be necessary to walk through each discrete step in this process for every risk an agency faces, this process is helpful for ensuring that the FHWA requirements for risk management in the TAMP are met.



Source: Adapted from FHWA, *Incorporating Risk Management into Transportation Asset Management Plans: Interim Document (2017)*

Figure 2. Risk Management Process

The process starts with **establishing the context** for risk management. In the case of risk management for a TAMP, the context is largely defined through other TAMP development steps.

The second step involves **identifying the risks** that can affect the conditions of pavements and bridges. Ideally, in this step the agency considers the full set of asset-related risks, even those that may appear insignificant.

The third step - **Risk Analysis** involves identifying the cause of the risk, the outcomes or consequences, and the likelihood of the risk occurring.

The fourth step - **Risk Evaluation** entails prioritizing and ranking risks.

Fifth, the **Address Risks** step is the response the agency takes to the risk. DOTs can choose to tolerate the risk or treat the risk in some manner.

The left side of the figure shows a continuous **communication and consultation** activity. Agencies need to communicate the risks to both internal and external stakeholders, as well as monitor and review the risks.

The right side of the figure shows an iterative **monitoring and review** process. Once the risks are identified, analyzed, and a mitigation plan is in place agencies need to monitor the risks and update the risk management documentation accordingly.

3. Summary of Current Policies, Procedures, Practices, and Issues

ODOT has a number of robust procedures and practices already in place to identify, analyze, evaluate, address, and communicate risks faced by the organization. On September 12th and 13th, 2017 the consultant team met with individuals from different business areas to learn about ODOT's current risk management efforts and discuss risk-related issues of concern. This section summarizes ODOT's existing activities, with a focus on risks relevant to the TAMP. Although the scope of risk management defined in the TAMP requirements is very broad, there are nonetheless many risks ODOT faces that are outside of this scope. While some of these "out of scope risks" were covered in discussions, they have been omitted from this white paper.

The remainder of this section is organized into the following sections:

- Bridge
- Pavement
- Environment
- Economic and Financial
- Organization and Leadership
- Other Tier 1 Assets

Each section identifies the key risks and concerns in the specific area and summarizes the existing work to address the risks. Note that there is some overlap across asset groups with respect to risks they are considering. For example, seismic risk is handled by both Bridge Engineering and those working on environmental issues.

In addition to the risk management work done in various groups across the organization, ODOT staff also developed a draft risk register. This was reviewed at the on-site interviews and is discussed further in the Gaps and Recommendations section.

3.1 Bridge

ODOT's Bridge Section is responsible managing the Oregon bridge inventory, and has performed extensive work to inspect the State's bridges, identify investment needs, and develop strategies for mitigating specific types of risks. Bridge conditions are summarized in the 2016 Bridge & Condition Report. This report identifies distressed bridges, which are bridges that are in poor condition or that have deficiencies on one of the following areas:

- Bridge Rail
- Cathodic Protection
- Load Capacity
- Low Service Life
- Movable Bridge
- Other Geometric Clearances (Deck Geometry)
- Paint
- Scour
- Timber Structures (Substructure)
- Vertical Clearance

The Bridge & Condition Report describes ODOT's process for routine bridge inspection, and its programs for bridge preservation, rehabilitation and replacement. Supplementing these activities, the Bridge Section has focused additional attention on risks related to four key areas: decks; corrosion on steel bridges and reinforced concrete bridges; fatigue cracking on steel bridges; and scour. In each of these areas, ODOT has identified bridges at increased risk and developed a mitigation plan identifying priorities for treatment. For instance, for addressing fatigue cracking, ODOT has performed supplemental bridge inspections of fatigue prone areas on its steel bridges, and has prepared a mitigation plan based on the inspections.

To continue to assess and monitor risks in these areas, ODOT is in the process of developing a watch list of bridges that are in need of long-term oversight. The goal of this list is to have all the information about the bridges in a central location that is available to anyone who needs it. The integrated list will replace the current set of risk-specific lists maintained by individual engineers.

Another area where ODOT has made progress is in assessing seismic risk to bridges. The agency performed a complete vulnerability assessment of its bridge inventory, and determined the funding necessary to address all the resiliency issues in the network. The 2014 *Oregon Highways Seismic Plus Report* describes the assessment, and includes a five-phase approach for performing all the necessary retrofitting

work. Because the cost of performing all of the seismic retrofit work identified in the plan would be prohibitive, the initial emphasis is on performing seismic retrofits for selected bridges to secure key lifeline routes in the event of a major earthquake.

Other potential risks to ODOT bridges identified by Bridge Section staff include:

- Bridge hits
- Construction defects
- Increased deterioration due to winter maintenance
- Increased deterioration from increases in truck sizes and weights; and
- Potential for reductions in bridge maintenance and rehabilitation funding to address capacity needs.

Who is Responsible?

Responsibility for bridge-related risk lies with the Bridge Section. Within this section the Bridge Engineering Unit is charged with developing mitigation plans for specific types of distresses.

3.2 Pavement

ODOT's Pavement Services Unit is responsible for pavement management and a variety of related activities. This unit has worked extensively to develop ODOT's pavement management system (PMS) and annually updates condition data, treatment assumptions, and deterioration rates in the system to reflect the best available data. The PMS is used routinely to analyze future conditions and forecast impacts of different funding scenarios. One such analysis is detailed in the recent ODOT report *Rough Roads Ahead 2: Economic Implications of Deteriorating Highway Conditions* published in February 2017.

The Pavement Services Unit attempts to address as many different risks to pavement as possible programmatically in the PMS. For instance, risks of accelerated deterioration of pavement are handled through the annual process of reviewing data on ODOT pavement conditions and the treatment assumptions and deterioration models in the PMS. Thus, the discussion with Pavement Services on September 13th focused on non-programmatic risks to pavement - those outside the scope of the PMS. One such risk is that although the TAMP is intended to address the entire NHS, a portion of the NHS in Oregon is owned by other agencies besides ODOT. While the non-state-maintained portion of the NHS represents a relatively small portion of system, there is a risk that a lack of asset management on off-system NHS roads will impact the overall pavement condition and the ability of the agency to meet the targets set forth in the TAMP.

Another risk is that despite the best efforts of ODOT staff, there is significant uncertainty in projections of future pavement conditions. While staff is fairly confident in the projection of conditions up to eight years in the future, there is less confidence in projections beyond eight years. ODOT attempts to mitigate this risk through annual updates of its pavement models and modeling assumptions, as described above.

Finally, pavement faces the risk of decreased or inadequate funding and project cost escalation. There is uncertainty around the funding received for pavement that contributes to this risk. To the degree possible, Pavement Services mitigates this risk by developing policy statements on how money is allocated and spent within the program. There is also a working group that assesses projects and works to address issues around project cost.

Who is Responsible?

The PMS and risks related to pavement are managed by the Pavement Services Unit.

3.3 Other Tier 1 Assets

ODOT's other Tier 1 assets besides pavement and bridges include culverts, tunnels, traffic signals, and ADA curb ramps. Tier 1 assets are the top priority assets for ODOT determined through criteria that includes: asset value; criticality for highway core, operations, accessibility, safety; risk and consequence; and criticality of stewardship and attention to status or condition. Although these assets may not be included in the TAMP submitted to FHWA in 2018, risks related to these assets are nonetheless relevant to the TAMP to the extent resources otherwise used for pavements and bridges may be required to mitigate Tier 1 asset risks. Further, ODOT expects that these assets may be included explicitly in future TAMPs.

Risks identified by staff responsible for these assets can be classified into three basic categories:

- **Asset failure.** Unexpected asset failures may require diversion of funds from other programs. Failures such as downed signs and rock falls are routine occurrences, and handled through day-to-day maintenance. However, increases in asset failure rates caused by factors such as aging infrastructure may require additional resources to address.
- **Lack of quality asset data.** It can be a challenge to obtain funding needed to collect and maintain asset data. This concern extends to all of ODOT's assets, not just the Tier 1 assets. Data collection and maintenance requires sustained investment in order to prevent data from aging and becoming

unusable. The lack of current, quality data can create uncertainty concerning what investments are needed, lead to inefficient decision-making, and contribute to incidence of unexpected asset failures.

- **Changes in standards/requirements.** When design standards or other requirements for an asset change, this may result in significant cost implications for ODOT. An example of this is ODOT's recent experience with ADA curb ramps. Many of the curb ramps on State-owned highways fail to meet current design standards. ODOT recently settled a lawsuit over this issue by committing to audit all curb ramps and pedestrian crossing signals along state highways, and then address all issues identified in the audit over the next 15 years.

Who is Responsible?

Responsibility for other Tier 1 asset is shared among the different asset owners.

3.4 Environment

A number of different efforts are underway in Oregon and at ODOT to address risks to the environment from the transportation system and risks to the system from environmental conditions. ODOT has assessed risks related to climate change in the *ODOT Climate Change Adaptation Strategy Report*. Risks considered in this report include coastal impacts, changes in vegetation and wildlife, wildfires, extreme storm events, flooding, changes in seasonal flow rates, landslides and rock falls, and population movement. Following preparation of this report ODOT performed a pilot vulnerability assessment on the North Coast of Oregon to identify specific improvements needed to address risks related to climate change.

Moving forward, the Sustainability Program under the Program Implementation and Analysis Unit is charged with providing leadership, policy analysis and technical support on sustainability-related issues, and is leading ODOT's climate change adaptation planning. This program is performing research related to green infrastructure techniques, coastal landslide and bluff monitoring, and landslide identification. Other efforts include work to map sea level rise, provide guidance for planning and project design teams, and document case studies on how communities in the State have prepared and adapted to the realities of climate change.

The Geo-Environmental Section is concerned with a number of environment-related risks. This section works with other Oregon stakeholders to address natural hazards statewide. Key risks noted in the meeting on September 13th that may impact the TAMP include risks of flooding and coastal erosion from storms or tsunamis. The

Oregon Natural Hazards Mitigation Plan (prepared by the State) assesses risks to Oregon from the following natural hazards:

- Coastal Hazards
- Droughts
- Dust Storms
- Earthquakes
- Floods
- Landslides
- Tsunamis
- Volcanoes
- Wildfires
- Windstorms
- Winter Storms

Who is Responsible?

Responsibility for environment-related risks is shared among multiple stakeholders, including the Sustainability Program under the Program Implementation and Analysis Unit of the Transportation Development Division, the Geo-Environmental Section in the Highway Division, and the individual asset owners.

3.5 Economic and Financial

The primary economic and financial risks for the TAMP are related to uncertainty of financial forecasts. Risks are accounted for in the State revenue projection and various mitigation actions were discussed in the on-site interview with ODOT staff. These include the need for adding confidence intervals to the forecasts, including alternatives in the forecast, investigating the possibility of improved tools for revenue projections, and updating the agency's accounting system.

There is also concern about the allocation of funds to the NHS. Regions do not have any spending requirements on the NHS which makes it difficult to ascertain how much money is spent on the NHS statewide. The group also identified a concern about legislative mandates and the prescriptive way the legislature spells out how the DOT can use certain funds.

Who is Responsible?

Dan Porter in the Program Implementation and Analysis Unit is responsible for developing the State revenue forecast. John Baker in the Director's Office is

responsible for developing the Federal revenue forecast. Stefan Hamlin in the Highway Program Office is responsible for developing the expenditure projections.

3.6 Organization and Leadership

ODOT's Executive Team and Human Resources staff both identified future loss of key staff as a major organizational risk. To address this risk, Human Resources has developed a *Succession Planning Guidebook* for ODOT managers. The guidebook helps managers identify critical positions within their team, assess their team's needs, and determine both position and employee competencies. Human Resources is also performing a pilot program in competency based performance related to this issue.

Another organization-related risk to the TAMP is that ODOT has a lean workforce, with limited capacity to meet the increasing need for project delivery and engineering. To mitigate the risk, ODOT is requesting additional project delivery staff from the legislature. The agency is in the process of expanding the transportation program to address this risk as well.

Staff also identified increased outsourcing as an organization-related risk to the TAMP. There is concern that contractors may not have the depth necessary to perform the needed work. In addition, it takes skills within ODOT to oversee contractors. Increased outsourcing also means that key knowledge now resides outside the agency and not with people on staff at ODOT.

Who is Responsible?

Responsibility for managing most organization and leadership-related risks lies with Human Resources and the Executive Team.

4. Gaps and Recommendations

As the preceding section describes, ODOT is currently engaged in a number of efforts to assess and mitigate risks to its transportation assets. However, several opportunities exist to improve risk management practices to best meet the federal requirements for risk management in the TAMP. The following are the gaps in current ODOT practices in risk management and recommendations to address the gaps.

Gap 1: Identification of Risk Management Process Owners

The first gap is in the identification of who is responsible for the risk management process. Currently risk is managed, to various degrees of formality, by different asset owners and other business units. However, John Baker who is based in the Director's Office, is responsible for preparing the TAMP, and thus for detailing ODOT's risk management process. Thus, there is some ambiguity as to which parties have which responsibilities regarding risk management.

Recommendation

We recommend that ODOT clarify responsibility for each step of the risk management process. Figure 3 illustrates an initial set of recommendations for responsibility for each step. In the figure, the TAMP Leadership Team is shown as being responsible for Establishing the Context; the asset owners are shown as being responsible for Risk Identification, Risk Analysis, Risk Evaluation, and Addressing Risks; the asset owners share responsibility of the Monitor and Review step with an Existing or Ad Hoc Committee; and finally an Existing or Ad Hoc Committee is responsible for Communication and Consulting.

The TAMP Leadership Team consists of the TAMP Coordinator, Asset Management Integration Program Manager, Asset Management Implementation Manager, the Bridge and Pavement Unit Managers, the STIP Fix-It Coordinator, as well as several other managers from various divisions within the agency. Since the context for risk management in the TAMP is largely defined through the broader TAMP development effort, this group should maintain that responsibility.

The asset owners should then identify, analyze, evaluate, and address risks in their asset group. Owners should also monitor the individual risks and update their processes over time. The asset owners and their risk management responsibility are as follows:

- Pavement Services Unit is responsible for pavement.
- Bridge Engineering is responsible for bridges and tunnels.

- Geo-Environmental Section is responsible for culverts, storm water, unstable slopes, material sources, and environmental threats.
- Traffic and Roadway Engineering is responsible for signs and signals.

Note that the Geo-Environmental Section is listed as an asset owner in this context, as this section helps manage various geotechnical assets, and has expertise on natural hazards such as flooding. Strictly speaking, the environment and natural hazards are not assets owned by ODOT, but in the context of risk management it appears this section is the ODOT unit best suited to assess these risks.

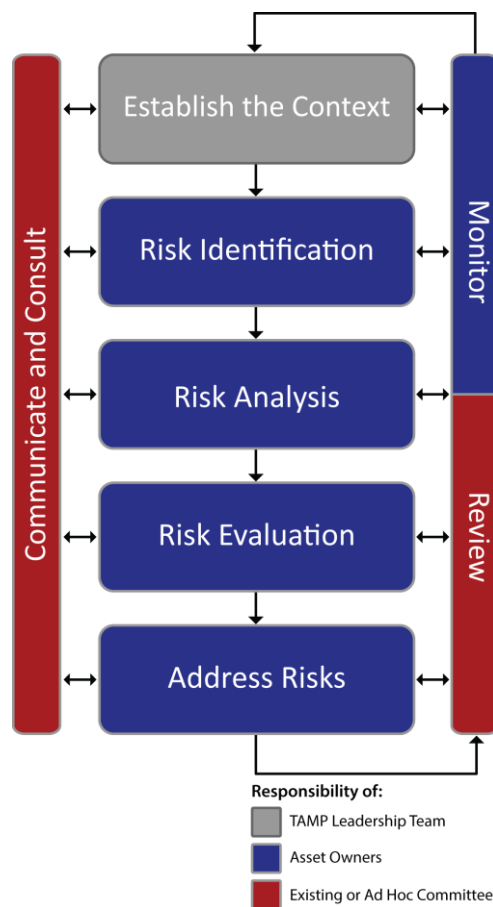


Figure 3. Risk Management Responsibility

Finally, this recommendation includes assigning responsibility for reviewing the risks and communicating the results to a committee with broad expertise on risks facing the agency. This could be an Ad Hoc Committee created expressly for this risk management effort or an existing committee assigned this additional responsibility. This committee should include, at a minimum, relevant asset owners, the Asset Management Integration Program Manager, the TAMP Coordinator, and any other

stakeholders involved in the risk management process including maintenance staff. This committee should meet at least once a year to review and update the risk register, ensure risk management is communicated appropriately in the TAMP, and report out to the Asset Management Executive Committee (AMEC). Specifically, the Committee should:

- Review the risks in the risk register. Are the risks classified properly? Are there any risks missing from the register? Are there any risks that should not be included in the register?
- Determine if there are risks across multiple assets that need to be addressed and discuss responsibility and mitigation strategies for these risks.
- Discuss risks and mitigation strategies that may require significant budget commitment.
- Review mitigation strategies. Are there any alternative or superior mitigation strategies? Are any strategies inadequate to fully address the risks? Are there opportunities for collaboration among asset groups to mitigate risks?
- Develop action items for asset owners to revise the risk register and contribute content for the Risk Management chapter of the TAMP.
- Report out to the Asset Management Executive Committee, providing information on the risks being managed and the mitigation strategies in place, especially highlighting any major risks that may require attention beyond the scope of the asset owners' responsibility.

While not shown in Figure 3, we recommend that the Asset Management Integration Program (AMI) also play a role in the risk management process. Since AMI already has a coordinating role within the agency, the program should also be responsible for coordinating the Ad Hoc Committee meeting. AMI should ensure that the appropriate people are in attendance and the risk register and mitigation strategies are prepared/ready for review at the meeting. AMI can also coordinate gathering the necessary pieces for drafting and updating the risk management section of the TAMP.

The approach recommended here is intended as a formalization of responsibility consistent with current ODOT practice. This delineation of responsibilities is also consistent with recent guidance on risk management. The final report for NCHRP Project 08-93 provides a list of the likely duties and responsibilities of asset owners managing risks. The list includes identifying, analyzing, evaluating, and addressing risks. The report also stresses that asset owners should monitor the individual risks and communicate the risks effectively to senior managers within the agency.

Gap 2: Improvement of the Risk Register

The draft risk register developed by ODOT staff addresses many of the requirements for risk identification. However, in order to produce a register that is fully compliant with the requirements, ODOT should supplement the register to include:

- Improved risk statements;
- Consensus on likelihood and impact of the risk; and
- Consensus on potential mitigation actions.

Recommendation

First, the columns of the risk register should be redefined as follows:

Risk Category	Risk Statement	Likelihood	Impact	Priority	Potential Mitigation Actions
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This redefines “Significance” in the draft register to “Impact” and it changes “Risk to Highway Infrastructure” to “Priority”.

Next, the risk register needs to have clear risk statements. Risk statements should consist of two elements: a description of the risk event, and a summary of its potential impact. For example:

Risk Event (if) *If ODOT does not plan for extreme weather events,*

Potential Impact (then) *then bridges, roadways, and structures will be damaged.*

Stating the risks in this way will help better define the risks and help in defining more focused mitigation strategies. In some cases, however, the process of clarifying the risk statements may result in identifying additional risks. For instance, though one may list “climate change” as a risk, in reality this term encompasses a number of different risks which may merit a variety of mitigation actions.

There may also be additional risks associated with maintenance and operations that need to be included in the risk register. Since maintenance and operations related risks were not the focus of the individual meetings held with different business areas within ODOT, additional attention may be needed to identify current practices in risk management for maintenance and add relevant risks to the register.

After the risks are identified with a risk statement, the risk register should include an “assessment of the identified risks in terms of the likelihood of their occurrence and their impact and consequence if they do occur” (23 C.F.R. 515.7(c)(2)). While the draft risk register includes Likelihood and Impact (labeled “Significance” in the draft register) ODOT can use a risk matrix, shown in Figure 4, to assign a risk priority.

This is one version of a risk matrix that can be used for this activity. Prior to assessment of the risks by individual risk owners, there should be consensus on a consistent approach for assigning likelihood and impact to risks.

Likelihood	Very High (>1x/Year)	Medium	Medium	High	Very High	Ultra High
	High (~1x/Year)	Medium	Medium	Medium	High	Very High
	Medium (1x/3 Years)	Low	Medium	Medium	High	High
	Low (1x/10 Years)	Very Low	Low	Medium	Medium	High
	Very Low (<1x/10 Years)	Very Low	Very Low	Low	Medium	Medium
	Very Low (Insignificant)	Low (Minor)	Medium (Moderate)	High (Major)	Very High (Catastrophic)	
			Impact			

Figure 4. Example Risk Matrix

Risk owners should then work within their individual asset groups to reach consensus and assign a likelihood and impact value to the risks. Risk owners should also identify the potential mitigation actions they want to include in the register. See the next gap for further discussion on mitigation actions.

Gap 3: Identification of Top Priority Risks and Mitigation Actions

Federal requirements stipulate that the risk management process established by the agency shall produce “an evaluation and prioritization of the identified risks” (23 C.F.R. 515.7(c)(3)). Only these top priority risks need to be included in the risk mitigation plan and monitored long term. In the current risk register developed by ODOT staff, the risks are not ranked or prioritized.

Recommendation

In order to comply with federal regulations, it is important that ODOT staff identify top priority risks. This prioritization starts with an initial prioritization of each risk based on its impact and likelihood. Mitigation strategies should then be defined for all risks exceeding a specified threshold (e.g., for all risk with priority “High” or greater). Then, once mitigation strategies are defined a further prioritization is needed considering factors such as the degree to which a risk may be mitigated and the resources required for mitigation. For example, there may be some risks identified as high priority in the initial prioritization for which mitigation is prohibitively expensive or simply infeasible. In such a case the risk may not be a very high priority in the mitigation plan.

Identifying top priority risks and mitigation actions in this manner will help support development of the mitigation plan required for inclusion in the TAMP. The mitigation plan should include the mitigation action, the owner of the action, an estimated completion date, and the first step that will be taken toward mitigation.

Gap 4: Document Risk Management Activities

The final step in the risk management process is to communicate the process and products to both internal and external stakeholders. The key place this information needs to be communicated is in the TAMP. Clearly ODOT will need to describe the specific risk management activities undertaken as part of TAMP development in the TAMP, including the development of its risk register and mitigation plan. However, the truth is that ODOT is already engaged in a number of risk management activities, and in many cases has already identified and is addressing high priority risks that may impact achieving the goals of the TAMP. Thus, the single most important portion of the TAMP risk management chapter will arguably be the description of ODOT's current risk management activities. However, in the past these activities have not been viewed as being part of an integrated process, and there is no single document that details the various risk management efforts across the organization.

Recommendation

In order to best meet the requirements for TAMP development, we recommend that ODOT prepare a narrative of risk management activities for inclusion in the risk management chapter. Depending on the risks that are identified as top priority, the narrative should incorporate relevant details from the following documents:

- Oregon Highways Seismic Plus Report (October 2014)
- Seismic Lifelines Evaluation, Vulnerability Synthesis, and Identification (May 2012)
- Nondestructive Evaluation of Bridge Decks using Infrared Thermography (IR) and Ground Penetrating Rader (GPR) (September 2016)
- Tsunami Inundation Scenarios for Oregon (2013)
- Cathodic Protection Evaluation (June 2014)
- Rough Roads Ahead 2 (February 2017)
- Climate Change Vulnerability Assessment and Adaptation Options Study (December 2014)
- ODOT's Climate Change Adaptation Strategy Report (April 2012)
- Oregon Statewide Transportation Strategy (March 2013)
- Succession Planning Guide
- ODOT Human Resources Branch Flex Competencies (September 2015)

Other activities that may be described in the risk management chapter of the TAMP, but that do not have existing official documentation include:

- Coastal Landslide and Bluff Retreat Monitoring for Climate Change Adaptation and Targeted Risk Assessment
- Development of Tsunami Design Guide Specifications for Bridges

5. Next Steps

The consultant team will work with staff at ODOT to revise the risk register. The consultant team will also present the gaps and recommendations from this white paper, as well as the revised risk register, on-site at ODOT.

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