



How to Account for Risk Factors in Pavement Management

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providing engineering solutions to improve pavement performance

Objectives



- Define risk and risk management
- Illustrate how risk can be applied to managing pavements (and other infrastructure assets)
- Provide guidance for incorporating risk into decisions



What Is Risk?



- Risk is “the effect of uncertainty on objectives” (ISO)
- Risk management is “a systematic process to identify risks that may impact agency objectives, to analyze their consequences, and to develop ongoing measures to address them” (Adapted from New South Wales Government Asset Management Committee)



Types of Impacts



- Negative threats
- Positive opportunities
- Focus of risk management is **protecting against excessive risk while capitalizing on opportunities that have acceptable risk levels**



Types of Risk



Enterprise Risk

Agency Risk

Affects the agency's ability to accomplish the its mission and achieve strategic goals

Owned by Chief Executive

Program Risk

Affects the agency's ability to achieve program objectives

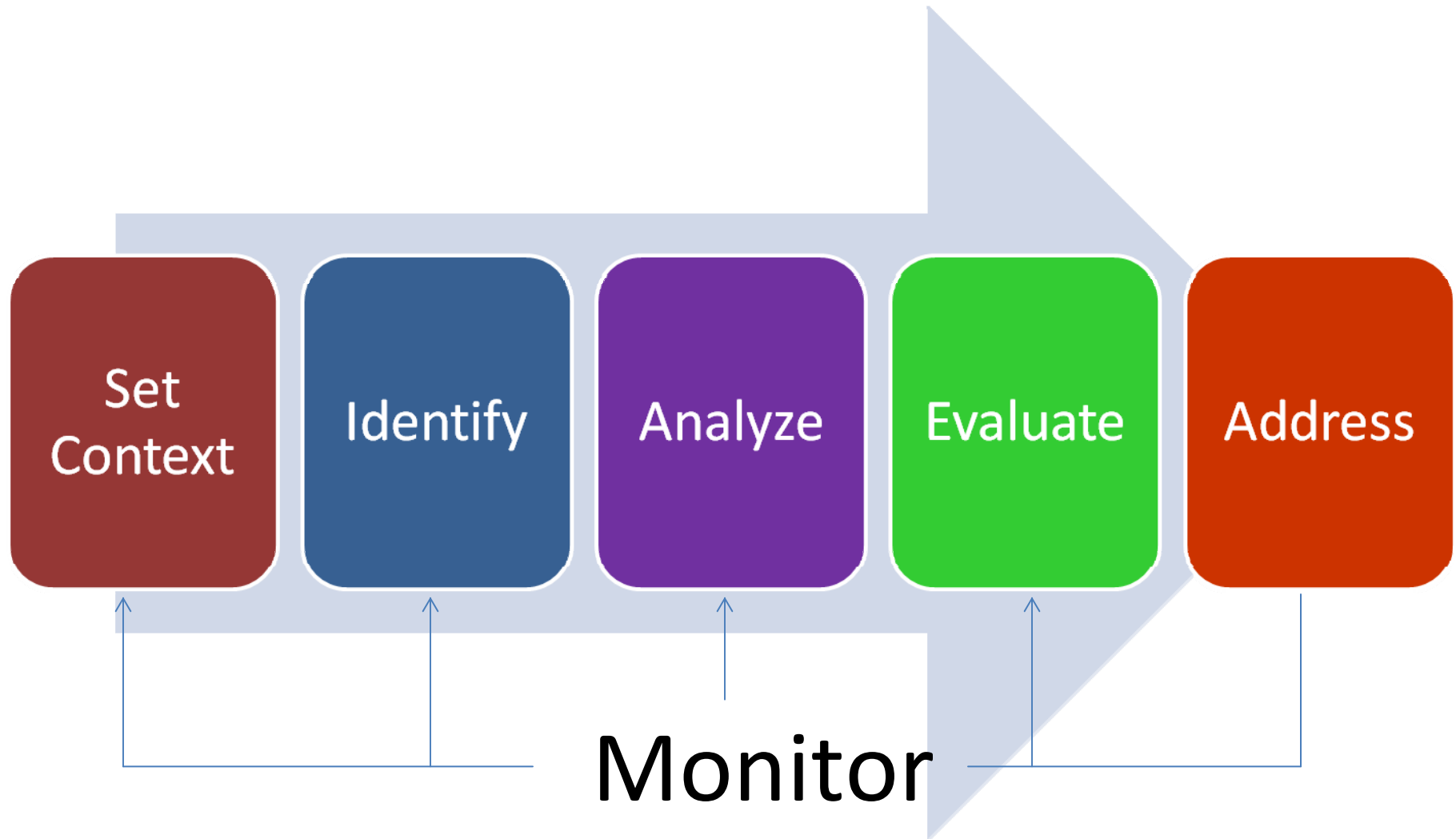
Owned by Program Manager

Project Risk

Affects the successful accomplishment of project objectives

Owned by Project Manager

Risk Management Steps



The Five Ts



Treat



Tolerate



Terminate



Transfer

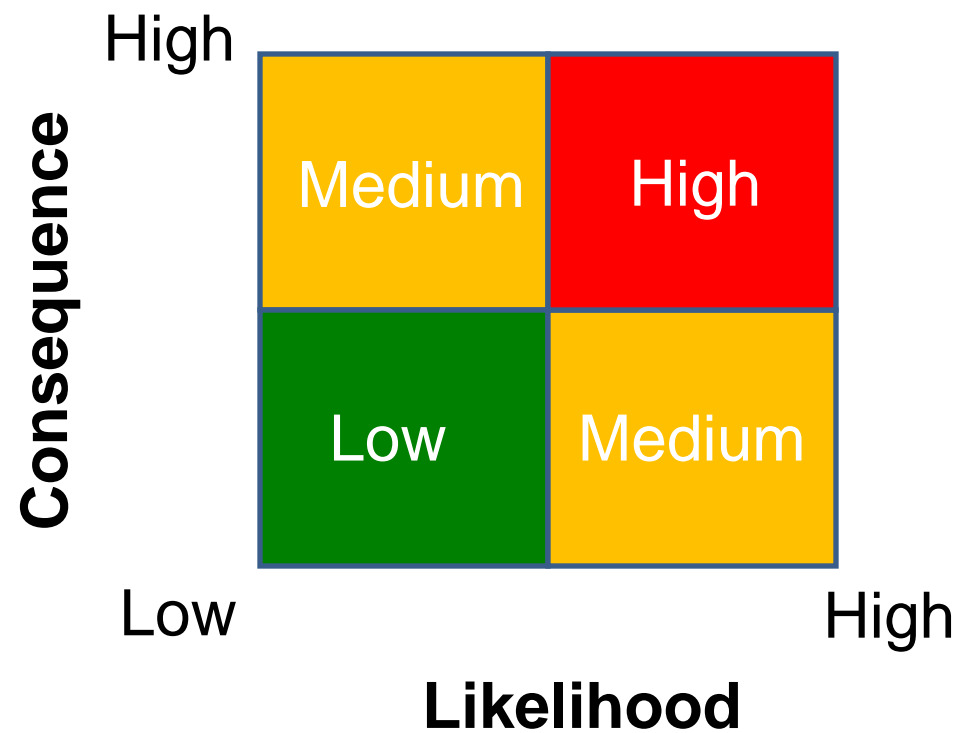


Take Advantage Of

Measuring Risk



- Likelihood of event
- Consequence of event



More Complex Measurement Scale



Likelihood (36 months)		Likelihood	Risk Map			
≥ 90%	Almost Certain	5	M	H	E	E
≥ 70% to > 90%	Likely	4	M	M	H	E
≥ 25% to < 70%	Possible	3	L	M	M	H
> 1% to > 25%	Unlikely	2	L	L	M	H
≤ 1%	Rare	1	L	L	L	M
Impact		Impact	1	2	3	4
			Minor	Moderate	Major	Extreme

Risk Register



Category	Event	Likelihood	Consequence	Score	Strategy
Strategic	Funding	4	4	16	Tolerate
Program	Models	3	4	12	Treat
Program	Staffing	4	3	12	Treat
Project	Flooding	2	3	6	Tolerate

Likelihood

- 1 = Rare
- 2 = Unlikely
- 3 = Possible
- 4 = Likely
- 5 = Almost Certain

Consequence (Impact)

- 1 = Negligible
- 2 = Low
- 3 = Medium
- 4 = Very High
- 5 = Extreme



Risk Register



ASSET MANAGEMENT RISK REGISTER

Risk Category	Risk Event				Risk Mitigation Strategy/Treatment
Enterprise/Strategic	Funding changes	4	4	16	Monitor budget process; inform legislators
Enterprise/Strategic	Material price changes	3	4	12	Monitor prices, prepare investment scenarios
Enterprise/Strategic	Lack of staff acceptance of TAM	2	5	10	Emphasize agency adoption of TAM
Programmatic Risk	Model forecasts	3	4	12	Calibrate, validate model outputs
Programmatic Risk	TAM staff turnover	4	3	12	Conduct training, succession planning
Programmatic Risk	Lack of staff acceptance of TAM	3	3	9	Emphasize agency adoption of TAM
Project/Activity	Districts' completion of preventive maintenance activities	3	2	6	Monitor PM program activities
Project/Activity	Timely collection of asset condition data	3	2	6	Provide more resources for data collection
Project/Activity	Flooding degrading drainage structures	2	3	6	Monitor events, prepare to respond
	Likelihood				Impact
	R=Rare	1		1	N=Negligible
	U=Unlikely	2		2	L=Low
	P=Possible	3		3	M=Medium
	L=Likely	4		4	V=Very High
	A=Almost Certain	5		5	E=Extreme



Risk Worksheet

Risk Map



Likelihood (in 36 month)	Likelihood Score	Risk Map			
Almost Certain	5	M	H	E	E
Likely	4	M	M	H	E
Possible	3	L	M	M	H
Unlikely	2	L	L	M	H
Rare	1	L	L	L	M
	Impact Score:	1	2	3	4
		Minor	Moderate	Major	Extreme
		Little to no noticeable impact	Some noticeable impact	Somewhat large impact	Catastrophic impact

Risk Register



Risk Category	Risk Event	Likelihood (L)	Impact (I)	Risk Score (L x I)	Strategy (Treat, Tolerate, Transfer, Terminate, Take Advantage Of)
Agency	Pressure from elected officials to address worst conditions first				
Agency	Fluctuations in revenue sources				
Program	Rockslides				
Program	Unexpected traffic loadings due to unusually heavy loads				
Program	Inadequate maintenance programs				
Project	Premature failure due to poor construction practices				

Risk Can Be Used To:



- Set priorities
- Assign resources
- Improve communication with stakeholders
- Increase the likelihood of organizational success
- Reduce agency liability

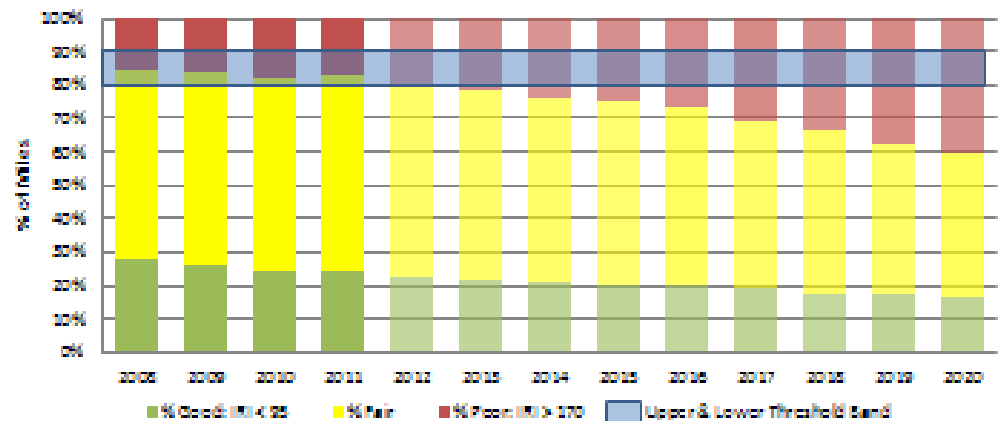


Utah DOT - Risk in Investment Decisions



- Budget: \$145M in federal funds + \$20M in state funds
 - Interstate - \$60M
 - Level 1 Roads (> 2,000 cars/day) - \$95M
 - Level 2 Roads (< 2,000 cars/day) - \$10M

Level 2 Pavement Condition
2,735 miles
Historical - Projected
Ride Quality - forecasted with 10 million / year



Why Manage Risk?



- As a steward of transportation assets, agencies have an obligation to:
 - Anticipate risk
 - Strategize on how to mitigate it or capitalize on it
 - Be prepared to act when it arises
- An understanding of risk helps avoid paralysis
- A formal assessment of risk can help increase an agency's likelihood of success and reduce agency liability



Risk in MAP-21



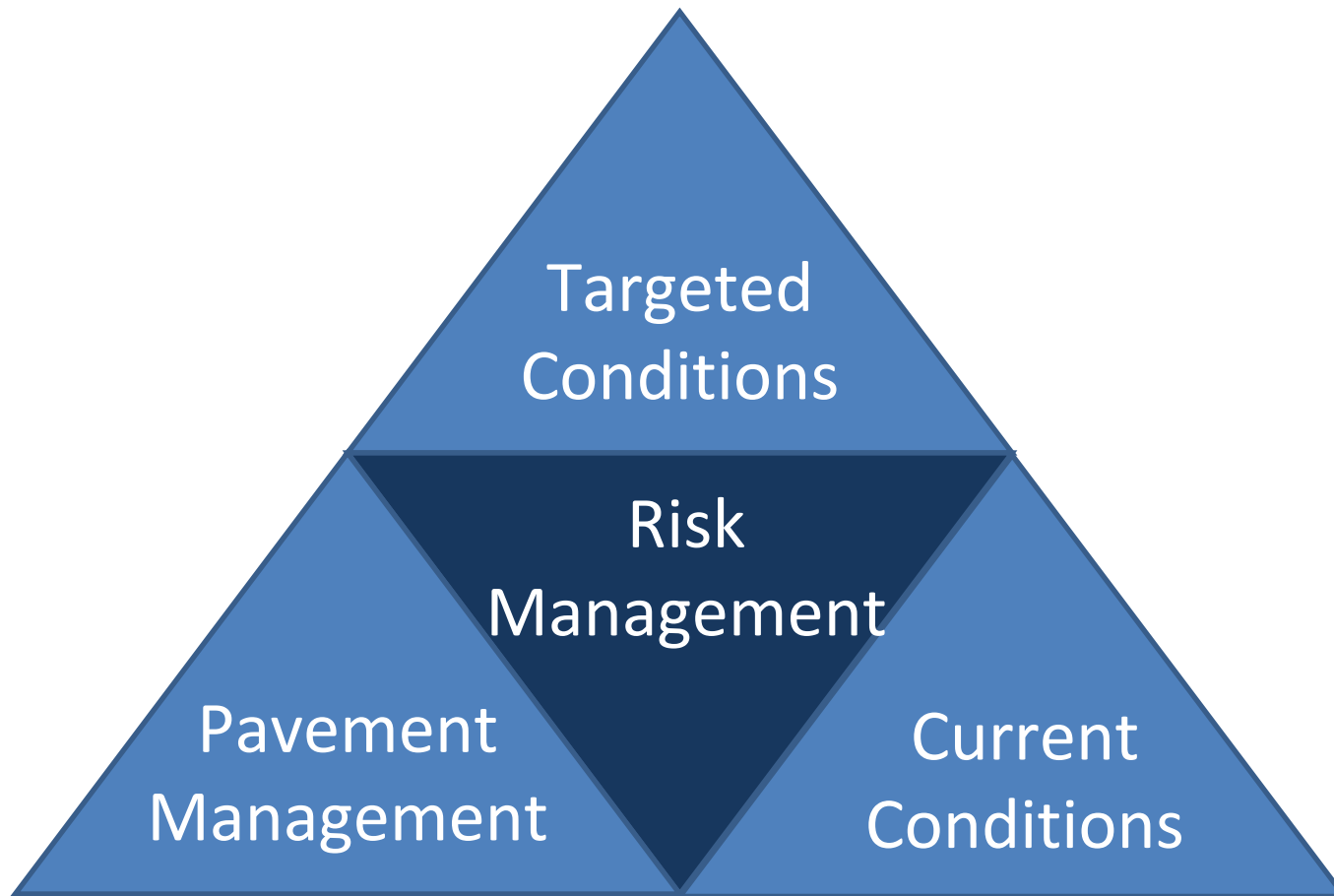
- *State Performance Management-*
- *(1) IN GENERAL- A State shall develop a risk-based asset management plan for the National Highway System to improve or preserve the condition of the assets and the performance of the system.*



Links to an Asset Management Framework



Links to a Pavement Management Framework



Getting Started



1. Define the context for considering risk
2. Ask: What could stop us from reaching our objectives and how can we deal with it? How can we turn uncertainty or change into opportunity?
3. Evaluate risk in terms of likelihood and consequence
4. Assign one of the five Ts (treat, tolerate, terminate, transfer, take advantage of)
5. Report and monitor results



For More Information



- FHWA Office of Asset Management website
<http://www.fhwa.dot.gov/asset/resources.cfm>

Risk-Based Transportation Asset Management:

*Evaluating Threats,
Capitalizing on Opportunities*

REPORT 1: OVERVIEW OF RISK MANAGEMENT




U.S. Department of Transportation
Federal Highway Administration

JUNE 2012

Risk-Based Asset Management:

*Examining Risk-based Approaches to
Transportation Asset Management*

REPORT 2: MANAGING ASSET RISKS AT MULTIPLE
LEVELS IN A TRANSPORTATION AGENCY




U.S. Department of Transportation
Federal Highway Administration

AUGUST 2012

