The FHWA Geohazards Program

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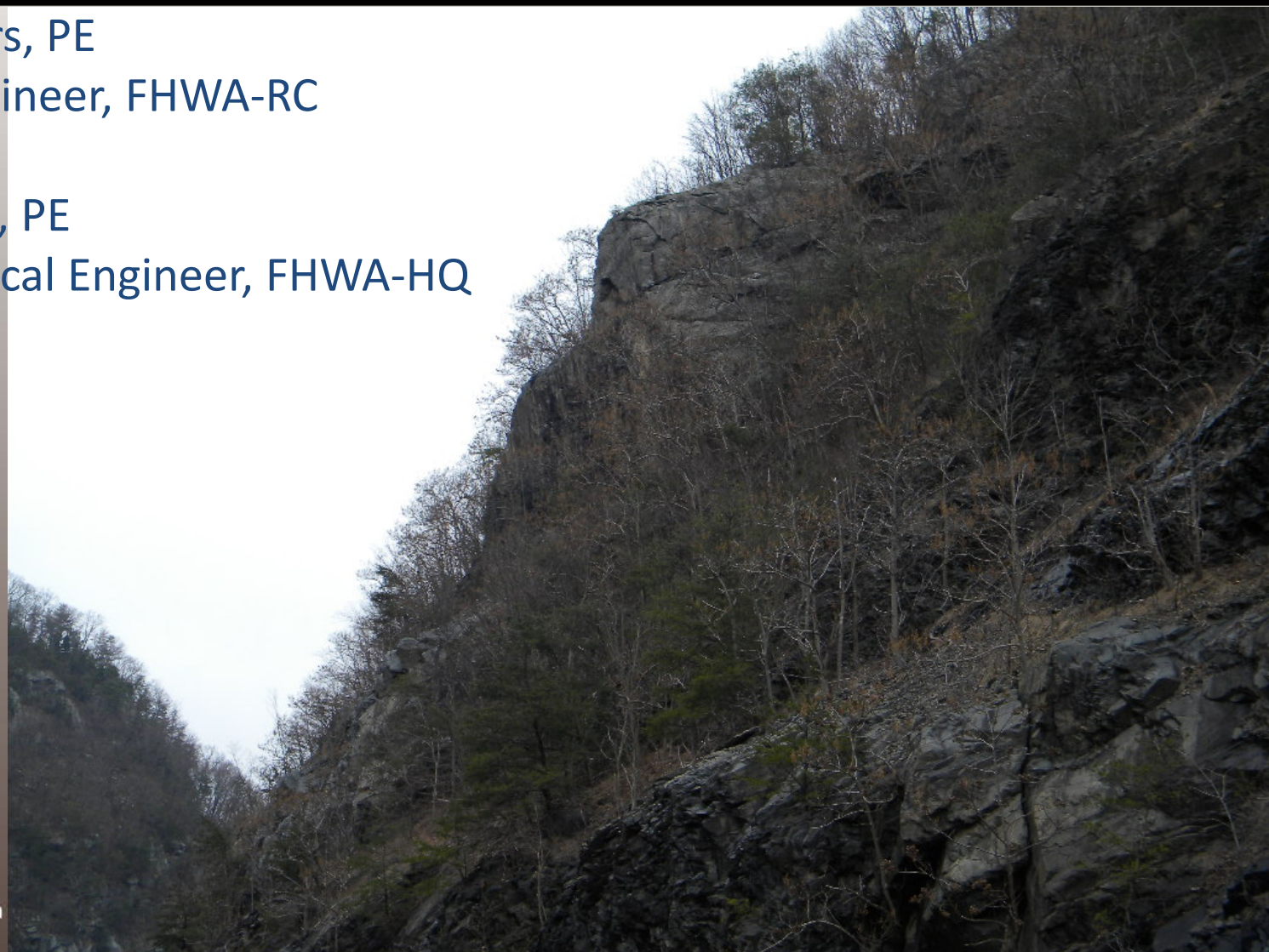


U.S. Department of Transportation
Federal Highway Administration

Geohazards & Risk

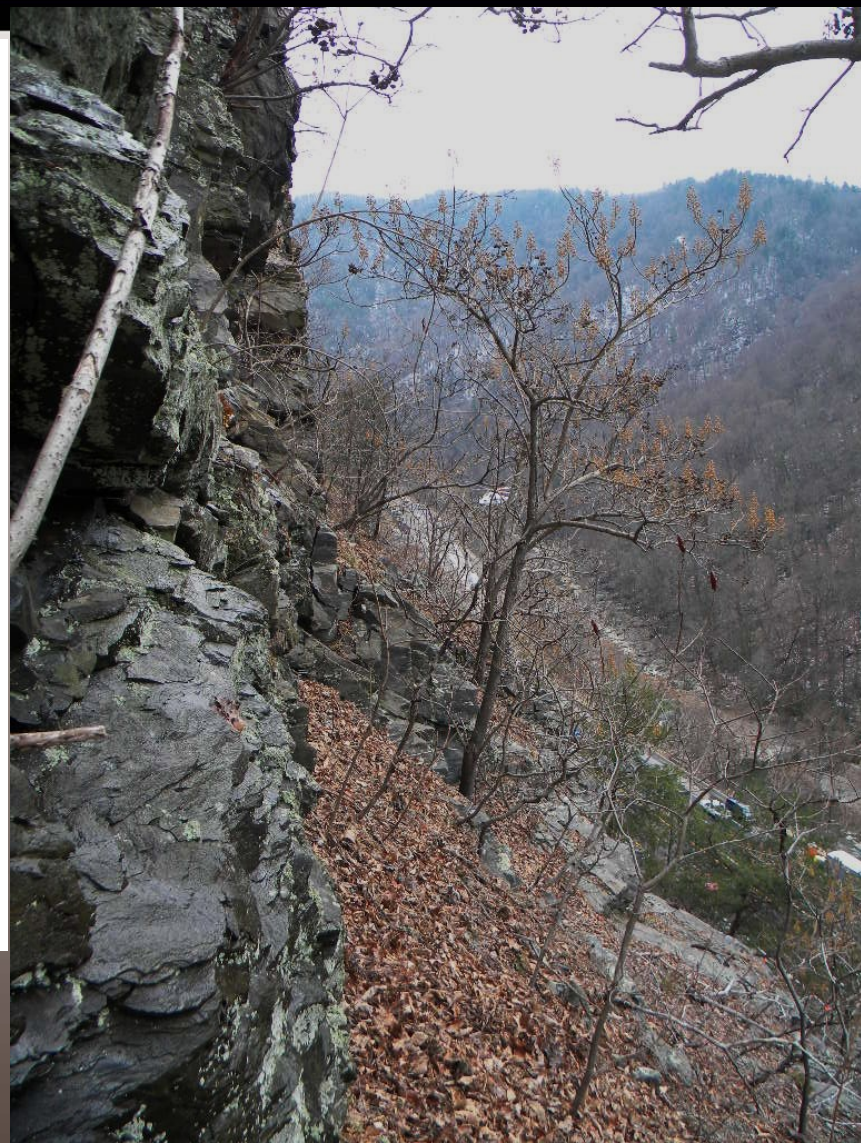
Geohazard - geological or earth-material state and environmental conditions that may lead to widespread damage or risk

- Probability of occurrence

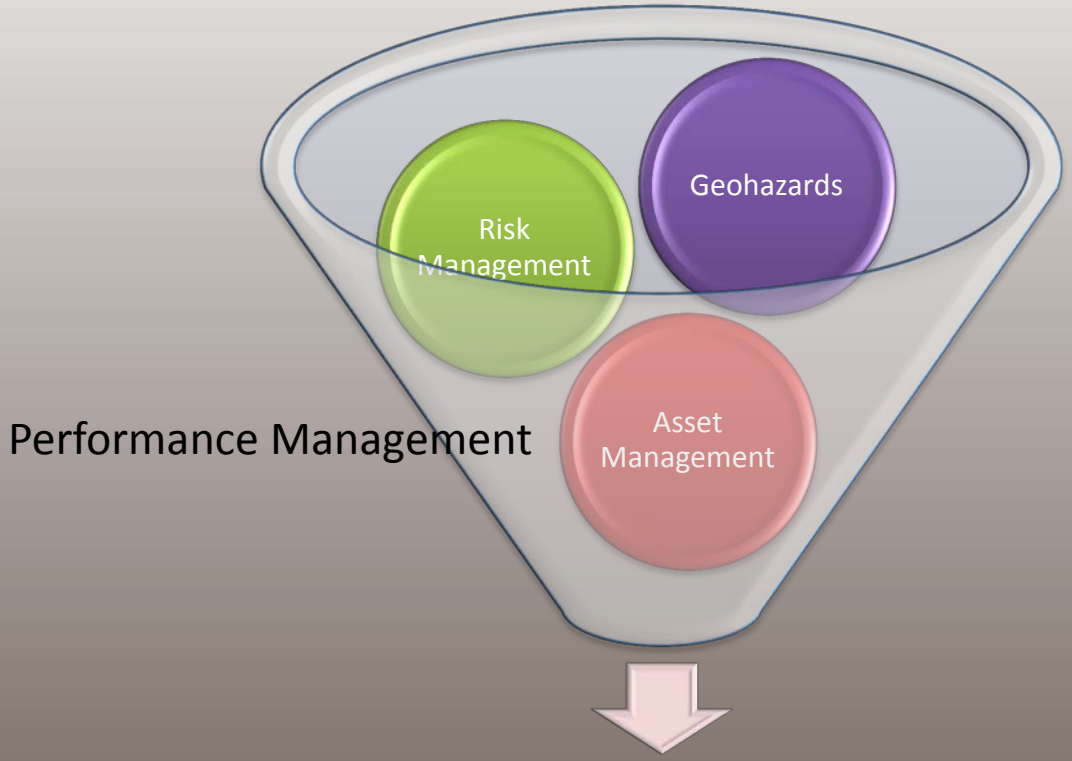
Geohazards & Risk

Risk – Exposure to the chance of loss or injury

- Future phenomenon; may or may not occur; has direct impact to project or system
- Probability*Impact = Risk



Geohazards and Performance Management



MAP-21 – Transportation Bill
July 2012

- **Establishes system performance requirements**
- **State Highway Agencies to develop asset management plan toward achieving national highway performance goals**
  - Risk-based plan to improve and preserve assets and performance of the system
  - Must include pavement and bridges
  - Encourages inclusion of all assets within the corridor right-of-way

MAP-21 National Performance Goals

1. **Safety**
2. **Infrastructure Conditions: State of Good Repair**
3. **Congestion Reduction**
4. **System Reliability- improve efficiency**
5. **Freight Movement and Economic Vitality**
6. **Environmental Sustainability**
7. **Reduced Project Delivery Delays**

Rockslide on I-40 in NC

- 6-Month Closure
- 130-mile detour
- Frequent Back-ups in excess of 7-miles common in Asheville, NC

Table 1: Total Transportation Costs of I-40 and US-64 Rock Slides

	I-40 Rockslide	US-64 Rockslide	TOTAL
Vehicle Operating Costs	$56.9	$7.2	$64.1
Diversion Travel Time Costs	$65.2	$10.7	$75.9
Emissions Costs	$4.5	$0.5	$5.0
Congestion Travel Time Costs	$43.8	$3.5	$47.2
Pavement Maintenance Costs	$4.6	$0.3	$4.9
TOTAL	$174.9	$22.1	$197.0

From HDR Report

Examples of Geohazards in Transportation

Geo-Environmental Hazards

- Contaminated Sites/Landfills
- Waste Materials with Heavy Metals
- Sulfate Soils
- Acid (Hot) Rock
- Acid Mine Tailings

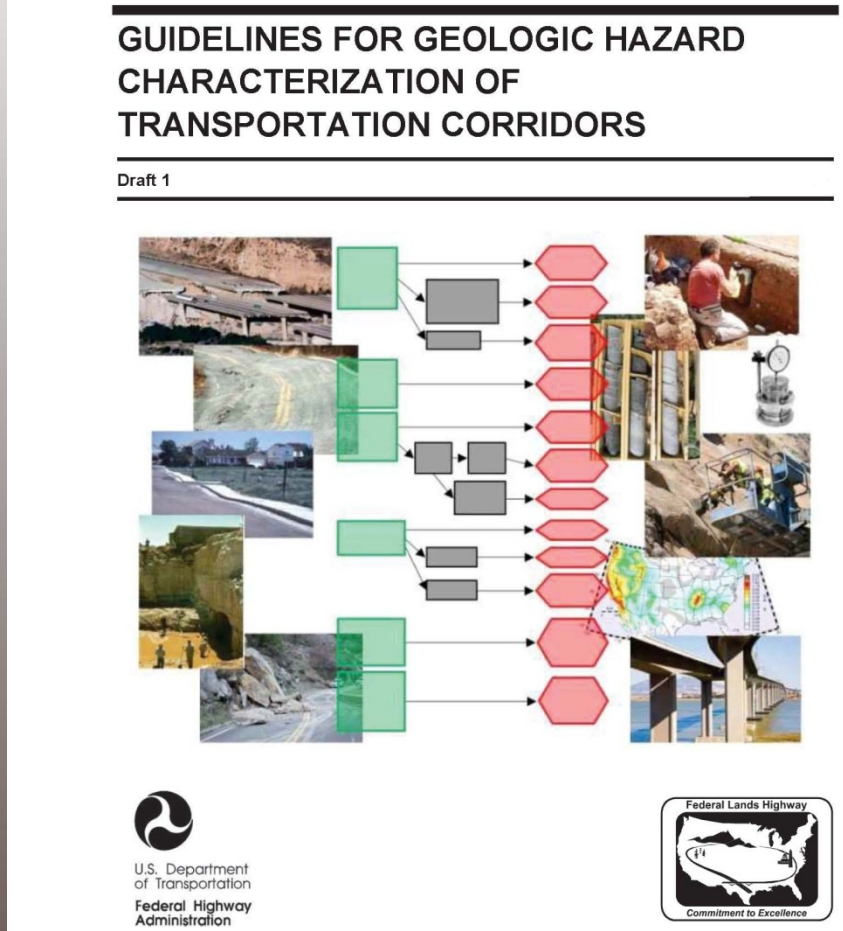
System Geohazards

- Seismic Hazards
- Scour
- Unstable Rock Slopes
- Unstable Soil Slopes
- Talus and Colluvium
- Carbonate and Evaporite Karst
- Saline, Gypsiferous and Evaporitic Soils
- Underground Mines
- Expansive Soils
- Heaving Bedrock
- Collapsible Soils
- Organic Soils and Peat
- Sensitive Clays
- Permafrost
- Degradable Rock
- Volcanic Hazards
- Coastal Hazards

Characterization of Geohazards

In Final Draft

Flow-chart guide based on causative and associative (e.g. environmental) conditions for investigation and characterization of geohazards


GUIDELINES FOR GEOLOGIC HAZARD CHARACTERIZATION OF TRANSPORTATION CORRIDORS

Draft 1

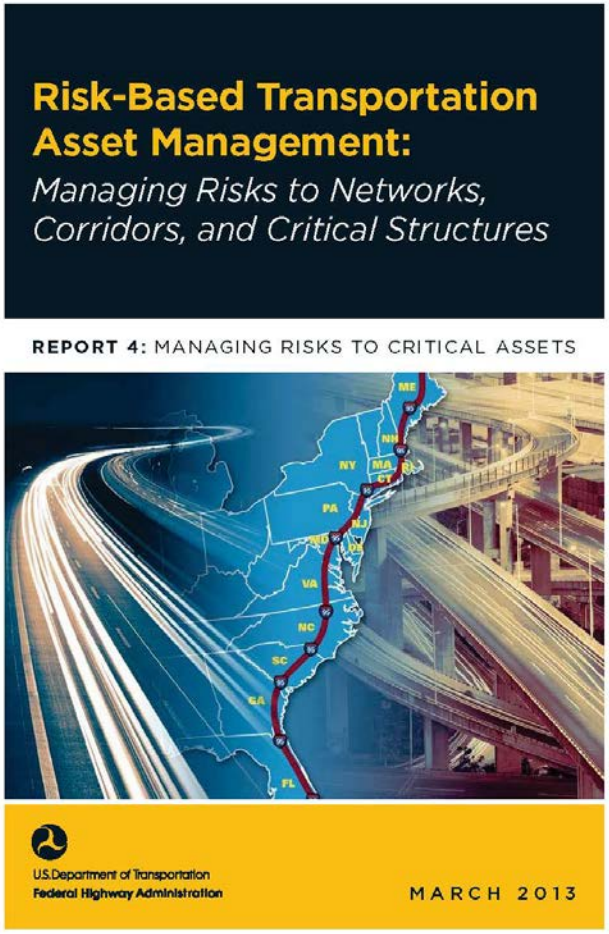
U.S. Department of Transportation
Federal Highway Administration

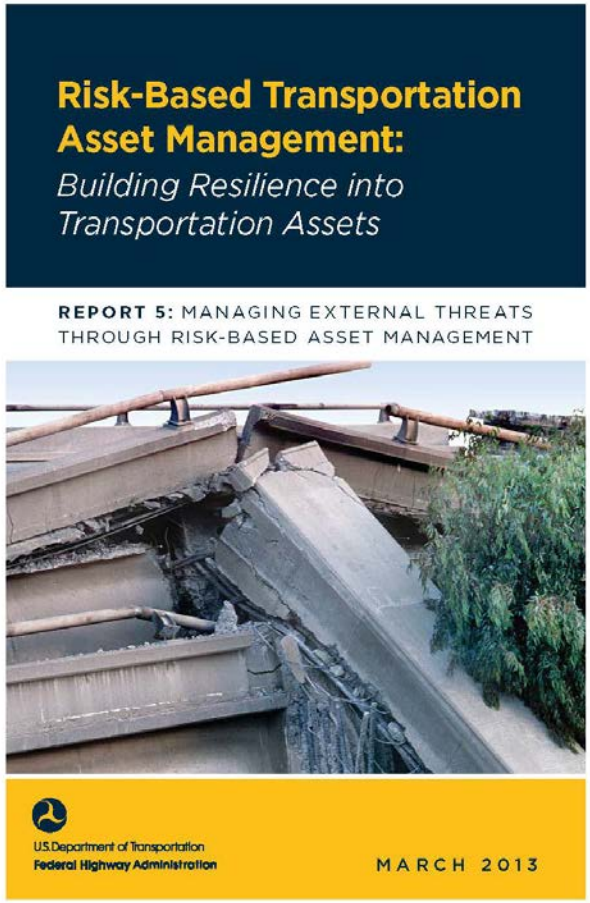
Federal Lands Highway
Commitment to Excellence

Central Federal Lands Highway Division
12300 West Dakota Avenue
Lakewood, CO 80228

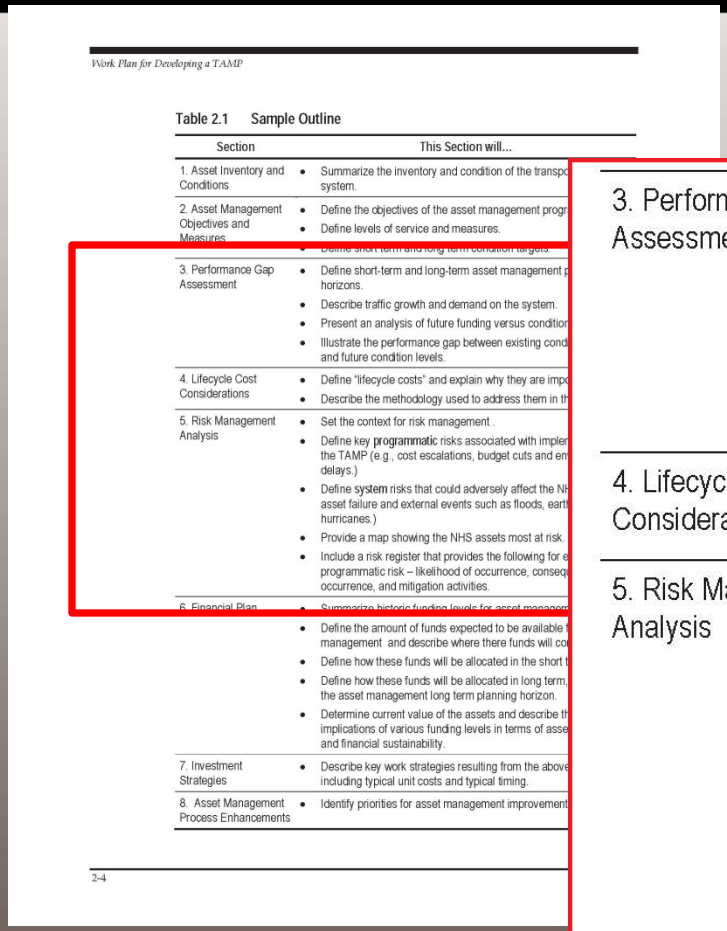
U.S. Department of Transportation
Federal Highway Administration

FHWA Office of Asset Management





Transportation Asset Management Plans (TAMP)



Work Plan for Developing a TAMP

Table 2.1 Sample Outline

Section	This Section will...
1. Asset Inventory and Conditions	• Summarize the inventory and condition of the transpo system.
2. Asset Management Objectives and Measures	• Define the objectives of the asset management progr • Define levels of service and measures. • Define short-term and long-term condition targets.
3. Performance Gap Assessment	• Define short-term and long-term asset management p horizons. • Describe traffic growth and demand on the system. • Present an analysis of future funding versus condition • Illustrate the performance gap between existing condi and future condition levels.
4. Lifecycle Cost Considerations	• Define "lifecycle costs" and explain why they are impo • Describe the methodology used to address them in th
5. Risk Management Analysis	• Set the context for risk management . • Define key programmatic risks associated with implen the TAMP (e.g., cost escalations, budget cuts and en delays.) • Define system risks that could adversely affect the NH asset failure and external events such as floods, eartl hurricanes.) • Provide a map showing the NHS assets most at risk. • Include a risk register that provides the following for e programmatic risk – likelihood of occurrence, conseq occurrence, and mitigation activities.
6. Financial Plan	• Summarize historic funding levels for asset manager • Define the amount of funds expected to be available f management and describe where there funds will co • Define how these funds will be allocated in the short t • Define how these funds will be allocated in long term, the asset management long term planning horizon. • Determine current value of the assets and describe th implications of various funding levels in terms of asse and financial sustainability.
7. Investment Strategies	• Describe key work strategies resulting from the above including typical unit costs and typical timing.
8. Asset Management Process Enhancements	• Identify priorities for asset management improvement

2-4

3. Performance Gap Assessment	• Define short-term and long-term asset management planning horizons. • Describe traffic growth and demand on the system. • Present an analysis of future funding versus condition scenarios. • Illustrate the performance gap between existing condition levels and future condition levels.
4. Lifecycle Cost Considerations	• Define "lifecycle costs" and explain why they are important. • Describe the methodology used to address them in the TAMP.
5. Risk Management Analysis	• Set the context for risk management . • Define key **programmatic** risks associated with implementation of the TAMP (e.g., cost escalations, budget cuts and environmental delays.) • Define **system** risks that could adversely affect the NHS (e.g., asset failure and external events such as floods, earthquakes, and hurricanes.) • Provide a map showing the NHS assets most at risk. • Include a risk register that provides the following for each programmatic risk – likelihood of occurrence, consequences of occurrence, and mitigation activities.
6. Financial Plan	• Summarize historic funding levels for asset management

Risks of Geohazards…

…Are Manageable.

- Management Systems
  - Number of states have slope or rockfall management systems
- Corridor Management Concept

Challenges as We Move Toward Performance Management

- Establish expectations for geotechnical performance
  - Implement methods for measuring and testing performance
  - Establish targets for performance

  (e.g. frequency of rockfall from a rock-cut, long-term settlement of bridge approach, movement of anchored wall, corrosion of steel MSE reinforcement or rock-bolt)
- Predicting change in performance over time
- Consistency in design & performance standards

Risk Standards

Risk=Probability*Impact

- Standards to which we design and mitigate based on risk and life-cycle costs
- Standard risk tolerances in relation to potential impact

Questions?