UDOT's Risk & Resiliency Initiative
AASHTO Committee on Transportation System Security and Resilience
Risk Management Objectives

1. Assess and prioritize physical threats
2. Quantify annual monetary risk to UDOT and travelers
3. Develop economical risk mitigation solutions
4. Provide a risk-based, fiscally-constrained input
   a. Asset Management Plan (TAMP)
   b. Maintenance and project selection strategies
5. Develop a repeatable Risk Management process
Risk Management Process

1. Asset Characterization
   - What assets exist, which are critical, and what should be considered?

2. Threat Characterization
   - What threats and hazards should be considered?

3. Consequence Analysis
   - What happens to assets if a threat or hazard occurs? What are the expected asset losses, economic impacts, injuries, and lives lost?

4. Vulnerability Analysis
   - What are the asset vulnerabilities that would allow a threat or hazard to result in expected consequences? How vulnerable is the asset to the identified threat?

5. Threat Assessment
   - What is the likelihood of the identified threat?

6. Risk/Resilience Assessment
   - What is the anticipated asset total risk and resilience?
     - Risk = Consequences x Vulnerability x Threat
     - Resilience = Service Outage x Vulnerability x Threat

7. Risk/Resilience Management
   - What options are there to reduce risk and increase resilience? What is the risk reduction? What is the economic analysis of mitigation alternatives?
## I-15 Final Threat-Asset Matrix

<table>
<thead>
<tr>
<th>Threat/Asset</th>
<th>Bridge</th>
<th>Bridge Approach</th>
<th>Roadway Prism</th>
<th>ATMS</th>
<th>Fiber</th>
<th>Wall</th>
<th>NBI Culvert</th>
<th>Non-NBI Culvert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquake &amp; Liquefaction</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>-----</td>
<td>☑</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fire (Wildland)</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Flood-Debris/Overtop</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Flood-Scour</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Railway</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Oil/Gas Pipeline</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>H2O Pipeline</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>H2O Canal/Ditch</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
Route Criticality Map

Criticality (% UDOT miles)
- Low (49.5%)
- Moderate (23.8%)
- High (26.7%)

Weight
- AADT (non-Truck) 20%
- Freight (AADT Truck) 20%
- AASHTO Road Classification 20%
- Tourism $2015 (County) 20%
- Maintenance Crew Miles 20%
Route Criticality Map

Resilience Segment

- A
- B
- C
- D
- E
- F
- G
- H
- J
- K
- L
- M
- N
- Q

UTDOT
Keeping Utah Moving
## Site 4: Non-NBI Culvert Flood Summary

<table>
<thead>
<tr>
<th>Proposed Mitigation</th>
<th>Description</th>
<th>Cost of Mitigation</th>
<th>Reduction in Annualized Owner Risk</th>
<th>Reduction in Annualized User Risk</th>
<th>B/C Total Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1 - 100-yr. Hydraulic Design</td>
<td>Replacement of existing culvert with 7' x 9' CBC</td>
<td>$3,501,698</td>
<td>$4,290</td>
<td>$36,588</td>
<td>0.34</td>
</tr>
<tr>
<td>Option 2 - 50-yr. Hydraulic Design</td>
<td>Line existing 72” metal pipe with UV CIPP*</td>
<td>$800,000</td>
<td>$3,768</td>
<td>$29,790</td>
<td>1.2</td>
</tr>
</tbody>
</table>
Internal Risk Planning Process
Incorporating R&R in the Intermediate Planning Process

**Corridor / Area Level Screening Throughout State (all corridors)**

- Identify Internal Interested Parties – Outline Planning Team
- Gather Corridor History, Studies, etc. Determine the Stakeholders / Knowledge Base
- Define the Corridor Context (Transportation, Community, Natural, Economic, and Risk & Resiliency)
- Define Goals for the Corridor / Sub Area Planning

**DELIVERABLE: Corridor Master Plan**

*i.e. Detailed Corridor Plan, Detailed Risk and Resiliency Plan, Environmental Document(s), and / or Defined Project(s), etc.*

**Detailed Corridor Planning Process**

- Incorporate Risk and Resiliency Efforts
- Feed Information into Risk & Resiliency Statewide Map

**Conduct High Priority Risk and Resiliency Studies**

**Interstate and Freight Corridors**

**Independent Action using Risk and Resiliency Framework**

**Incorporate new data**

**Share Data**

**Between Processes**
Risk Implementation Approach

Current Activity

• Awarded FHWA grant for Resilience and Durability to Extreme Weather Pilot Project in spring of 2018
• Selected additional corridor (US-40) to refine process, develop work flows/module for implementation into planning process

Future Activity:

• Define high priority corridors (Interstate and Freight)
• Apply process to develop base map for priority corridors
• Employee process on corridors statewide as an integral part of the planning process
UDOT’s Risk & Resiliency Initiative
AASHTO Committee on Transportation System Security and Resilience