Coordinating Minnesota’s Transportation Assets and Climate Change and Extreme Weather Vulnerability

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What is a Transportation Asset Management Plan?

The TAMP serves as a way to formalize and document the following types of key information into a single document:

- A summary listing of the transportation assets in the State, including a description of the condition of those assets.
- Initial requirements include pavements and bridges on the NHS system.
- Asset management objectives and measures.
- A summary of the gap between targeted and actual performance.
- Strategies for cost-effectively managing the assets, including lifecycle cost and risk management analysis.
- A financial plan for addressing the performance gap.
- Investment strategies that describe planned improvements and planned performance resulting from the implementation.
Performance-based Planning and Programming

**Policy Plan**

- Overarching goals, policies, and performance measures that guide investment

**Investment Plans**

- Detailed analysis of investments, including expected performance impacts, legislative guidance, and stakeholder input

**Performance Monitoring**

- Regular review of performance in each policy area
MAP-21

Systems

Highway
- NHS
- Other

Transit
- Highway
- Rail

Airports

Ports/Waterways

Assets

• Pavement
• Bridge
• Drainage Structures
• Guardrails
• Traffic Signals
• Signs
• Pavement Markings
• ITS
• Overhead Signs
• Pedestrian Ramps
• Lighting
• Land
• Rest Areas
• Sidewalks
• Retaining Walls
• Tunnels
• Noise Barrier
• Fencing
• Weigh Stations
• ADA Infrastructure
• Modal Infrastructure
• Transit Vehicles

Plan Elements

Capital (Financial) Planning
Maintenance Planning
Risk Assessment
Life Cycle Cost Analysis
Minnesota’s Transportation Asset Management Plan

- All State Highways
- Pavements
- Bridges
- Drainage
- Tower Lighting
- Overhead Sign Structures
TAMP Objectives

- 1. Inventory and conditions
- 2. Objectives and measures
- 3. Performance gap ID
- 4. Lifecycle cost considerations
- 5. Risk management analysis
- 6. Financial plan
- 7. Investment strategies
- 8. Asset management process enhancements
Desired Outcome

• “Planning for operations” - bridge the divide between capital investment decisions and operation and maintenance budgeting.
• Document established asset management practices in pavement and bridge
• Expand asset management principals and practices to other asset types.
• Make investment decisions more transparent
Climate Change and Extreme Weather Vulnerability Assessments

• FHWA Pilot Project Criteria
  – Exposure to Climate Effects
  – Sensitivity to Climate Effects
  – Adaptive Capacity
Recent Minnesota Extreme Weather Events

- Flooding
- Forest Fires
- Extended Winter Season
Trunk Highway 210—Thomson

Duluth Flooding June 19, 2013
• Pagami Creek Fire

- 93,000 acres
- August 18, 2011
- Lighting Induced

Pagami Creek Fire Progression
9/19/2011
April 2013 Extended Winter Season
Desired Outcomes

- Risk Assessment methodology that can be applied to future projects to assess vulnerability to extreme weather events.
- GIS-based maps that display vulnerable locations and system threats
- A benefit/cost analysis of adaptive and mitigation methods
- Analytical toolkit to supplement the TAMP
Risk Assessment Methodology

- Determine vulnerability of infrastructure
- Measure degree of exposure, sensitivity, adaptive capacity and consequences of impacts
- Conduct in-depth analysis of mitigation strategies
- Use risk reduction analysis to maximize benefit of strategy implementation
Methodology

- Project Management team approach utilizing advisory group and consultants for support.
- Selection and Characterization of relevant assets
- Selection of key climate exposure variables
- Vulnerability and risk assessment
- Identify, analyze and prioritize adaption options.
- Integrate benefit/cost
Potential Risk Reduction Strategy Example

• 2012 Flooding Near Duluth, Minnesota – 500 year event.
• Damage concentrated in areas with steep terrain, unstable soils, culverts that became blocked with debris.
• Examine Undermined Pavement
TH 2 and I-35 Proctor/Duluth
Identify Risk Event

- Pavement undermining due to steep grades in combination with parallel flow in ditches and watercourses.
Identify Probability of Event and Impact on MnDOT Vision

- Probability may be very low for 100 to 500 year event < 5%.
- Impact would be great in that this type of event would result in a road closure that could last more than a week to several months and depend on the number of users and length of detour.
Identify risk response strategies and costs

• One strategy for this risk may be to partially pave the in-slope in areas where this flow may be concentrated near the pavement.

• Cost could be a pure calculation based on the GIS analysis of the system, length of roadway where the risk is present and unit cost of the repair.
Identify the effectiveness of the strategy

- Identify the residual risk
- Identify the return on risk
- Determine the cost/benefit
Outcome:

- Methodology of determine which risk mitigation and adaptation strategies are most cost effective.
Conclusions

• Public Agencies should address the potential impacts of extreme weather events.
• In transportation, these events can interrupt service and have significant recovery costs.
• The extreme weather vulnerability assessments will help MnDOT identify the most beneficial mitigation strategies to pursue in addressing these events.