**American Association of State Highway and Transportation Officials**

**Special Committee on Research and Innovation**

**FY2021 NCHRP PROBLEM STATEMENT OUTLINE**

**1. Problem Title**

Develop Methods to Allow Agencies to Incorporate Quantitative Risk Assessment at Project and Network Level

**2. Background**

Managing risk is a critical component of asset management. On a day-to-day basis transportation asset managers spend much of their time responding to or mitigating a large number of risks, which may range from external events that damage transportation infrastructure to unplanned changes to budget or workloads resulting from unexpected events. Various recent and on-going research efforts aim to improve approaches for risk management for transportation agencies. However, most of these efforts treat risk management as a high-level activity. Further research is needed to develop quantitative, repeatable approaches at the appropriate staff level, to assessing and identifying the highest priority risks transportation agencies face in managing physical assets. This project aims to develop such approaches to assess risks (e.g., financial, strategic, operational, political, environmental, technological, social justice risks) and incorporate them into life cycle analysis and planning efforts.

**3. Literature Search Summary**

Risk management has been studied quite extensively in the transportation sector. Risk management encompasses four major steps: Risk identification, risk assessment, risk mitigation, and continuous updating of results. Risk assessment focuses on determining the magnitude of risk, which is directly proportional to the likelihood and consequences of an event to occur. Risk assessment has been a major area of study in pavement and bridge management efforts. In recent decades, the focus has shifted from assessing risk in single networks towards more holistic risk assessment approaches.

Between 2012 and 2013, Federal Highway Administration (FHWA) published a five-part report series on Risk Based Asset Management. These reports focus on: (1) Overview of risk management, (2) Managing risk at different levels, (3) Strategic risk management (risks to agency objectives), (4) Managing risk to critical assets, and (5) Managing external threats such as climate change and extreme weather risks. These reports played an important role in introducing risk management concepts into asset management efforts. In 2016, American Association of State Highway and Transportation Officials (AASHTO) published the Guide for Enterprise Risk Management. In this Guide, risk management is defined as *“the systematic application of policies, procedures, and practices to the identification and management of uncertainty or variability on achievement of agency objectives.”* In addition, the Guide introduces four levels at which risks need to be managed: Strategic, Program, Project, and Activity levels. Enterprise Risk Management is defined as management of risks at all levels. Other research projects (recently completed, active, or pending) in this area include:

* NCHRP 08-113: Integrating Effective Transportation Performance, Risk, and Asset Management Practices
* NCHRP 08-118: Risk Assessment Techniques for Transportation Asset Management
* NCHRP 20-44(02): Implementation of the AASHTO Guide for Enterprise Risk Management
* NCHRP 20-123(04): Development of a Risk Management Strategic Plan and a Research Roadmap
* NCHRP 08-129: Incorporating Resilience Concepts and Strategies in Transportation Planning
* NCHRP 23-09: Scoping Study to Develop the Basis for a Highway Standard to Conduct an All-Hazards Risk and Resilience Analysis.

Managing risk at program (or network) and project levels is particularly important to achieve desired performance levels and to improve resilience of a transportation system. While existing research efforts in this area are highly significant, there is a need for developing more practical and repeatable risk assessment calculation methods for project and network level risks. This proposed study will build on these recent efforts, particularly NCHRP 23-09, and serve as the next phase in risk assessment and management.

**4. Research Objective**

The objectives of this research are to:

* Generate risk identification techniques to determine high risk threats at project and network levels,
* Develop quantitative, repeatable approaches for assessing likelihood and consequences for these threats,
* Develop visual, interactive characterization methods (e.g., dashboards) to reflect an agency’s level of risk and the effectiveness of proposed mitigation actions,
* Allow risk and resilience to be on par with traditional performance measures.

High risk threats to be studied include, but are not limited to, extreme events (e.g., earthquakes, fires, hurricanes, avalanches, tornadoes), asset failure (structural and operational), financial, strategic, political, environmental (e.g., sea level rise, flooding), technological, and social justice risks.

The final deliverables could include guidebook with a spreadsheet or a framework for assessing high risk threats and incorporating the results into TAM efforts. The guidebook should feature a comprehensive review of existing literature and current practice. It should present a standard definition of resilience as well as step-by-step instructions to develop models, methods, and metrics for estimating resilience of highway systems to high risk threats. Pilot studies should be conducted with select agencies to test the guidance and calculation procedures.

**5. Urgency and Potential Benefits**

While existing reporting mechanisms allow agencies to see the parts of their network that are in good and poor condition, risks associated with different threats and the impact of failure are not reported as an explicit performance measure. Competing design documents, financial implications, legal concerns, maintenance practices, focus on building new capacity rather than managing existing infrastructure, and other factors that affect decision making procedures may counter-act risk-based TAM practices. Issues related to social justice and equity, and consequences of failures make risk-based TAM even more important. Creating harmony in the TAM decision making space in consideration of risk and resilience represents an urgent need. A practical, quantitative, and repeatable risk assessment process could play a major role in addressing this need.

**6. Implementation Considerations and Supporters**

The target audience for the research results is asset management and risk-management champions at state and local government transportation agencies. The results of this project will potentially empower these individuals in convincing other decision makers in these agencies to take actions that not only align with traditional performance management objectives but also that result in lower risk and higher resilience for the whole transportation system. The results of this project can also be effective in communicating the rationale behind risk-based decisions to the general public. Due to legal implications of identifying and documenting risks, the research and final product should include advice on how to protect the agency from litigation if they cannot implement a recommended action.

Risk assessment is at the core of implementing a risk-based asset management approach. Therefore, FHWA and AASHTO view this as a subject of great importance. In addition, risk management cuts across all areas of a state DOT’s business and just about any AASHTO Committee and any state DOT and local agency could realize benefits from these research results.

**7. Recommended Research Funding and Research Period**

Recommended funding: $500,000.

Recommended research period: 12 to 18 months.

**8. Problem Statement Author(s)**

The following individuals contributed to development of this problem statement:

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1. **Others Supporting the Problem Statement**

List organizations, including AASHTO Committees or Councils, which support this problem statement, and provide contact information.

* AASHTO Committee on Performance-based Management, Tim Henkel, Chair
* AASHTO Subcommittee on Risk Management, Jean Wallace, Chair
* AASHTO Subcommittee on Asset Management, Matt Haubrich, Chair
* AASHTO Subcommittee on Organizational Management, Charlie Purcell, Chair

1. **Potential Panel Members**

* Please contact Matt Hardy, AASHTO Program Director for Planning and Performance Management, for a list of recommended panel members representing the AASHTO Committee on Performance-based Management and the Subcommittee on Risk Management. Below are those indicating their desire to serve:
  + Jean Wallace, Minnesota Department of Transportation, Chair, AASHTO Subcommittee on Risk Management, [(651\_](mailto:(651_) 366-3181, Jean.Wallace@state.mn.us
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**11. Person Submitting the Problem Statement**

Provide contact information for the individual submitting this problem statement.

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  AASHTO staff on behalf of the AASHTO Committee on Performance-based Management, Tim Henkel, Chair.