

# NCHRP Project 23-09, “Scoping Study to Develop the Basis for a Highway Standard to Conduct an All-Hazards Risk and Resilience Analysis”

## Project Background

Transportation owners and operators are responsible for the highway system and the delivery of a range of services and functions through the management of that system. There are inherent risks involved with the management of the system, including aging infrastructure, and fiscally constrained resources.

Many agencies are moving toward performance-based resource allocation while simultaneously recognizing risks that may undermine their strategic goals. These risks affect every component of a highway system, and analysis tools are needed to accurately account for and address these risks within a highway agency’s enterprise-wide management program. In addition, state DOTs are required to develop a process for quantifying annual risk to increase their system resilience as part of the Infrastructure Investment and Jobs Act (IIJA) also known as the Bipartisan Infrastructure Bill (BIL).

The purpose of this study is to establish an understanding of the research required to establish quantitative methods to support all-hazards risk and resilience analysis for the highway system.

## Project Accomplishments

### Glossary of Terms

The research team compiled a glossary with more than 180 terms and definitions from more than 90 sources. Definitions were derived from transportation sectors such as FHWA, AASHTO, and TRB and selected to craft a standard for risk and resilience analysis.

### Gap Analysis

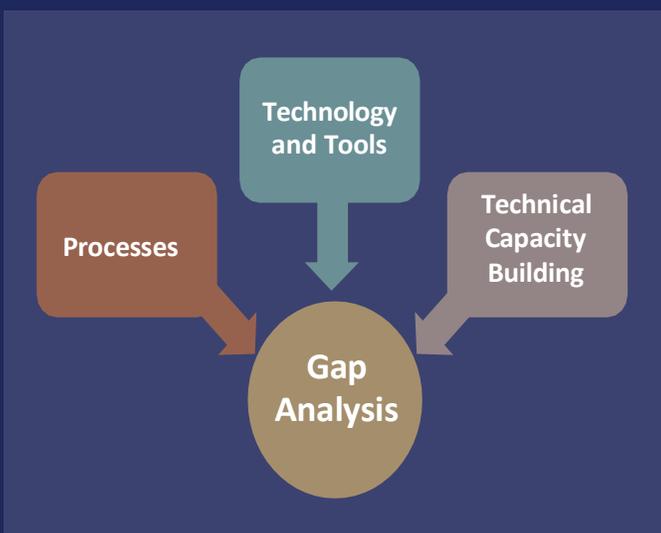
A comprehensive review of the state of practice revealed gaps that can be organized into three categories: (1) Processes, (2) Technology and Tools, and (3) Technical Capacity Building.

- **Processes** include institutional and DOT business processes that are used to develop risk and resilience (R&R) assessments.
- **Technology and Tools** are used to develop and support the R&R assessments.
- **Technical Capacity Building** includes gaps in areas such as educational support, staff training, and skill development.

### The Risk and Resilience (R&R) Framework

As part of this project, a framework for conducting a quantitative R&R assessment was developed based on multiple existent and proven R&R frameworks, such as FHWA Vulnerability Assessment and Adaptation Framework, ISO 3100, and RAMCAP frameworks among others. The provided framework:

- Followed the core bases for conducting quantitative R&R assessment.
- Provides flexible sequencing of steps.
- Provides linkages to practice integration and decision-making.
- Served as the bases to create the research roadmap and research problem statements (RPSs).

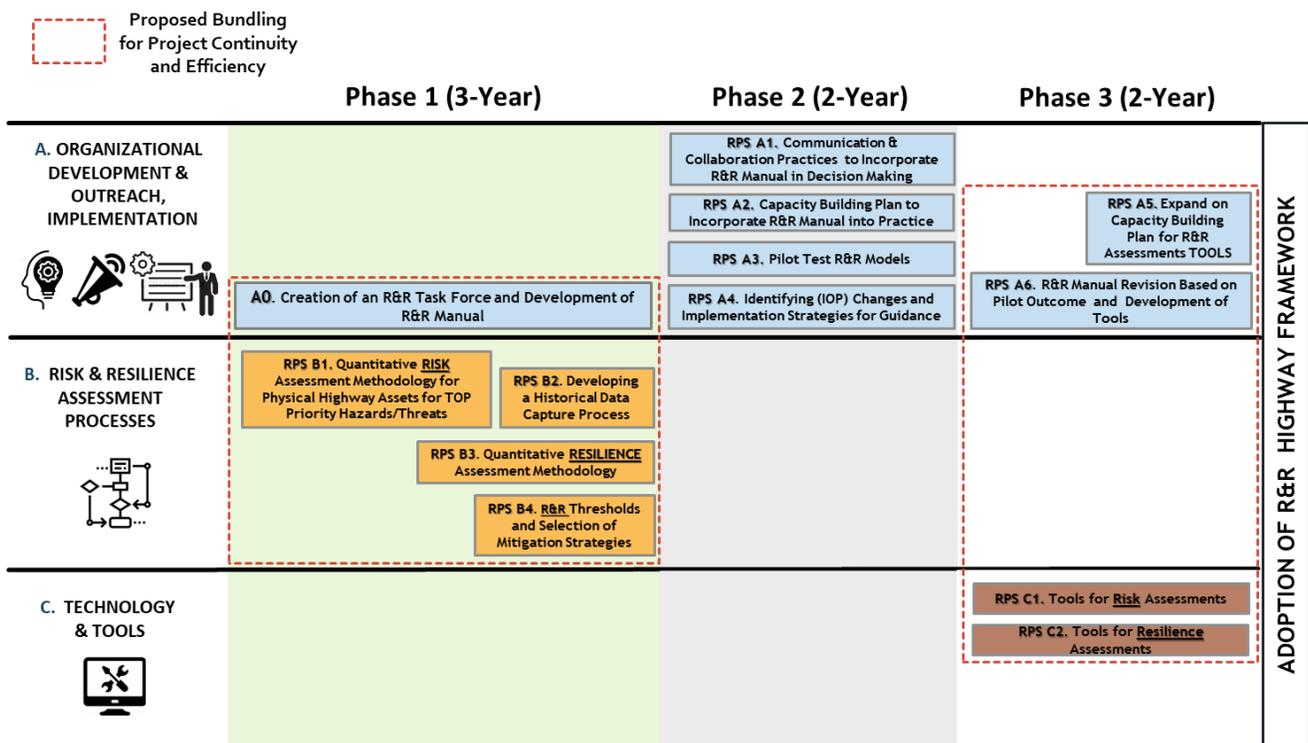
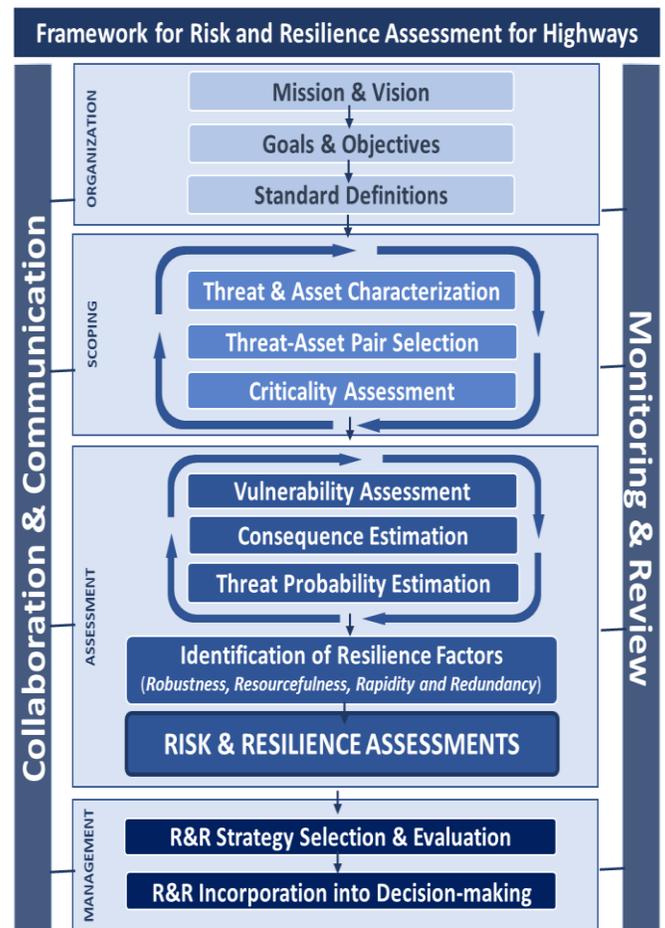


Gap Analysis

Twelve RPSs were developed to cover all the steps of the R&R framework. The RPSs were divided into three thematic lanes that built the research roadmap: (A) Organizational Development, Outreach, and Implementation; (B) R&R Assessment Processes; and (C) Technology and Tools as shown in the figure.

### Benefits for DOTs

- Provides a research roadmap to develop a comprehensive manual, tools, training, and implementation guidance for quantitative R&R assessment that satisfies the requirements of the new IIJA.
- Lays the framework for a consistent approach to R&R assessments, conduct of economic analysis, project prioritization, and asset and performance management for the more efficient use of available funds.
- Advances the preparedness of the transportation sector for emerging threats, including extreme weather, climate change, and cyber.
- Enables state DOTs to communicate risk and make the business case for resilience investments in the face of uncertainty.



**Expected Outcomes:** Phase 1: R&R framework/manual; Phase 2: Validation of the framework, training, and implementation; Phase 3: R&R tools and revised R&R manual

### Research Roadmap and Research Problem Statements (RPS)