**Domestic Scan Proposal Form 2014**

**Proposal Contact Information**

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| AASHTO Committee | T-5 | Date of submission | 10/31/2021 |

**Title of Proposed Scan**

*Redundancy Evaluation of Critical Bridges for safety, Security, and functionality*

**Problem Statement** (What topic is to be examined? What drives the need for the scan? Why now?)

Recent collapse of several bridges, such as the I-35 truss bridge collapse in Minneapolis, cable stayed bridge in Genoa, Italy, Pedestrian Bridge at Florida International University, steel single-arch bridge in Taiwan, and many other small or large catastrophic bridge superstructure and substructure failures have highlighted the importance of the role of redundancy in the safety of bridges. The purpose of this domestic scan is to identify needs and gaps in the current state-of-the-practice on different aspects of redundancy, which is defined as “the quality of a bridge that enables it to perform its design function in the damaged state”. The AASHTO LRFD Bridge Evaluation manual defines bridge redundancy as the capability of a bridge structural system to carry loads after damage to or the failure of one or more of its members. The System reliability encompasses redundancy by considering the system of interconnected components and members. The AASHTO LRFD Bridge Design Specification that the current approach of incorporating redundancy in bridge design is “arbitrary” and "subjective”. The use of redundancy as a means for hazard mitigation in the event of loss of a critical member has also not been explored in the current framework. Current simulation technology has advanced to the point where it can be used for assessing the effect of member criticality on the overall system collapse response. This approach is more rational and objective for assessing redundancy in critical and important bridges, but particularly for long-span bridges which are critical assets. Consideration of redundancy is not fully formulated for long span bridges, therefore rupture or yielding of an individual component may or may not mean collapse or failure of the whole structure or system. There is therefore an urgent need for an open forum discussion through a domestic scan for assessing the current framework on the state-of-practice on redundancy and identifying the gaps and challenges, and future research priorities.

**Scan Scope** (What specific subject areas are to be examined? Which cities and states might be visited? Which agencies/organizations (including specific departments or types of staff if applicable)?

The national bridge redundancy scan will include redundancy critical bridges on the state highway system as well as those carrying local streets and roads. The scan will focus on redundancy related bridge rehabilitation practices, safety to travelling public, and design and rehabilitation standards practiced by state DOT’s and local agencies. Consideration will be given to all redundancy critical bridge types, long span bridges, fracture critical bridges, and maintenance and safety inspection. The scan will also include forensic inspection, rehabilitation, design, and repairs with respect to existing non-redundant bridges and consideration for system redundancy. The domestic scan identifies best practices with regard to redundancy considerations among states and other transportation agencies. The scan will focus on states with significant number of redundancy critical bridges including long span bridges, fracture critical bridges, cable supported bridges, truss bridges in their inventory.

**Anticipated Scan Results** (What key information is to be gained? What information is to be shared after the scan? Who would the audience be for this information?)

The bridge redundancy domestic scan will augment information already identified in the FHWA Framework for Improving Resilience of Bridge Design (HIF11016), Assuring Bridge Safety and Serviceability (PL10014) which considered bridge redundancy for safety, security, and functionality. One of the objectives will be to identify specialized technology and standards used in monitoring or inspecting structural elements to ensure optimal performance and minimize downtime during maintenance or rehabilitation. The scan findings will be essential in developing a guidance on best practices with regard to determination of component redundancy as well as the system redundancy. The scan findings will be published and made available for AASHTO consideration in advancing redundancy design guidance and standards.

**Benefits Expected** (Including potential impacts on current technology or procedures)

The domestic scan on bridge redundancy will facilitate the development of AASHTO guidance and standards for safety and functionality with respect to bridge redundancy in the United States. With a national inventory on redundancy critical bridges, and better information on existing non-redundant bridge attributes, we will be in a better position to identify redundancy critical bridge infrastructure needs with respect to safety and functionality. This scan would be of specific interest to the AASHTO Subcommittee on Bridges and Structures Technical Committee T-2 “Bearings and Expansion Devices”, the AASHTO Subcommittee on Materials and the AASHTO Subcommittee on Maintenance. It will also provide valuable information to the AASHTO Committees for future consideration when developing their work plans and research needs. A synthesis of this information would also be of interest to State DOTs and FHWA offices, other Federal and local agencies involved in bridges, bearing and joint manufacturers, university researchers, consultants, county and local transportation agencies.

We will have better information to assess programmatic needs such as program level cost, scope and schedule for improving bridge redundancy, emergency operations, maintenance and inspection best practices, that will likely go along with future design and rehabilitation standards. The scan will include cost estimating for rehabilitation of existing redundancy critical bridges, retrofitting, maintenance and repairs for planning purposes.