

ABSTRACT

Reising, Rebecca. M.S.C.E., Purdue University, May 2014. Reliability Based Bridge Inspection Practices. Major Professor: Robert J. Connor.

Improving bridge safety, reliability, and the allocation of bridge inspection resources are the goals of the proposed reliability-based bridge inspection practices. Currently, bridges in the United States are inspected at a fixed calendar interval of 24 months, without regard to the condition of the bridge. Newer bridges with little or no damage are inspected with the same frequency as older, more deteriorated bridges thus creating inefficiency in the allocation of inspection resources.

The proposed methodology incorporates reliability theory and expert elicitation from the Indiana Department of Transportation's Reliability Assessment Panel to rationally determine bridge inspection needs. Assessments are made based on the likelihood and consequence of failure for specific bridge components. The likelihood of failure is determined through attributes based on design, loading, and condition characteristics while the consequence of failure is based on expected structural capacity, public safety, and serviceability. By combining the expressions of likelihood and consequence for each component, a maximum inspection interval for the entire bridge can be determined through the use of reliability matrices.

The methodology was verified through case studies involving Indiana bridges. Over 30 years of historical inspection reports were utilized in the back-casting process to evaluate deterioration levels and assess the adequacy of the reliability criteria. Overall, the proposed reliability based methodology maintains or increases safety and reliability while also optimizing inspection and maintenance resources.