0-6938: Synthesis of Service Life Prediction for Bridges in Texas

Background

In procurement requirements for design-build (DB) project contracts for bridge structures, the Texas Department of Transportation (TxDOT) may implement a 100-year service life requirement. However, there are no indicated measures or any technical recommendations that provide directions to satisfy the given requirement of service life. In addition, TxDOT and consultants use TxDOT recommendations for durability to improve performance during service life of design-bid-build and DB projects but no quantitative methods or codified guidance are available to validate how the enhanced service life requirements are met. Further, Texas has many older bridges, so evaluation of the remaining service life of these bridges is a critical economic issue for TxDOT. Replacement of all these bridges is not possible given the limited financial resources available. Prioritizing repairs based on the estimated remaining service life is thus essential. This research study was conducted to obtain information about state-of-the-art and state-of practice approaches to bridge service life prediction. The research team gathered and analyzed the relevant information on service life prediction, to enhance the determination of service life of both existing and new bridges.

What the Researchers Did

The research team conducted a thorough review of the state of the art and state of the practice of bridge service life prediction. A wide range of topics—such as empirical and mechanistic service life prediction models, deterioration modeling, bridge condition inspection, appropriate tests and thresholds, and design and acceptance requirements for DB and design-bid-build projects in the United States and in other countries—were covered. Further, the research team performed an extensive literature review on the durability tests for concrete and steel bridges and corrosion protection methods. Also considered were service life predictions for newly constructed bridges under DB and design-bid-build contracts, as well as several case studies of scenarios in which the operation and maintenance responsibility was transferred back to a government owner from a private developer.

What They Found

Value of research

The research team prepared a Value of Research analysis that contains economic-based calculations, the description of economic variables used within the calculations, and the qualitative values of TxDOT's selected benefit areas.

Service life prediction

From the extensive literature review, the research team obtained beneficial information about

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bridge condition inspection, mechanistic and empirical service life prediction models, service life prediction models for bridges beyond 75 years, remaining service life verification at handoff, and service life prediction for newly constructed bridge under DB contracts.

Service life prediction for bridges beyond 75 years

The research team summarized the state of the art of service life prediction for bridges beyond 75 years and evaluated existing practice on measuring bridge condition and performance in Texas and end-of-life criteria for old bridges. The literature review under this task has covered other topics, such as non-destructive technologies, life cycle cost analysis models, maintenance practices, and rehabilitation interventions.

DB and design-bid-build projects

The research team found and summarized acceptance strategies employed by state DOTs, federal agencies (e.g., FHWA and AASHTO), and major transportation agencies around the globe. The information includes verification methods, roles and responsibilities, and contracting and specification strategies. In addition, the real-world DB projects were reviewed, as well as recent case studies, to identify the state-of-art and innovative practices.

Tests or inspections with appropriate thresholds

The research team compiled information about the scenarios when the maintenance responsibility is transferred back to government owner from a DB developer. The case studies considered relate to various public-private partnership projects such as DB, build-operate-transfer, and design-build-finance-operate projects. Necessary tests or inspections with appropriate thresholds for determining remaining service life when a bridge is turned back to its owner can be identified from the available literature.

What This Means

The extensive literature survey conducted by the research team provides the valuable information as well as potential recommendations for TxDOT to inform service life prediction of bridges. The project's findings yielded the following benefits:

1. Guidance on managing the available funds efficiently for the required repair activities using the data on condition of the bridges.

2. Better understanding of various deterioration models used for predicting service life, inspection checks and methods, maintenance practices, and rehabilitation or replacement requirements for bridges; enhanced knowledge of achieving and extending the service life of Texas bridges.

3. Enhanced maintenance of the existing bridges in a good condition, improving their service life to make them economically efficient and determining strategies to achieve design service life for newly constructed bridges.

For More Information

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