SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Service Limit State Design for Bridges (R19B)

A bridge design approach informed by qualitative data that adds years to service life

Challenge

Bridge components deteriorate at different rates, which can lead to unanticipated bridge closings. Under the current system, bridge components are planned based on "ultimate limit state performance," which does not take into account service limit states focused on longevity-driven and durable design.

Solution

SHRP2's Service Limit State Design for Bridges toolkit offers a quantitative framework to assess service limit states more accurately. The toolkit provides actual performance data, component-based distress models, and specific guidance for common bridge elements, as well as:

- A framework for calibrating service limit state specifications.
- Service limit state load and resistance factors.
- Bridge design procedures and model specifications for service limit states.
- Tools required for future service limit state improvements.
- Model specification changes that include designing for durability.

The toolkit contains databases, software tools used in the calibration (such as Monte Carlo spreadsheets), and instructions for developing new or revised spreadsheets and deterioration models.

The framework will calibrate the following AASHTO service limit state design elements:

- Live load deflections
- Bearing movements
- Settlement of foundations and retaining structures
- Permanent deformations of compact steel components
- Fatigue of structural steel and the steel reinforcement in concrete (complementary research being conducted through the National Cooperative Highway Research Program [NCHRP] 12-83)
- Slip-critical bolted connections
- Concrete approaches

Benefits

Improved service limit state design can increase the service life of bridge components and give designers the option to select bridge components based on expected maintenance time and difficulty of replacement.

The Implementation Assistance Program

Implementation assistance is available to help State departments of transportation (DOTs), metropolitan planning organizations (MPOs), and other interested organizations deploy SHRP2 Solutions. A range of opportunities is available to raise awareness of SHRP2 Solutions and to encourage early adoption of these products. Application periods are offered approximately twice per year. Each product selected for implementation assistance has the potential to deliver more efficient, cost-effective programs to meet the complex challenges facing transportation today.

Save Lives

Knowledge of service limit states, such as cracks, corrosion, and deformation can prevent structural collapses. Additionally, fewer maintenance repairs and road closures can reduce the safety risks for workers and road users.

Save Money

By extending the service life of bridges, the frequency of rehabilitating and replacing costly elements of the transportation system is significantly reduced.

Save Time

The enhanced designs reduce the regularity of construction work associated with bridge preservation, rehabilitation and reconstruction, and lead to longer and more predictable bridge service life.

RENEWAL

One of four SHRP2 focus areas, Renewal products help transportation organizations rapidly build and restore highway infrastructure that lasts longer while minimizing user disruption and delay.

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Learn more about products, case studies, and implementation assistance.

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- Additional product information
- Information about how this product is being used in the field
- Contact information for peers who are familiar with this product
- Links to research reports

Contacts

Silas Nichols (FHWA)
silas.nichols@dot.gov

Reggie Holt (FHWA)
Reggie.Holt@dot.gov

Patricia Bush (AASHTO)
pbush@aashto.org

About SHRP2 Implementation

The second Strategic Highway Research Program (SHRP2) is a partnership of the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), and the Transportation Research Board (TRB). TRB completed the research, and now FHWA and AASHTO are jointly implementing the resulting SHRP2 Solutions that will help the transportation community enhance productivity, boost efficiency, increase safety, and improve the reliability of the Nation's highway system.