Overview of SHRP2 R19A and Activities Done by Other States

Virginia DOT Workshop – Charlottesville, VA

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Presentation Overview

• Need for Service Life Design

• SHRP2 R19A Implementation Action Program
  – Program Goals
  – Work Focus Areas
  – Participating Agency (Lead Adopter) Projects
  – Lessons Learned

• Summary
Need for Service Life Design

• Growing interest by the industry to make bridges more durable with longer expected lives

• Influenced by political motivation – popular to state that a new bridge will last 100+ years…

• Evident by requirements in recent Owner’s RFPs – particularly on Design Build projects
Service Life Designed Structures

- Ohio River Bridge, KY – 2016 (100 years)
Service Life Designed Structures

• Tappan Zee Bridge, NY – 2018 (100 years)

courtesy of New York State Thruway Authority
Need More Focus on These

• Representing the majority of the 600,000+ bridges in the US
Need for Service Life Design

- Expectations of SLD requirements often unclear
- A more robust definition was needed for SLD
- FHWA in conjunction with AASHTO and TRB through the 2nd Strategic Highway Research Program (SHRP2) initiated project R19A
  - Bridges for Service Life Beyond 100 Years: Innovative Systems, Subsystems and Components
SHRP2 Project R19A
Research Work Completed

- Project R19A – Service Life Design Guide

- [http://www.trb.org/Main/Blurbs/168760.aspx](http://www.trb.org/Main/Blurbs/168760.aspx)
IAP Lead Adopter Agencies

Oregon

Central Federal Lands (project in Hawaii)
IAP Lead Adopter Agencies

Iowa

Maine

Pennsylvania

Virginia
IAP Goals

• Promote SLD concepts through:
  – Marketing, outreach & training
  – Workshops & Peer Exchanges

• Assist Lead Adopter agencies in developing in-house SLD skills

• Build a strong technical foundation
  – Develop training & reference materials
  – Develop “Academic Toolbox”
  – Lessons learned summaries
Current Work Focus Areas

• Performing tests on material durability properties of concrete mix designs
  – Concrete chloride diffusion coefficients (NT Build 492)
  – Measurement of as-constructed concrete cover
Current Work Focus Areas

• Tests on existing bridges to assess environmental loading and material behavior
  – Taking concrete cores to measure chloride loading from de-icing chemicals or sea water

Source: Germann Instruments
Current Work Focus Areas

- Developing design tools and processes to aid in SLD
  - Excel spreadsheet for chloride profiling
Implementation Products –
Dedicated Webpage

http://shrp2.transportation.org/Pages/ServiceLifeDesignforBridges.aspx
IAP Projects
IAP Team Leaders

• FHWA Central Federal Lands
  – Bonnie Klamerus, Mike Voth

• Iowa DOT
  – Ahmad Abu-Hawash, Norm McDonald

• Oregon DOT
  – Bruce Johnson, Paul Strauser, Zach Beget, Ray Bottenberg, Andrew Blower, Craig Shike

• Pennsylvania DOT
  – Tom Macioce

• Virginia DOT
  – Prasad Nallapaneni, Soundar Balakumaran
• Tropical Coastal Exposure on North Shore, Island of Kauai, HI
  – 3 bridge replacements - 500’ to 1,000’ from the coastline
• Testing brackish water salinity

• Coring of existing abutments at water line / splash zone for surface chloride concentration

• NT Build 492 tests performed on baseline concrete mix designs
• New Bridge at Site with Extreme De-Icing Spray Exposure

- Using A1010 High Chromium Structural Steel
- Lab and field testing A1010 for steel corrosion resistance performance
- Recommendations from ODOT experience - Hormoz Seradj
Iowa DOT

- Replacement of Twin Structures on I-35 over South Skunk River near Ames

- Chloride profile testing on existing structures
- NT Build 492 tests on concrete mix designs
- SB Bridge – Designed to current Iowa DOT policies
- NB Bridge – Will be designed using SLD
- Final Product – Side-by-side comparison report between the two structures
Maine DOT

- Replacement of Beals Island Bridge in cold weather coastal environment
  - Chloride profiling on existing bridge
  - NT Build 492 tests on proposed concrete specifications
• Bridge Deck Evaluation in Various Chloride Exposure Zones
  – Performed chloride profile testing and categorization of chloride loading by geographic/climatic zones (Pacific Coast, Willamette Valley, Cascade Mountains and east)
• I-5 Columbia River Crossing Design/Build – Portland to Vancouver
  – Evaluate/modify RFP requirements for contractor to design/document to a 100-year service life

• Replacement Bridge over Ochoco Creek in Prineville
Statewide Evaluation of Chloride Resistance of Concrete

Performed NT Build 492 tests on 105 samples from 7 ready mix and 2 precast concrete suppliers

Figure 1: Company location map relative to PennDOT districts
Lessons Learned
Lessons Learned

- Chloride profiling on core samples produce much better results than powder samples from rotary drilling
- Deicing application is low enough in some parts of Oregon to disregard corrosion from chlorides
- Need to develop contour maps of chloride loading
- Chloride migration tests (NT Build 492) are relatively easy to implement
  - Virginia and Iowa performing in-house testing
Lessons Learned

- Most state concrete classifications are flexible in w/c ratio, and % flyash or slag replacing cement
- Mix design flexibility ≠ Consistent durability properties
  - Chloride migration test values (NT Build 492)
  - Aging coefficients (need ≥ 20% flyash to benefit)
- Need to develop guidelines for more consistent concrete specifications for SLD
IAP Next Steps

- Conduct Agency Final Training Workshops for CFL, IA, OR, ME
- Develop Reference Material Documentation / add to AASHTO/SHRP2 web page
  - Academic Toolbox
  - Lessons Learned Summaries
- Develop 5 FHWA Peer Exchanges in non-IAP states
• Uniform Service Life Design Guide Specification
  – Sponsored by AASHTO T-9 – Bridge Preservation Technical Committee
  – Modjeski & Masters / John Kulicki / Rutgers University / COWI / NCS GeoResources

• Project Goals
  – Develop Case Studies to Demonstrate the Application of the Proposed Guide
• Deemed-to-Satisfy and Avoidance of Deterioration Strategies to form the majority of the Guide Specification
  – Calibrated by more rigorous approaches
• Full Probabilistic and Partial Factor Methods
  – Included as an Appendix
• Environmental Classification
• Recommended Service Life
  – Main Structure Components
  – Replaceable Components
    • Bearings, Joints, etc.
Current Research – NCHRP 12-108

- **Work Plan / Schedule**
  - Tasks 1 & 2 – Literature Review and Synthesis
  - Task 3 – Develop Proposed Methodology
  - Tasks 4a & b – Propose Annotated ToC & Case Studies
  - Task 5 – Interim Report #1
    (all completed 03/10/17)
  - Tasks 6, 7 & 8 – Develop & Execute Methodology & Sample Section & Interim Report #2
    (scheduled 10/01/17)
  - Tasks 9 & 10 – Develop Guide and Case Studies
    (scheduled 07/01/18)
  - Tasks 11 & 12 – Revisions & Final Deliverables
    (scheduled 12/01/18)
  - End of Project
    (scheduled 02/28/19)
Summary

- Service Life Design is necessary to promote more durable, longer lasting structures
- Current implementation
  - SHRP2 R19A projects (FHWA CFL, IA(2), ME, OR, PA, VA)
- Tools being developed to assist designers
  - [http://shrp2.transportation.org/Pages/ServiceLifeDesignforBridges.aspx](http://shrp2.transportation.org/Pages/ServiceLifeDesignforBridges.aspx)
- AASHTO T-9 Initiated Research
  - NCHRP 12-108 Uniform Service Life Design Guide
Questions?

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**Subject Matter Expert Team:**
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**Resource: AASHTO’s R19A Product Page**
- http://shrp2.transportation.org/Pages/ServiceLifeDesignforBridges.aspx