SHRP 2 Renewal Program Overview

ARCHES – SPENS Seminar
Ljubljana, Slovenia
August 2009
• Overview of SHRP2 Renewal Program
• Review of Selected Projects
• Planning for Implementation
Renewal Program - Goals

"GET IN, GET OUT, STAY OUT"

The search for renewal tools and techniques that reduce preparation and execution times, reduce disruptions to traffic, utilities, and neighborhoods, and extend the time between renewal activities.
Balanced approach
28 Research Projects - $32 Million

Rapid Approaches
- R01. Locating Utilities*
- R02. Geotech Solutions
- R03. Worker Fatigue
- R04. Innovative Bridge Designs
- R05. Modular Pavement
- R06. High-Speed NDT*
- R07. Performance Specs
- R09. Risk Manual
- R10. Project Management for Large Projects

Minimize Disruption
- R11. Strategic Approaches at Corridor/Network Level
- R15. Integrating Utility and Transportation Agency Priorities*
- R16. Railroad-DOT Mitigation Strategies

Long-Lived Facilities
- R19. Bridges for Service Life of 100 Years*
- R21. Composite Systems
- R23. Using Existing In-place Pavement & Achieving long Life
- R26. Preservation Approaches

Technology Related
Project Delivery Related
* Indicates Multiple Projects
Integrated Tactic 1

Enable Performance-Based Renewal
- Rapid Approach
- Minimum Disruption
- Long Life

R06. High-Speed NDT

R07. Performance Specs
Incentive Specs
Warranties

R09. Risk Manual for Renewal Contracts
Integrated Tactic 2

Facilitate Project Start-up

- Minimum Disruption
- Rapid Approach

R01: Locating & Characterizing Utilities
R15: Integrating Utility and Transp. Agency Priorities
R09: Risk Manual for Rapid Renewal Contracts
R04: Innovative Bridge Designs
R16: Railroad-DOT Mitigation Strategies
R11: Approaches at Corridor/Network Level
R06: High-Speed NDT
Integrated Tactic 3

Accelerate Construction
- Rapid Approach
- Minimum Disruption

- R02. Geotechnical Solutions
- R03. Reducing Personnel Fatigue
- R04. Innovative Bridge Designs
- R05. Modular Pavement
- R06. High-Speed NDT
- R10. Innovative Project Management
- R23. Using Existing In-place Pavement
Integrated Tactic 4

Reduce Maintenance Frequency

- Minimum Disruption
- Extends Life

R21. Composite Systems
R23. Using Existing In-place Pavement
R19. Durable Bridge Systems
R02. Geotechnical Solutions
R26. Preservation Approaches
R06. High-Speed NDT

SHRP2
STRATEGIC HIGHWAY RESEARCH PROGRAM
TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES
Integrated Tactic 5

Facilitate Responsive Contracting

- Rapid Approach
- Minimum Disruption
- Long Life

R07. Performance Specs Incentive Spec Warranties

R09. Risk Manual for Renewal Contracts

R10. Innovative Project Management

R03. Reducing Personnel Fatigue

R04. Innovative Bridge Designs
Status - Renewal Research Program

Rapid Approaches
- R01
- R02
- R04
- R05
- R06
- R07
- R09
- R10

Minimize Disruption
- R15
- R16
- R11

Long-Lasting Facilities
- R19-A
- R19-B
- R21
- R23
- R26

Follow on Projects
- Technology related
- Project Delivery related
Modular Pavement Technology
What we are facing...

- Heavy Traffic Volumes
- Concern to maximize the movement of traffic
- Restrictions on the time and length of traffic lane closures
- Need to maximize pavement service life
- Need to minimize impacts on traffic

STRATEGIC HIGHWAY RESEARCH PROGRAM

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES
What is SHRP2 Doing

Project R05. Modular Pavement Technology

Focus on
Developing tools for the design, construction, installation, maintenance, and evaluation of modular pavement systems

Contract: Fugro, $1M
Why Modular Pavements?

- More control on the quality of the materials
- Better quality control of the fabrication
- Better curing conditions
- Minimal weather restrictions on when it can be placed
- Reduced delay prior to opening to traffic (no on-site concrete curing)
Modular Pavement Applications

• Intermittent repairs – plain concrete panels
  – Full-depth or full panel replacement

• Continuous Applications (longer length/larger area) – Rehab of ACP or PCCP; bridge approach slabs
  – Conventional jointed systems
  – Prestressed panels – fewer active joints
On-going or Planned Projects

- New York DOT
- New Jersey DOT
- Delaware DOT
- Illinois Tollway
- Caltrans
- MTO, Canada
Gaps in Modular Pavement Technology

• Insufficient understanding of modular pavement behavior and long-term performance.
• Lack of Best Practices for design, construction and M&R of modular pavement systems
• Lack of well developed, experienced-based generic specifications for use of precast systems
• Well developed acceptance testing (QA) procedures for different systems
• Opening to traffic requirements
R05. Modular Pavement Technology

**Anticipated Products**

- Guidance on the potential uses of modular pavement systems for specific rapid renewal applications.
- Generic Modular Pavement Design Procedures.
- Guidelines and model specifications for construction, installation, and acceptance criteria for modular pavements.
- A long-term evaluation plan to assess the performance of modular systems and refinements in designs and materials.
Railroad / DOT coordination
in Highway Renewal Projects
What we are facing...

- Railroad (RR) presence complicates highway renewal projects
- RRs are very protective of their corridors
  - Issues arise of safety, train operations, highway project scope
- Railroads are private & for profit
  - Most highway projects do not provide an inherent benefit to the RR
- Each RR is unique
R16. Railroad-DOT Institutional Mitigation Strategies

Focus on

Identifying institutional arrangements and developing tools to facilitate beneficial relations between railroads and DOTs

Anticipated Products

- Effective practices document
- Model agreements
- Streamlined permitting procedures.
- Recommended specifications, institutional, and policy changes for implementation
Life of Bridges
What we are facing...

- Debris inhibits deck drainage.
- Standing water promotes deck deterioration.
- Water and deicers corrode steel reinforcement, causing spalling.
- Speed, surface roughness, and truck suspension interact to amplify stress.
- Bridge superstructure is susceptible to corrosion, water damage, metal fatigue, and stress caused by vibration.
- Surface corrosion.
- Water movement can scour away soil under foundation.
- Decaying or misalignment of bearings.
- Debris-clogged joint prevents movement necessary to relieve superstructure stresses.
- Improper drainage causes damage to concrete.
- Crack in substructure caused by settling of foundation.
What SHRP 2 is doing ...

Project R19-A. 100-Year Bridges: Innovative systems

Focus on

Improving existing and prove promising concepts for systems, subsystems, and components that historically limit the service life of bridges

Contract: University of Nebraska-Lincoln, $2 M
Desired Characteristics of Bridges Designed for 100+ Years of Service Life

a) Components should be designed considering the system
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b) Should be Easy to Replace
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a) Components should be designed considering the system

b) Should be Easy to Replace

c) Predictable Service Life

![Graph showing service life with specified and real values, initiation, propagation, and deterioration stages.]

Service life: Design: 100 years  Expected: 15 years

Specified value  Real value  Cl− ingress
Desired Characteristics of Bridges Designed for 100+ Years of Service Life

a) Components should be designed considering the system
b) Should be Easy to Replace
c) Predictable Service Life
d) Inspectability
Desired Characteristics of Bridges Designed for 100+ Years of Service Life

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e) Maintenance Plan
Desired Characteristics of Bridges Designed for 100+ Years of Service Life

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c) Predictable Service Life

d) Inspectability

e) Maintenance Plan

f) Economy – Life cycle cost analysis needs to be part of design process
Products will include...

• New / improved systems, subsystems, components – *Proof of concept*

• Analysis methods, examples, details, etc.

• Recommendations for AASHTO-formatted LRFD design and construction specifications.

• Stand alone document devoted to Design for Life.
## Example of Technology Table

Concrete durability

<table>
<thead>
<tr>
<th>Service Life Issue</th>
<th>Solutions</th>
<th>Advantage</th>
<th>Disadvantage</th>
<th>Failure Modes</th>
<th>Expected Service Life</th>
<th>System Preservation Requirements</th>
<th>Areas for Further Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeze and thaw</td>
<td>Good air void system</td>
<td>High resistance to freezing and thawing</td>
<td>Reduction in strength due to extra air</td>
<td>Cracking, scaling</td>
<td>High</td>
<td>good drainage and low permeability for reduced level of saturation</td>
<td>Small, well distributed bubbles</td>
</tr>
</tbody>
</table>
**Example of Strategy Table**

Concrete durability – Strategy to combat Freeze and Thaw

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Air Entrainment Criteria</th>
<th>Aggregate Criteria</th>
<th>Strength Criteria</th>
<th>Other Protection Methods</th>
<th>Maintenance Requirements</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT1</td>
<td>Min 6%</td>
<td>Sound</td>
<td>$\geq 3500$ psi?</td>
<td>N/A</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>
IMPLEMENTATION

Recommendations of the report committee:

• Establish an implementation program

• The principal agent should be FHWA with AASHTO, NHTSA, and TRB

• Provide stable and predictable funding

• Formal stakeholder advisory structure

• Detailed plans as soon as possible
Principles

• Establish principal implementation agent early
• Involve stakeholders
• Communicate ceaselessly
• Prioritize products for optimal success
• Market and package/brand products
• Choose the right implementation strategies
• Balance divergent and convergent approaches
Key Strategies

- Strategic packaging and branding
- Technical assistance
- Standards, specifications, guidebooks, manuals
- Follow-on research, testing, evaluation
- Lead users and demonstration projects
- Training and education
- Long-term stewardship

*Knowledge Management and IT*
Recommendation 3

Funding:
$400 million over 6 years

– Over and above ongoing FHWA and NHTSA research budgets
Early Implementation Activities

- TRB implementation coordinator—Jerry DiMaggio
- Meetings with FHWA, NHTSA, other stakeholders, international
- Prepare product lists “First Fruits”—early product marketing
Thank You for your Attention

For more information:
www.trb.org/shrp2