Legislation Update & Bridge Preservation Strategies

2012 Pacific Northwest Bridge Maintenance Conference
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Office of Bridge Technology
Presentation Outline

• Bridge Program Challenges

• Moving Ahead for Progress in the 21\textsuperscript{st} Century Act (MAP-21)

• Bridge Preservation Strategies and National Efforts
Bridge Facts & Challenges

• More than 600,000 Bridges Nationwide

• Aging Infrastructure
  o 33% of bridges have exceeded their theoretical 50 year design life
  o Average bridge age is over 40 years
Bridge Facts & Challenges

- Deteriorating Condition
  - 25% of bridges are deemed deficient
    - 12% structurally deficient (SD)
    - 13% functionally obsolete (FO)
Bridge Facts & Challenges

- Increase in Travel Demand
  - 4.4 billion total ADT carried – *Represents 18% increase since 2000*
  - 413 million total Truck ADT carried - *Represents 23% increase since 2000*

- Increase in materials and labor costs
Truck Volumes in 2000

1998 Daily Truck Volume
- Green: Truck <= 5,000
- Blue: 5,000 < Truck <= 10,000
- Red: Truck > 10,000
- Other

Miles

Battelle, February 25, 2002
Truck Volumes in 2020

2020 Daily Truck Volume
- Green: Truck <= 5,000
- Blue: 5000 < Truck <= 10,000
- Red: Truck > 10,000
- Other

Battelle, February 25, 2002
Presentation Outline

• Bridge Program Challenges

• **Moving Ahead for Progress in the 21\textsuperscript{st} Century Act (MAP-21)**

• Bridge Preservation Strategies and National Efforts
MAP-21 FOR BRIDGES

- SAFETEA-LU expired on 9/30/09
  - 10 extensions (final one from 7/1/12 - 7/6/12)
- MAP-21 Signed by President July 6, 2012
- 2 year Bill (FY2013 & FY2014)
- Many provisions took affect on October 1st, 2012
- Avg. annual funding at FY12 levels (plus minor inflation)
MAP-21 FOR BRIDGES

• Two year bill
  – $37.5 billion in 2013
  – $37.8 billion in 2014

• Four main programs related to bridge
  – National Highway Performance Program (NHPP)
  – Surface Transportation Program (STP)
  – Highway Safety Improvement Program (HSIP)
  – Congestion Mitigation and Air Quality Improvement Program (CMAQ)
$37.7 Billion/Year in Formula Funding

- National Highway Performance Program ($21.8)
- Surface Transportation Program ($10.0)
  - HSIP ($2.2)
  - CMAQ ($2.2)
- Railway-Highway Crossing ($0.2)
- Transportation Alternatives ($0.8)
- Metro Planning ($0.3)

Note: Amounts in $Billion
MAP-21 FOR BRIDGES

National Highway Performance Program (NHPP)

• Funds an enhanced National Highway System, combining functions of the existing NHS, IM and Bridge Programs
• Enhanced NHS includes existing NHS, all principal arterials, STRAHNET, and intermodal connectors
• Requires an asset management plan
• States set targets for conditions and performance
• Min. standards for Interstate & bridge conditions in a State
  – DOT to set minimum standard for Interstate pavement condition
  – Law sets standard for NHS bridges -- no more than 10% of deck area may be structurally deficient
MAP-21 FOR BRIDGES and Tunnels

• National Highway Performance Program (SEC 1106)
  – Eligible facility = any facility on the NHS
  – Eligible project = supports the national performance goals and meets at least one listed purpose
  – Performance targets for the NHS set by state as part of an asset management plan
    • Risk and performance based
    • In line with national goals, specified in law (SEC 1203)
MAP-21 FOR BRIDGES

• National Highway Performance Program
  – Timing of actions
    • 18 months after October 1st – USDOT Secretary to issue regulations defining the process for developing an asset management plan
    • 18 month transition period beyond publication of final rule
MAP-21 FOR BRIDGES

• Surface Transportation Program (STP)
  – Includes bridges and tunnels on public roads of all functional classifications
  – Eligible - construction, replacement, rehabilitation, preservation, protection, inspection, evaluation, inspector training
  – 15% of 2009 Highway Bridge Program apportionment set aside for bridges not on Federal-aid highways (waiver still allowed)
MAP-21 FOR BRIDGES

- National Bridge and Tunnel Inventory and Inspection Standards Program
  - Congress determined that it is in the vital interest of the U.S. to use performance based bridge management systems
  - Need to establish tunnel inspection standards and inventory
  - Need to revisit Sufficiency Rating – consider emergency and freight mobility
MAP-21 FOR BRIDGES

• National Bridge and Tunnel Inventory and Inspection Standards Program (Continued)
  – Classify bridges according to serviceability, safety, and essentiality for public use, including the potential impacts to emergency evacuation routes and to regional and national freight and passenger mobility if the serviceability of the bridge is restricted or diminished;
  – Based on that classification, assign each a risk-based priority for systematic preventative maintenance, replacement, or rehabilitation; and
MAP-21 FOR BRIDGES

• National Bridge and Tunnel Inventory and Inspection Standards Program (Continued)
  – Determine the cost of replacing each structurally deficient bridge
  – Element level data:
    • Issue guidance and begin collecting w/in 2 years of enactment
    • Study cost-effectiveness, benefits, feasibility of collecting for non-NHS bridges
MAP-21 FOR BRIDGES

• National Bridge and Tunnel Inventory and Inspection Standards Program (Continued)
  – Update the National Bridge Inspection Standards within 3 years
    • National inspector certification process
    • Establish procedures for reporting critical findings
    • Risk-based approach to setting inspection intervals
  – Annual compliance process and penalty (both bridges and tunnels)
  – Develop training program for tunnel inspectors
MAP-21 FOR BRIDGES

• National Goals and Performance Management Measures
  – 7 national goal areas defined in law
  – Infrastructure condition – maintain a state of good repair
  – 18 months after enactment – rulemaking to “establish performance measures and standards.”
  – 12 months after the rule, states set their targets
MAP-21 FOR BRIDGES

• National Goals and Performance Management Measures (Continued)
  – For bridges, limited to standards and measures for bridge conditions on the NHS
• 4 years after enactment and biennially thereafter, states report on conditions and progress
• More information on MAP-21 can be found at http://www.fhwa.dot.gov/map21/
Presentation Outline

• Bridge Program Challenges
• Moving Ahead for Progress in the 21st Century Act (MAP-21)
• Bridge Preservation Strategies and National Efforts
National Bridge Preservation Initiatives

• FHWA
  – Bridge Management Peer Exchanges
  – TSP Preservation Roadmap
  – Establishment of the BPETG
  – National Bridge Management Conference 2011

• AASHTO
  – TSP-2 Bridge Preservation Expansion
  – Technical Assistance for member agencies
  – Regional Partnerships
  – SCOBS, T-9 Bridge Preservation Committee
  – SCOM, Bridge Technical Working Group

• TRB
  – TRB, AHD-00 Bridge Preservation Committee
  – TRB, AHD-30 Structure Maintenance Committee
  – TRB, Bridge Preservation & Durability ETG

• ARTBA
  – Bridge Action Team
Common Definitions

• Bridge Preservation
• Preventive Maintenance
• Rehabilitation
• Replacement
• State of Good Repair
• Structurally Deficient
• General Condition Ratings
• Condition States
Bridge Preservation Definition

Actions or strategies that prevent, delay or reduce deterioration of bridges or bridge elements, restore the function of existing bridges, keep bridges in good condition and extend their useful life. Preservation actions may be preventive or condition-driven.

- This Definition was adopted by ASHTO SCOH in Sep. 2011
Bridge Preservation Classification

- Bridge Preservation
- Preventive Maintenance
- Rehabilitation

Cyclical (Non-Condition Based) Activities
Condition Based Activities

Bridge Replacement
Preventive Maintenance

Preventive maintenance is a planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without substantially increasing structural capacity).

Source: AASHTO Subcommittee on Maintenance.
Preventive Maintenance

• Preventive maintenance (PM) is considered a component of preservation
• PM includes cyclical and condition based activities
• Examples of condition based PM activities include:
  - Sealing or replacing leaking joints
  - Installation of deck overlays
  - Complete, spot, or zone painting of steel elements
  - Scour countermeasures installation
  - etc.
## Preventive Maintenance

<table>
<thead>
<tr>
<th>Cyclical PM Activity Examples</th>
<th>Commonly Used Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wash/clean bridge decks or entire bridge</td>
<td>1 to 2 Years</td>
</tr>
<tr>
<td>Install deck overlay on concrete decks such as:</td>
<td>10 to 15 Years</td>
</tr>
<tr>
<td>- Thin bonded polymer system overlays</td>
<td></td>
</tr>
<tr>
<td>- Asphalt overlays with waterproof membrane</td>
<td>10 to 15 Years</td>
</tr>
<tr>
<td>- Rigid overlays such as silica fume and latex modified</td>
<td>20 to 25 Years</td>
</tr>
<tr>
<td>Seal concrete decks with waterproofing penetrating sealant</td>
<td>3 to 5 Years</td>
</tr>
<tr>
<td>Zone coat steel beam/girder ends</td>
<td>10 to 15 Years</td>
</tr>
<tr>
<td>Lubricate bearing devices</td>
<td>2 to 4 Years</td>
</tr>
<tr>
<td>Coat timber elements with wood preserver sealant</td>
<td>1 to 2 Years</td>
</tr>
</tbody>
</table>
Rehabilitation

Rehabilitation involves major work required to restore the structural integrity of a bridge as well as work necessary to correct major safety defects. *Source: 23 CFR 650.403(c).*

- Bridge rehabilitation activities are considered bridge preservation.
- Functional improvements such as adding a travel lane or raising vertical underclearance are not considered preservation.
Replacement

Total replacement of a structurally deficient or functionally obsolete bridge with a new facility constructed in the same general traffic corridor...

Source: 23 CFR 650.405(b)(1)

• Bridge replacement is not considered a preservation activity.
State of Good Repair (SGR)

A condition in which the existing physical assets, both individually and as a system (a) are functioning as designed within their useful service life, (b) are sustained through regular maintenance and replacement programs. SGR represents just one element of a comprehensive capital investment program that also addresses system capacity and performance.

Source: Secretary Mary Peters July 25, 2008 letter to Congress on this topic
State of Good Repair (SGR)

SGR for bridges would mean: the existing physical conditions of bridge elements, components or entire bridges are such that the bridges (a) are functioning as designed and (b) are sustained through regular maintenance, preservation, and replacement programs.
Structurally Deficient (SD)

A bridge is deemed SD if:
• A bridge component (deck, superstructure, substructure or culvert) having an NBI general condition rating of a 4 or less (poor condition), or
• Structural Evaluation or Waterway Adequacy rated a 2 or less (a bridge with a very low load rating capacity, or a bridge that is subject to overtopping with significant or severe traffic delays).
General Condition Ratings (GCRs)

- GCRs are used to describe the existing, in-place bridge or culvert as compared to the as-built condition. The materials used in the bridge are considered as well as the physical condition of the deck, superstructure and substructure components. This information is used to determine GCRs on a numerical scale that ranges from 0 (failed condition) to 9 (excellent condition) as described in the FHWA Coding Guide.
# General Condition Ratings (GCRs)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Commonly Employed Feasible Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>EXCELLENT CONDITION</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>VERY GOOD CONDITION No problems noted.</td>
<td>Preventive Maintenance</td>
</tr>
<tr>
<td>7</td>
<td>GOOD CONDITION Some minor problems.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>SATISFACTORY CONDITION Structural elements show some minor deterioration.</td>
<td>Preventive Maintenance; and/or Repairs</td>
</tr>
<tr>
<td>5</td>
<td>FAIR CONDITION All primary structural elements are sound but may have some minor section loss, cracking, spalling or scour.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>Commonly Employed Feasible Actions</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>POOR CONDITION Advanced section loss, deterioration, spalling or scour.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SERIOUS CONDITION Loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.</td>
<td>Rehabilitation or Replacement</td>
</tr>
<tr>
<td>2</td>
<td>CRITICAL CONDITION Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored the bridge may have to be closed until corrective action is taken.</td>
<td></td>
</tr>
</tbody>
</table>
## General Condition Ratings (GCRs)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Commonly Employed Feasible Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IMMINENT FAILURE CONDITION Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put back in light service.</td>
<td>Rehabilitation or Replacement</td>
</tr>
<tr>
<td>0</td>
<td>FAILED CONDITION Out of service - beyond corrective action.</td>
<td></td>
</tr>
</tbody>
</table>
Condition State (CS)

CS categorizes the nature and extent of damage or deterioration of a bridge element. The AASHTO Guide Manual for Bridge Element Inspection, first edition, 2011, provides detailed information on bridge elements and their corresponding condition states. According to this guide manual, each bridge element can have four condition states. The higher the condition state, the higher the severity of the damage and/or deterioration.
# Condition State (CS)

<table>
<thead>
<tr>
<th>Condition State</th>
<th>Description</th>
<th>Commonly Employed Feasible Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Varies depending on element – Good</td>
<td>Preventive Maintenance</td>
</tr>
<tr>
<td>2</td>
<td>Varies depending on element – Fair</td>
<td>Preventive Maintenance or Repairs</td>
</tr>
<tr>
<td>3</td>
<td>Varies depending on element – Poor</td>
<td>Rehabilitation</td>
</tr>
<tr>
<td>4</td>
<td>Varies depending on element - Severe</td>
<td>Rehabilitation or Replacement</td>
</tr>
</tbody>
</table>
Consequences of Deferring Maintenance & Preservation

- Condition Gets Worse
- Leads to Limited Alternatives
- Most Costly
Benefits of Maintenance & Preservation

- Cost Effective
- Minimum Traffic Disruption
- Lower User Costs
- Public Safety
- Reduce Need to Replace
Implementation Strategies for Bridge Preservation Program
Implementation Strategies – Objectives

Example Objective: Implement timely preservation treatments on structurally sound bridges, thereby extending their useful life.

Structurally sound may be defined as having an overall NBI general condition rating of 5 or greater for the deck, superstructure, substructure, or culvert components, or AASHTO Element Condition State of 1 or 2 for the elements associated with the deck, superstructure, substructure, and culvert units.
Implementation Strategies – Goals & Measures

Example of Program Goal: Maintain 90 percent of bridges in a state of good repair.

• **Measure:** Percent of bridges with element condition state ≤ 2.

• **Measure:** Percent of bridges with NBI general condition rating ≥ 6.
Implementation Strategies – Goals & Measures

Considerations:
- Current Condition of the Bridge Inventory
- Historical Condition and Funding Trends
- Available Resources
- Customers & Stakeholders Input
Implementation Strategies – Condition Assessments

Condition Assessment Through:
- Safety Inspection (NBIS)
- Element Level Inspections

Considerations:
- Inventory and Condition Data Attributes
- Quality and Currency of Data
- Quality and Expertise of Staff
- Integration with Other Systems such as BMS, AMS, Traffic, Planning, etc.
Implementation Strategies – Work Activities

• Identify Feasible and Cost Effective Activities & Treatments, and

• Classify Activities Under Major Programs For Ease of Management.
  – For Example Work Activities Can be Classified Under Three Programs: Preventive Maintenance, Rehabilitation, and Improvement
## Implementation Strategies – Work Activities Examples

<table>
<thead>
<tr>
<th>Preservation</th>
<th>Rehabilitation</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge Cleaning/Washing</td>
<td>Deck Repairs and Installation of Thin Bonded Overlay</td>
<td>Bridge Replacement</td>
</tr>
<tr>
<td>Deck Joint Maintenance/Repairs</td>
<td>Deck Repairs and Installation of Rigid Bonded Overlay</td>
<td>Bridge Widening/Raising</td>
</tr>
<tr>
<td>Deck Joint Replacement</td>
<td>Deck Repairs and Installation of Thin Bonded Overlay, and Cathodic Protection</td>
<td>Bridge Relocation</td>
</tr>
<tr>
<td>Deck Surface Repairs</td>
<td>Deck Repairs and Installation of Rigid Bonded Overlay and Cathodic Protection</td>
<td>Culvert Replacement</td>
</tr>
<tr>
<td>Rail Maintenance/Repairs</td>
<td>Superstructure Rehabilitation</td>
<td>Culvert Extension</td>
</tr>
<tr>
<td>Crack Sealing</td>
<td>Superstructure Repairs and Painting</td>
<td></td>
</tr>
<tr>
<td>Deck Sealing</td>
<td>Retrofitting Fatigue Prone Details/Fracture Critical Members</td>
<td></td>
</tr>
<tr>
<td>Installation of Thin Bonded Deck Overlay</td>
<td>Substructure Rehabilitation</td>
<td></td>
</tr>
<tr>
<td>Installation of Rigid Bonded Deck Overlay</td>
<td>Culvert Rehabilitation</td>
<td></td>
</tr>
<tr>
<td>Superstructure Maintenance/ Surface Repairs</td>
<td>Culvert Lining/Sleeking</td>
<td></td>
</tr>
<tr>
<td>Superstructure Spot/Zone Painting</td>
<td>Substructure Repairs and installation of Pile Jacketing</td>
<td></td>
</tr>
<tr>
<td>Complete Superstructure Painting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substructure Maintenance/ Surface Repairs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Culvert Cleaning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channel Debris Removal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation of Scour Countermeasures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pile Jacketing</td>
<td></td>
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</tr>
</tbody>
</table>
Implementation Strategies – Work Activities

Considerations:

- Activities that will facilitate achievement of goals
- Condition threshold for bridge elements, components, or entire bridge
- Bridge material types
- Frequencies
Implementation Strategies - Funding

Determine Needs and Funding Levels
- Identify Unmet Needs
- Determine Funding and Resources Needs for Meeting Your Program Goals
- Compare the Unmet Needs and Targeted Needs with Allocated Funds (Authorized Budget)
- Develop Short and Long-term Plans
- Seek or Make Adjustments to Budget
Implementation Strategies - Funding

Determine Needs and Funding Level

Considerations:
- Means for estimating the cost and the reliability of cost data.
- Network level vs. Project level estimates
- Adequacy and sustainability of funding levels to achieve desired goal(s)
Implementation Strategies – Work Plan

• Select and Rank Projects
• Classify Projects Based on Work Groups as Discussed Earlier (PM, Rehab, Improvement)
• Group Projects Based on Type and Location (Site Specific, Multiple Sites, Corridor, Region-wide, etc.)
Implementation Strategies – Work Plan

Considerations:
- Identify key factors to be considered in the ranking and prioritization process. Factors such as: ADT, Condition, Age, Detour length, Safety, Criticality, Risk, etc.)
- Available Funding
- Resources (in house vs. outsourcing)
- Environmental Restrictions
- Work Zone Traffic Restrictions
- Past Plan Delivery Performance
If All Fails......
Bridge Preservation Guide

Copies can be ordered from the FHWA Report Center
Email: Report.center@dot.gov
Telephone: (814) 239-1160

Copies may be downloaded from
Other On-going FHWA Initiatives

• Update NHI bridge maintenance course (4 ½ days)
• Develop a new NHI bridge preservation course (1-day)
• Develop a new NHI performance based management of highway bridges course (1-day)
• Conduct Bridge Management and Preservation Peer Exchanges
• Develop a bridge preservation web-based training for contractors and construction personnel (sealing/water proofing; coatings; safety practices)
• Implement Element Level Inspections
Thank You

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