NATIONAL BRIDGE INSPECTION PROGRAM
COMMENDABLE PRACTICES

Portland, Oregon
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Federal Highway Administration
Office of Technical Services – Resource Center
National Bridge Inspection Program

• 1 National Bridge Inspection Standard
  – statewide inspection policies/procedures
  – quality assurance/quality control
  – preparation/maintenance of a bridge inventory
  – inspections, reports, and load ratings

• 20 Federal agencies
• 52 State Transportation Departments
• 607,380 highway bridges
Commendable Practices

- Organization
- Policies & Procedures
- QC/QA
- Bridge Inventory
- Reports
- Load Rating
- Inspections
Organization

- State bridge inspection, repair, design and management aligned in same functional section
- Field inspection teams that report to personnel under direct supervision of the NBIS Program Manager
- Inspection teams with more than 2 members for team leader development and succession planning
- Local Bridge Advisory Committee
Policies & Procedures

- Comprehensive bridge inspection manuals that are regularly updated and easily accessible (web, inspection software)
Policies & Procedures

• Use of extended inspection intervals in accordance with the NBIS
  – FHWA Technical Advisory T 5140.21
• Electronic documentation of follow-up actions, prioritization, tracking and reporting
Policies & Procedures

• Electronic document management systems with accessible bridge record information
• Utilization of technologies for remote monitoring of scour critical bridges
• Use of rope climbing techniques by state inspectors and refresher training

April 2013
**QC/QA**

- Comprehensive documentation of QC/QA procedures for State, local agencies and consultants
- Regularly scheduled meetings of bridge inspection staff (annual, quarterly, bi-monthly)
- Annual refresher training
QC/QA

• Regularly scheduled compliance reviews of other public agencies by State DOT
• Rotation of inspection teams, state and consultants
• Independent field review
QC/QA

- Independent QC review of each report
- Use of statistical sampling for QA reviews
  - Standard ANSI/ASQ Z1.4 Sampling Procedures
- Documentation of QA review results
QC/QA

• Electronic documentation and management of inspection personnel education, certification, experience and training by Program Manager

• Inspection of reference bridges for refresher training and certification
Bridge Inventory

• Database web-interfaces to enter, maintain and view inventory and condition data with reporting capabilities
Bridge Inventory

• Customized electronic data checks beyond FHWA Edit/Update program
• Use vehicle mounted laser to obtain vertical clearances at highway speeds
Reports

• Regularly scheduled bridge inspection status reports either monthly or quarterly
• Standardized reports for all inspection types whether by state, local or consultant
• Standard timber boring report
Reports

• Use of electronic photo management system
• Measure and plot channel cross-sections upstream and downstream sides of bridge for each inspection
• Inspection reports maintained and accessible electronically

April 2013
Load Rating

- Comprehensive documentation of load rating policy and procedure
- Clear authority to post and close bridges when needed
- Load rating summary form
Load Rating

- Annual state-wide posting and closure reviews
- Registered structural engineer performs site inspection of all poor bridges for load re-rating
- Review of load rating analysis following each bridge inspection
Load Rating

• Partner with local University to complete load ratings and develop student experience
Inspections

• Perform hands-on inspection for each routine inspection
• All inspections performed by state forces or by consultant contracts administered by the state
• Team leaders are registered professional engineers
Inspections

• Electronic field collection of data using tablet PC, laptop or PDA
  – Report essentially complete before leaving the bridge
Inspections

• State climb-teams for FC bridge inspection
• Deck inspection on heavily congested urban highways using van-mounted video cameras
• Use of pole mounted cameras to supplement visual inspections above and/or below water
Inspections

• Use of phased array ultrasonic testing for detecting and quantifying crack indications in steel members on fracture critical bridges
• Ultrasonically test pins, hangers and eyebars for each inspection
• Check horizontal and vertical clearances during each inspection
Inspections

• Element level bridge inspection data collection with pictorial field manuals
  – AASHTO CoRe Elements
  – AASHTO NBEs/BMEs
Element Level Bridge Inspection

City of Phoenix

AASHTO CoRe element data
New AASHTO NBE/BME data

45 States & FHWA-FLHD

April 2013
Element Level Bridge Inspection

- Legislation (MAP-21)
- Elements
- Element Level Data Collection
Legislation

• National Bridge and Tunnel Inventory and Inspection Standards Program
  – Statutory citation(s): MAP-21 §1111; 23 USC 144
    • Each State and Federal agency – within 2 yrs. of enactment, report element level data on bridges on the NHS to the Secretary as each bridge is inspected
    • The Secretary – study cost-effectiveness, benefits, feasibility of collecting for non-NHS bridges

Fact Sheet - http://www.fhwa.dot.gov/map21/bti.cfm
Legislation

• Anticipated timeline for element level data reporting to FHWA
  – October 1, 2012: Enactment
  – October 1, 2014: Year 2
    • Data is expected to be collected during inspections of NHS bridges that are due for inspection in Oct 2014 and after
  – April 1, 2015: First submittal of data to FHWA
Elements

  – National Bridge Elements (NBEs)
  – Bridge Management Elements (BMEs)
  – Agency Developed Elements (ADEs)
    • NBE or BME sub-elements
      – ADE-NBE or ADE-BME
    • ADE
      – Defect Flags

Elements

• Each element has...
  – Description
  – Quantity calculation
  – Condition state definitions
  – Feasible actions
  – Element commentary
  – Element definitions
Elements

• Each element has four defined condition states (CS)

• General condition state descriptions
  – CS 1 (Good)
  – CS 2 (Fair)
  – CS 3 (Poor)
  – CS 4 (Severe – load capacity implications)
Elements

- AASHTO NBEs and BMEs have pre-defined condition state definitions
  - Defect description and severity
- Element quantities are distributed to one or more of the four condition states depending upon the condition of the element

<table>
<thead>
<tr>
<th>Element</th>
<th>Total QTY</th>
<th>Units</th>
<th>CS-1 QTY</th>
<th>CS-2 QTY</th>
<th>CS-3 QTY</th>
<th>CS-4 QTY</th>
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Elements - NBES

- Primary structural members of bridges necessary to determine the overall condition and safety of the primary load carrying components
- Descriptions, quantity measurements and condition state definitions expected to remain consistent from agency to agency
Elements - NBEs

• FHWA plans to collect data for all NBEs
  – Decks/Slabs – area (sq. ft.)
  – Superstructure – length (ft.), each
  – Substructure – length (ft.), each
  – Culverts – length (ft.)
  – Bearings – each
  – Bridge Rails – length (ft.)
Elements - BMEs

- Elements such as joints, wearing surfaces, protective coatings and approach slabs typically managed by agencies utilizing systematic preventive maintenance strategies and BMS.
Elements - BMEs

• Conditions of element protective systems are assessed using separate elements
  – Wearing Surfaces
  – Steel and Concrete coatings
  – Deck/Slab reinforcing steel (coatings, cathodic)
Elements - BMEs

- FHWA plans to collect data for these BMEs
  - Joints – length (ft.)
  - Wearing surfaces – area (sq. ft.)
  - Steel protective coatings – area (sq. ft.)
  - Concrete protective coatings – area (sq. ft.)

- Descriptions, quantity measurements and condition state definitions expected to remain consistent from agency to agency
Elements - ADEs

• Agency Developed Elements (ADEs) can be sub-elements of NBEs or BMEs
  – ADE-NBE
  – ADE-BME

• Or agency defined without ties to the AASHTO Guide Manual elements
  – ADE
Elements - ADE-NBE

- Must have 4 Condition States
  - Good (1), Fair (2), Poor (3), Severe (4)
- Condition state and defect definitions must remain consistent between the NBE and the ADE-NBE sub-element
- Element must be aggregated back together with NBE (linked to NBE) for reporting
- 108 Steel Beam/Girder, End (NBE 107)
Elements - ADE-BME

• Must have 4 Condition States
  – Good (1), Fair (2), Poor (3), Severe (4)
• Would have the same condition state and defect definitions as BME
• Element musts be aggregated back together with BME (linked to BME) for reporting
• 516 Steel Protective Coating, Lead (BME 515)
Element Level Data Collection

Elevation

Typical Section

Element #: xxx
Element Level Data Collection

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<th>Element</th>
<th>Total QTY</th>
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<th>CS-2 QTY</th>
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Element Level Data Collection

- Proposed data items to be collected by FHWA for each NHS bridge inspection
  - Element Number (EN)
  - Element Parent Number (EPN)
  - Total Element Quantity
  - Condition State 1 Element Quantity
  - Condition State 2 Element Quantity
  - Condition State 3 Element Quantity
  - Condition State 4 Element Quantity
## Element Level Data Collection

### Example Data Set for 1 Bridge

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<th>Str. #</th>
<th>Insp. Date</th>
<th>Insp. Type</th>
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Summary

• Maximize your bridge inspection program efficiency and effectiveness
  – Obtain, train and retain qualified personnel
  – Regularly assess your program
    • Level of quality in \( \rightarrow \) impacts level of quality out
  – Utilize extended inspection intervals
  – Utilize readily available technologies
  – Network with peers to share and learn
Enjoy the rest of your conference!