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Background
Objective
To develop guidelines for complex bridge inspection to support State DOTs in preparing their own complex bridge inspection procedures (Metric 19 of 23).
Objective (Continued)
The Guidelines are intended to be incorporated into the Section 4 of the AASHTO Manual for Bridge Evaluation or be presented as a stand-alone supplement.
Report Organization
Section I describes the Research phase of the project and contains six chapters.

- Present findings from preliminary project tasks:
  - Literature reviews
    - Domestic
    - International
  - Surveying owner Agencies

Section II presents the “Guidelines for Inspecting Complex Components of Bridges” comprising three chapters.
Section I - Research
Chapter 1

- Provides background information including definitions of complex bridge inspections described in:
  - National Bridge Inspection Standards (NBIS)
  - AASHTO Manual for Bridge Evaluation (MBE)
Complex Bridge Definition

- A bridge, due to its intricacy, may require significantly greater inspection effort than could be accomplished on normal routine inspection or may have complex component.
- Inspections may require greater engineering knowledge and/or expertise to accurately or fully determine the condition of the various bridge elements.
- May require specialized equipment or climbing to access all parts of the bridge.

For example, a bridge may be fairly conventional but have external post-tensioning with intricate details, which would be complex components that may require special knowledge to properly inspect.
Chapter 2

- Describes the purpose and scope of the guidelines.
  - Purpose is to develop guidelines for complex bridge inspections.
  - NBIS require all complex bridge inspections to follow procedures specific to the complex needs of each bridge.
Scope

- Focus exclusively on inspecting complex components of bridges, *not categorized as fracture critical, movable or underwater.*
  - FCI addressed in the current NBIS, and Course No. FHWA-NHI-130078 “Fracture Critical Inspection Techniques for Steel Bridges” training for inspecting Fracture Critical Bridges.
  - UWI discussed in the current NBIS, and Course No. FHWA-NHI-130091 “Underwater Bridge Inspection” criteria for UW Inspection of Bridges.
  - MBI mentioned in the current NBIS, and AASHTO Movable Bridge Inspection, Evaluation and Maintenance Manual criteria for movable bridge inspection (NCHRP Project 14-32 is underway to develop the Second Edition).
Chapter 3

- Highlights the findings from the literature reviews:
  - Domestic Scans
  - International Scans
Domestic Scan


Table 40 – U.S. Complex Bridges

Provides a list of structures identified by respondent DOTs as complex or needing special inspection methods:

- **Suspension Bridge** 19/32 = 59%
- **Cable-Stayed Bridge** 17/32 = 53%
- **Movable Bridge** 14/32 = 44%
- **Tied-Arch Bridge** 13/32 = 41%
- **Eyebar Bridge** 8/32 = 25%
- **Box Girder w/ External P-T** 8/32 = 25%
- **Single Concrete Box Girder** 7/32 = 22%
- **Two-Girder Bridge** 6/32 = 19%
- **Single Steel Box Girder** 6/32 = 19%
- **Bridges w/ Pins & Hangers** 6/32 = 19%
International Scan


Bridge Inspector Training & Certification in France

Modules 1 through 5 are as follows:

- Module 1: A 6-day course on basic knowledge
- Module 2: A 1-day course on large prestressed concrete bridges
- Module 3: A 3-day course on uncommon retaining walls
- Module 4: A 2-day course on large steel bridges and cable bridges
- Module 5: A 3-day course on tunnels and underground structures

Module 6 is a 3-day project manager’s course covering:

- Methodology of detailed inspection
- Investigation techniques
- Monitoring and surveillance techniques
- Repair and strengthening techniques
- Actions to be proposed after an inspection
Chapter 4

- Summarizes results of Agency Survey:
  - qualifications required for inspecting complex components of bridges,
  - inspection procedures,
  - non-destructive testing methods,
  - existing issues with complex bridge inspections, and
  - areas where improvements could be made to current inspection procedures.

- Surveys sent to 65 State/Agency Bridge Engineer representatives.
  - 36 completed surveys returned (55%)
Chapter 5

- Lists definitions, references and guides from both domestic and international sources.
Chapter 6

- Summarizes the conclusions of the research and introduces the guidelines.
Section II – Guidelines for Inspecting Complex Components of Bridges
Chapter 1

- Describes inspection personnel qualifications, experience and training for inspecting complex components of bridges.
Federal Requirements

- Most recently updated on August 31, 2009 to incorporate by reference the AASHTO Manual for Bridge Evaluation in the NBIS and revise the definition thereof.

For reference, the following sections of the NBIS specifically mention “Complex Bridge(s)”:

§ 650.305 Definitions.
Complex bridge. Movable, suspension, cable stayed, and other bridges with unusual characteristics.

§ 650.313 Inspection procedures.
(f) Complex bridges. Identify specialized inspection procedures, and additional inspector training and experience required to inspect complex bridges. Inspect complex bridges according to those procedures.
Non-Regulatory Inspection Practices for Complex Components of Bridges

- The minimum requirement is to establish specialized inspection needs, level of effort and additional inspector training and/or experience.

- These procedures are applied to the unique features of complex bridges that would not normally be covered in a routine inspection.

Inspection Personnel Qualifications

Federal Requirements of 23 CFR 650.309 set the minimum requirements to serve as (a) Program Manager and (b) Team Leader.

Inspection Personnel Experience

Establish special experience requirements as the complexity may require previous experience inspecting the specific complex components.

Inspection Personnel Training

Establish special training requirements as the complexity of the specific components may require specialized training for the inspector.
Chapter 2

- Identifies complex components of bridges and describes specialized inspection procedures for complex components of bridges.
Bridges may be comprised of complex features or have structure types with unusual characteristics that require a specific complex inspection plan.

These same bridges have defined procedures for routine inspections, and may also have specific defined procedures related to fracture critical and/or underwater inspections.

A complex inspection plan is intended to complement these existing procedures, it is not intended to replace them.

For the member to be considered complex, it would have unusual characteristics subject to:

- Specialized inspection procedures.
- Additional inspector training and experience.

Procedures should include:

- Type, detail, and frequency of inspection required.
- The location of members to be inspected.
- Special equipment required.

**Complex Components**

- Bridges may be comprised of complex features or have structure types with unusual characteristics that require a specific complex inspection plan.
- These same bridges have defined procedures for routine inspections, and may also have specific defined procedures related to fracture critical and/or underwater inspections.
- A complex inspection plan is intended to complement these existing procedures, it is not intended to replace them.
Chapter 3

- Includes examples of written inspection procedures:
  - Recommended inspection preparations
  - Recommended inspection procedures
- Two detailed examples of complex bridge component inspection procedures for:
  - Suspension Bridge
  - Cable-Stayed Bridge
Suspension Bridge
- Main Suspension Cable
- Tower Saddle
- Cable Bent
- Cable Bands
- Suspender Cables and Connections
- Sockets
- Anchorages:
  - Strands
  - Anchorage Walls and Roof (Chain Gallery)
  - Eyebars and Strand Wires

Cable-Stayed Bridge
- Stay Cable
- Pylon/Tower Anchorage
- Girder/Deck Anchorage
- Pylon/Tower
- Dampening System
05 Wrap Up
Suspension Bridge
Cable-Stayed Bridge
Acknowledgements

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Thank you for your time

QUESTIONS?