BRIDGE EVALUATION AND LOAD RATING

APWA Conference
November 17-18, 2011

Dana Feng and Arthur D’Andrea, P.E.
The US Highway Bridge Network contains over 600,000 structures. The management of these assets is becoming more challenging for public and for public-private owners as well.
• Bridges include many categories of structures.
• Technology has enabled complex designs to be built adding difficulty to asset management.
Structural Failures on the Bridge Network

Recent bridge failures caused US. Congress to question whether or not we are doing enough to prevent these failures?

1967 - Silver Bridge on the Ohio River collapsed (46 deaths);
1983 - Minus River Bridge in Connecticut (3 deaths);
1987 - Schoharie Creek Bridge in New York State (10 deaths);
1989 - Hatchie River Bridge in Tennessee (8 deaths);
1995 - Arroyo Pasajero Bridge near Coalinga California (7 deaths);
2007 - I-35 Mississippi River Bridge Minneapolis, Minnesota (13 deaths and 145 injuries).
In 1971 national inspection standards were issued by the Federal Highway Administration for locating, inspecting, evaluating, and acting upon bridge deficiencies. When deficiencies pose major safety problems, the owner is responsible for either 1) making repairs to correct the deficiencies; 2) posting restriction signs as to the bridge’s load-carrying capacity with respect to size and weight of vehicles allowed to cross the bridge, or 3) closing the bridge to vehicular traffic.
After the 2007 Minnesota bridge collapse, the bridge inspection process and the federal enforcement of the current NBIS was discussed at various hearings at both the US House and US Senate. The resulting initiative named “the 23 metrics” demands full compliance with the NBIS.
The bridge load ratings are a companion process to bridge inspections. The initial, as-built, ratings are revised as the bridge deteriorates, is modified or rehabilitated.
The expectations of Bridge Ratings from the US Congress in 1971 and again in 2007 implied a more complete guarantee on the bridge ratings. The state DOT’s bridge ratings historically have been much less ambitious. A complete conditional structural ratings of all elements for all bridges requires a large effort from owners.
NBIS

- Bridge Files (Records)
- Bridge Management Systems (BMS)
- Bridge Inspection
- Material Testing
- Load Rating
- NDT
NBIS

- Federal Regulation (NBIS)
  CFR Title 23/Part 650

- Metrics 1 - 23
NBIS

Bridge Files – Records

- Construction Plans
- Shop and Working Drawings
- As-Built Drawings
- Specifications
- Correspondence
- Photographs
- Material Testing
- Coating History
- Accident Records
NBIS

Bridge Inspection

- Type: Initial, Routine, Damage, In-Depth, Fracture-Critical, Underwater, Special
- Frequency
- Qualification, Safety, Planning, Report
- Procedures
Bridge Load Ratings and Load Posting Process

• The load rating process requires accurate drawings and inspection data, a multitude of structural analysis tools, access to non-destructive testing tools as well a family of rating vehicles that represents trucks allowed passage in a given state.
Load Rating Goals

• Bridge load rating is defined as the determination of the live load carrying capacity of a bridge.

• A proper understanding of our bridges gained through a standardized method of rating provides a relatively uniform level of bridge structural safety and enhance bridge performance.
Load Rating Goals

• Ensure Bridge Safety
• Comply with Federal Regulation (NBIS)
  – CFR Title 23/Part 650
  – Report to FHWA Yearly
• Validates rehabilitation or replacement Needs
• Posting Needs
• Processing of Overload Permits
Load Rating Requirements

• New or Reconstructed Bridge
  – Within 90 Days of Opening
  – After the Initial Inventory Inspection

• Existing Bridges
  - When Bridge Conditions Change
    - Changes in live load, dead load, physical condition or load rating method.

• Report to FHWA Yearly
Load Rating Manuals

• AASHTO - Manual for Bridge Evaluation (MBE) (2011)

• LADOTD - Policies and Guidelines for Bridge Rating and Evaluation (2009)
THE POLICIES AND GUIDELINES FOR BRIDGE RATING AND EVALUATION

Prepared by staff of the Bridge Rating Unit,
Under the direction of
Hossein Ghara,
Bridge Design Engineer Administrator

March 1, 2009
QA/QC

• EDSM
• DIRECTIVES 1 TO 10
• LADOTD the Policies and Guidelines for Bridge Rating and Evaluation (2009)
• Bridge Inspection Program QC/QA
QUESTIONS?