NATIONAL BRIDGE INSPECTION STANDARDS (NBIS)
THE HISTORY OF THE NATIONAL BRIDGE INSPECTION STANDARDS
SILVER BRIDGE
SILVER BRIDGE

- Completed in 1928
- Traversed the Ohio River between Point Pleasant, WV and Gallipolis, OH
- Collapsed December 15, 1967
- Collapse resulted in the deaths of 46 people
CONGRESS REACTS

• Collapse of the Silver Bridge aroused national interest in the condition of bridges.

• Congress prompted to add a section to the “Federal Highway Act of 1968” requiring the Secretary of Transportation to establish a national bridge inspection standard.

• National Bridge Inspection Standards (NBIS) came into being in 1971.
MIANUS RIVER BRIDGE
MIANUS RIVER BRIDGE

- Opened in 1958
- I-95 North over Mianus River, Greenwich, CT
- Collapsed June 28, 1983
- Collapse resulted in deaths of 3 people
CULVERTS

- Several tragic failures in the 1980’s
- 1979 NBIS revisions prompted increased interest in culverts
SCOHARIE CREEK BRIDGE

- Opened October 1955
- NY State Thruway over Schoharie Creek near Fort Hunter, NY
- Collapsed April 5, 1987
- Collapse resulted in the deaths of 10 people
I-35W MISSISSIPPI RIVER BRIDGE

- Opened November 1967
- I-35W over Mississippi River in Minneapolis, MN
- Collapsed August 1, 2007
- Resulted in the deaths of 13 people and the injury of 145 others
Extensive investigation identified the cause of the collapse as a failed gusset plate. The gusset plates were severely undersized due to a design error.
CODE OF FEDERAL REGULATIONS (CFR)
TITLE 23, PART 650, SUBPART C

NATIONAL BRIDGE INSPECTION STANDARDS (NBIS)
PURPOSE

Sets the national standards for the proper safety inspection and evaluation of all highway bridges.
APPLICABILITY

The NBIS applies to all structures defined as **highway bridges** located on all **public roads**.
WHAT IS A HIGHWAY?
The term “Highway” includes –

- a road, street, and parkway;
- a right-of-way, bridge, railroad-highway crossing, tunnel, drainage structure, sign, guardrail, and protective structure, in connection with a highway; and
- A portion of any interstate or international bridge or tunnel and the approaches thereto, the cost of which is assumed by a State transportation department, including such facilities as may be required by the US Customs and Immigration Services in connection with the operation of an international bridge or tunnel.
WHAT IS A BRIDGE?
BRIDGE

A structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than twenty (20) feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening.
WHAT IS A “PUBLIC” ROAD?

Need photo of gated bridge.
PUBLIC ROAD

Any road or street under the jurisdiction of and maintained by a public authority and open to public travel.
Each State transportation department must inspect, or cause to be inspected, all highway bridges located on public roads that are fully or partially located within the State’s boundaries except for bridges owned by Federal agencies.

Federal agencies are responsible for the inspection of bridges located on public roads within the agencies’ responsibility or jurisdiction.
INSPECTOR QUALIFICATIONS

• PROGRAM MANAGER
• TEAM LEADER
• UNDERWATER BRIDGE INSPECTION DIVER
Program Manager

Must, at a minimum, be a registered Professional Engineer or have ten (10) years of bridge inspection experience and successfully complete a Federal Highway Administration (FHWA) approved comprehensive bridge inspection training course.
TEAM LEADER

There are five (5) ways to qualify as a Bridge Inspection Team Leader; all of which are dependent on experience, education, or certification and successful completion of a Federal Highway Administration (FHWA) approved comprehensive bridge inspection training course.
UNDERWATER BRIDGE INSPECTION DIVER

Must complete an FHWA approved comprehensive bridge inspection training course or other FHWA approved underwater diver bridge inspection training course.
INSPECTION TYPES & FREQUENCY

• INITIAL – When the construction of the bridge has been completed.
• ROUTINE – Regular intervals not to exceed 24 months.
• FRACTURE CRITICAL - Regular intervals not to exceed 24 months.
• UNDERWATER - Regular intervals not to exceed 60 months.
• IN-DEPTH – Criteria to be determined by the organization.
• SPECIAL – Criteria to be determined by the organization.
• DAMAGE – Criteria to be determined by the organization.
INSPECTION PROCEDURES

• Inspect each bridge in accordance with the Manual For Bridge Evaluation (MBE)
• Provide at least 1 Team Leader for all Initial, Routine, In-Depth, Fracture Critical, and Underwater inspections.
• Rate each bridge to determine its safe load carrying capacity.
• Prepare bridge files as described in the MBE.
• Identify bridges with fracture critical members, bridges requiring underwater inspection, and bridges that are scour critical.
• Identify complex bridges and any specialized procedures and/or training need to inspect them.
• Assure systematic QA and QC procedures are used to maintain a high degree of accuracy and consistency.
• Assure that critical findings are addressed in a timely manner.
INVENTORY

- Each organization must prepare and maintain an inventory of all bridges subject to the NBIS.
- Certain Structure Inventory & Appraisal (SI&A) data must be collected and retained for collection by the FHWA as requested.
- SI&A data must be entered into the inventory within 90 days for State and Federal bridges and within 180 days for all other bridges.
HOW DOES FHWA ENSURE COMPLIANCE?

- 23 Individual Metrics
  - Cover specific requirements of the NBIS regulations (23 CFR 650 Subpart C)
- 4 Levels of Compliance
  - Have specific thresholds to meet for compliance
- 3 Assessment Levels
  - Have specific criteria to be reviewed
BRIDGE MAINTENANCE DIRECTIVES

1. Streambed Profile For All Bridges Over Water
2. Notification Of Proper Officials In Cases Of Bridges In Danger Of Collapse
3. Monitoring Bridges With Possible Overtopping, Scour, Or Drift Problems
4. Bridge Inspection Procedures And Frequencies
5. Off-System Bridges – Posting/Closing – Follow-Up Actions
6. Installation And Removal of Bridge Weight Limit Signs
7. Rating and Re-Rating Of Timber Bridges
8. Adding, Deleting, Updating, Data In The Master Structure File
9. Qualifications And Responsibilities Of Bridge Inspection Personnel
10. Bridges Which Are Closed To Traffic / Out Of Service
11. Bridges Which Are Closed To Traffic / Out Of Service
12. Fracture Critical Bridge Inspection Procedure
13. Critical Findings – Recording, Follow-Up, And Reporting
• EDSM I.1.1.8 – Establishment Of Uniform, Regulatory Truck Weight Limit For Structurally Deficient Highway Bridges Located On Public Roads

• EDSM I.1.1.15 Uniform Bridge Re-Rating Policy

• EDSM IV.4.1.2 Louisiana Bridge Inspection & Load Rating Standards
ASSESSMENT LEVELS

- **Minimum**: Division Bridge Engineer’s general knowledge and awareness of the state’s program in relation to the metric.

- **Intermediate**: Verifying minimum level review through sampling of inspection records or files, analysis of NBI data, visits to bridges, interviews with inspectors, and documentation of qualifications.

- **In-depth**: Supplementing intermediate review with larger sample sizes, more interviews, and research of records and/or history.
LEVELS OF COMPLIANCE

• **Compliance:** The act of adhering to the NBIS regulation.

• **Substantial Compliance:** The act of adhering to the NBIS regulation with minor deficiencies. Deficiencies are expected to be corrected within **12 months or less with an Improvement Plan (IP),** unless the deficiencies are related to issues that would most efficiently be corrected during the next inspection.

• **Non-Compliance:** The act of not adhering to the NBIS regulation. Identified deficiencies may adversely affect the overall effectiveness of the program. Failure to adhere to an approved plan of corrective action is also considered non-compliance.

• **Conditional Compliance:** The act of taking corrective action in conformance with an **FHWA approved Plan of Corrective Action (PCA) to achieve compliance with the NBIS.** Deficiencies, if not corrected, may adversely affect the overall effectiveness of the program.
Improvement and Corrective Action Plans

• Substantial Compliance
  • **Improvement Plan (IP)** – A written response by State DOT to FHWA which documents agreement for corrective actions to address deficiencies identified. The timeframe is limited to 12 months or less.

• Conditional Compliance
  • **Plan of Corrective Action (PCA)** – A documented action agreement prepared by State DOT and approved by FHWA Division describing the process, status reporting frequency, and timelines to correct non-compliant NBIS statutory and regulatory requirements.
### Metric #6: Inspection frequency – Routine – Lower risk bridges

**NBIS Reference:** 23 CFR 650.311 (a) – Routine inspections

**Criteria:**
- Routine inspections are performed at regular intervals not to exceed (NTE) 24-months, or NTE 48-months when adhering to FHWA approved criteria.
- Lower risk bridges are defined for this metric as those with superstructure and substructure, or culvert, condition ratings of fair or better, and not requiring load restriction.

**Population:** Lower risk bridges for the entire State or selected geographic/owner subset that are open to traffic, and whose inspection dates have changed since the previous year’s NBI submission or whose inspections are overdue.

**Compliance (C):** All of the following must be met for C:
- All bridges are inspected within the required NTE 24 or 48-month interval, as applicable, unless documented unusual circumstances have caused a 1-month delay for any inspections.
- All sampled 1-month delayed bridge inspections are documented for unusual circumstances.

**Substantial Compliance (SC):** All of the following must be met for SC:
- At least 90% of bridges are inspected within the required NTE 24 or 48-month interval plus one-month, as applicable.
- 100% of bridges are inspected within the required interval plus four-months.
- All bridges with extended inspections conform to FHWA approved criteria.

**Non-Compliance (NC):** One or more SC criteria not met.

**Conditional Compliance (CC):** Adhering to FHWA approved plan of corrective action (PCA).

**Minimum Assessment (Min-AL):** Perform the following if PCA in effect:
- Monitor the PCA.
- Review Metric 6 ART Report (MAR6) to resolve all overdue inspections.

Otherwise, perform all of the following:
- Review MAR6 to resolve all overdue inspections and other issues indicated on the MAR6’s Summary tab (see commentary).
- Where a SC snapshot is indicated in the MAR6 and all bridges are inspected within a 25- or 49-month interval, as applicable, perform first bullet under Int-AL below.
- Review current list of bridges approved for extended interval, as applicable.
- Consider supplemental analysis using current data as described in the Int-AL where changes in procedures have occurred.

**Intermediate Assessment (Int-AL):** In addition to the Min-AL:
- Randomly sample bridges with inspections at 25- and 49-month intervals using Intermediate criteria and review for documentation of unusual circumstances.
- If appropriate after review of the MAR6, perform supplemental frequency interval analysis using current data for recent inspections obtained from the State.

**In-Depth Assessment (Ind-AL):** In addition to the Int-AL:
- Randomly sample bridges with inspections at 25 and 49-month intervals using In-depth sampling criteria.
**Population:** The population is defined to eliminate review of the same inspection interval for the same bridge in successive review years. It also includes bridges indicated by the submitted data to be overdue for inspection—those that were due prior to the NBI submission date but did not have a new inspection date submitted. The analysis includes the 90/180 day NBIS allowance for entering data and an additional 30 days for compiling the submittal.

Risk classification is based on the bridge’s super/substructure condition and required load restrictions, determined using NBI Items 41, 63, 64, and 70. Using these items will help identify posted bridges that do not require load restriction, and therefore are lower risk. All bridges meeting approved extended interval NTE 48-month criteria are considered lower risk. Criteria used:

Metric #6 - Lower risk bridges criteria: (NBI Item 59 and 60, or 62)>4 and either (NBI Item 70=5 and Item 63=5) or (Item 63=5 and Item 70=5 and Item 41= A, D, or E)

Bridges adhering to FHWA approved extended frequency criteria are assumed to be lower risk.

**Compliance levels:** Compliance levels are based on several cumulative thresholds, which allow consideration of unusual circumstances that can make the completion of inspections within the required month impractical or inefficient. The percentages used in the summary of the MAR6 are numerical representations of the compliance level thresholds.

For Compliance (C), while all bridges are expected to meet the NTE 24-/48-month interval, the summary uses 85% for that count, and 100% for 25-/49-months. This allows 15% to have been inspected 1-month late without further analysis and still be assessed as C if there is a process in place to document late inspections for unusual circumstances. However, if the 85% NTE 24-/48-months is not met, a random sample of those bridges inspected in the 25th/49th month should be used to determine if unusual circumstances are documented. If all sampled bridges are documented, then the metric can be assessed as C.

As identified in the preamble of the NBIS regulation, severe weather, concern for inspector safety, concern for inspection quality, the need to optimize scheduling with other bridges, or other unique situations may be justifiable cause to push the inspection interval into the 25th/49th month. Such circumstances need to be documented. The thresholds also allow for flexibility so that structures previously inspected earlier than scheduled can get back on the original schedule.

An assessment of C can also be made if there are intervals that exceed the 25th/49th month and prior approval has been provided by FHWA.

For an assessment of Substantial Compliance (SC), the thresholds allow up to 10% of inspections to have been done after the 25th/49th month but 100% must be done by the 28th/52nd month. If these thresholds are exceeded as shown in the MAR6 snapshot, further review of the data as described below may be necessary.

Also note that for SC, a 50% threshold is included in the MAR6 for the NTE 24-/48-month interval. The intent of this threshold is to convey an expectation that at least half of inspections should be done on time. Failure to meet the 50% threshold should not by itself result in a non-compliance determination; it may indicate other issues for which further investigation is needed.
• Routine inspections are performed at regular intervals not to exceed (NTE) 24-months, or NTE 48 months when adhering to FHWA approved criteria.
• Lower risk bridges are defined for this metric as those with superstructure and substructure, or culvert, condition ratings of fair or better, and not requiring load restriction.
Four (4) Compliance Levels with specific criteria for each level.

**Compliance (C):** All of the following must be met for C:
- All bridges are inspected within the required NTE 24 or 48-month interval, as applicable, unless documented unusual circumstances have caused a 1-month delay for any inspections.
- All sampled 1-month delayed bridge inspections are documented for unusual circumstances.

**Substantial Compliance (SC):** All of the following must be met for SC:
- At least 90% of bridges are inspected within the required NTE 24 or 48-month interval plus one-month, as applicable.
- 100% of bridges are inspected within the required interval plus four-months.
- All bridges with extended inspections conform to FHWA approved criteria.

**Non-Compliance (NC):** One or more SC criteria not met.

**Conditional Compliance (CC):** Adhering to FHWA approved plan of corrective action (PCA).
Three (3) Assessment Levels with methods for each.

**Minimum Assessment (Min-AL):** Perform the following if PCA in effect:
- Monitor the PCA.
- Review Metric 6 ART Report (MAR6) to resolve all overdue inspections.
Otherwise, perform all of the following:
- Review MAR6 to resolve all overdue inspections and other issues indicated on the MAR6’s Summary tab (see commentary).
- Where a SC snapshot is indicated in the MAR6 and all bridges are inspected within a 25- or 49-month interval, as applicable, perform first bullet under Int-AL below.
- Review current list of bridges approved for extended interval, as applicable.
- Consider supplemental analysis using current data as described in the Int-AL where changes in procedures have occurred.

**Intermediate Assessment (Int-AL):** In addition to the Min-AL:
- Randomly sample bridges with inspections at 25- and 49-month intervals using Intermediate criteria and review for documentation of unusual circumstances.
- If appropriate after review of the MAR6, perform supplemental frequency interval analysis using current data for recent inspections obtained from the State.

**In-Depth Assessment (InD-AL):** In addition to the Int-AL:
- Randomly sample bridges with inspections at 25 and 49-month intervals using In-depth sampling criteria.
METRICS

Bridge Inspection Organization Qualifications of Personnel

1. Bridge Inspection Organization 23 CFR 650.307
2. Program Manager 23 CFR.309 (a) and QA/QC 23 CFR 650.313 (g)
3. Team Leader(s) 23 CFR 650.309 (b) and QA/QC 23 CFR 650.313 (g)
4. Load Rating Engineer 23 CFR 650.309 (c)
5. Underwater Bridge Inspection Diver 23 CFR 650.309 (d)
METRICS

Inspection Frequency

6. Routine – Lower Risk Bridges 23 CFR 650.311 (a)
7. Routine – Higher Risk Bridges 23 CFR 650.311 (a)
8. Underwater – Lower Risk Bridges 23 CFR 650.311 (b)
9. Underwater – Higher Risk Bridges 23 CFR 650.311 (b)
10. Fracture Critical Member (FCM) 23 CFR 650.311 (c)
11. Frequency Criteria 23 CFR 650.311 (a)(2), (b)(2), (c)(2), (d)
METRICS

Inspection Procedures

12. Quality Inspections 23 CFR 650.313 (a) & (b)
13. Load Rating 23 CFR 650.313 (c)
14. Post or Restrict 23 CFR 650.313 (c)
15. Bridge Files 23 CFR 650.313 (d)
16. Fracture Critical Members (FCM) 23 CFR 650.313 (e)(1)
17. Underwater 23 CFR 650.313 (e) & (e)(1)
18. Scour Critical Bridges 23 CFR 650.313 (e)
19. Complex Bridges 23 CFR 650.313 (f)
20. QC/QA 23 CFR 650.313 (g)
21. Critical Findings 23 CFR 650.313 (h)
22. Prepare and Maintain 23 CFR 650.315 (a)
23. Timely Updating of Data 23 CFR 650.315 (a), (b), (c), & (d)
SUMMARY

- Congress, in response to the collapse of the Silver Bridge, added a section to the “Federal Highway Act of 1968” that prompted the Secretary of Transportation to develop a national bridge inspection standard.
- The resulting law, the National Bridge Inspection Standards (NBIS), came into being in 1971.
- The NBIS stated requirements pertaining to the bridge inspection organization, qualifications of personnel, inspection frequency, inspection procedures, and inventory.
- Various means were employed to ensure compliance with the NBIS until the current “NBIS Oversight Program” and its 23 Metrics went into effect in 2011.
LINKS

• METRICS
  www.fhwa.dot.gov/bridge/nbip/metrics.pdf

• MAINTENANCE DIRECTIVES
  http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Operations/BridgeMaintenance/Pages/default.aspx

• ENGINEERING DIRECTIVES AND STANDARDS MANUAL (EDSM)
  http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/EDSM/Pages/default.aspx
Questions