

## Chapter Six

# BRIDGE INVENTORY AND INSPECTIONS

BUREAU OF LOCAL ROADS AND STREETS MANUAL



**Chapter Six**  
**BRIDGE INVENTORY AND INSPECTIONS**

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## Chapter Six

# BRIDGE INVENTORY AND INSPECTIONS

### 6-1 NATIONAL BRIDGE INSPECTION STANDARDS (NBIS)

#### 6-1.01 General

The National Bridge Inspection Standards (NBIS) is the Federal regulation that establishes the requirements for inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of a State bridge inventory. The NBIS applies to all structures defined as bridges carrying a roadway and open to the public. The program resulting from the NBIS is intended to detect structural and functional deficiencies to minimize the probability of structural failure and to improve bridge traffic safety. The Federal Highway Administration has promulgated regulations to establish the applicable criteria that each State transportation department must meet. See 23 CFR, Part 650, Subpart C.

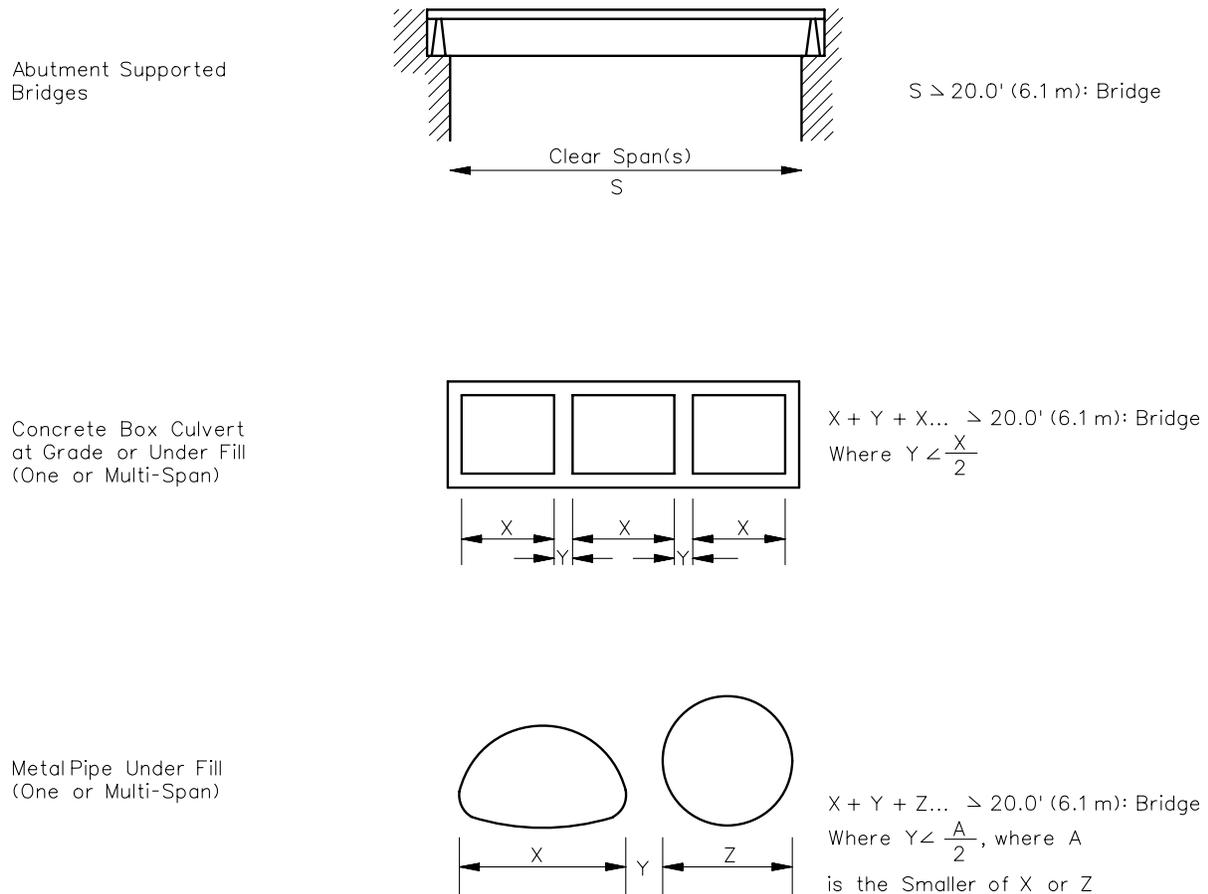
#### 6-1.02 Definitions

The following definitions apply to the NBIS and its implementation:

1. Bridge. A “bridge” is a structure — comprising of a deck, superstructure, and substructure/foundation or culvert — erected over a depression or obstruction (e.g., water, highway, or railroad) and having a track or passageway for carrying traffic or other moving loads. In addition, a bridge’s length must meet the following minimum criteria: The opening, measured along the centerline of the roadway, is greater than 20.0 ft (6.1 m), between undercopings of abutments or springlines 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. For closed pile bent abutments, the distance between the front faces of exposed piling is used.

See Figure 6-1A for examples of various bridge openings.

2. Damage Inspection. This is an unscheduled inspection to assess structural damage resulting from natural or man-made causes. The scope of inspection should be sufficient to determine the need for load restrictions, including closure of the bridge to traffic, and to assess the level of effort necessary to implement a repair.
3. In-Depth Inspection. This is a physical inspection of the bridge above and/or below water level (where applicable) to detect any deficiency not readily detectable using Routine Inspection procedures. These include fracture critical and underwater inspections.



### DETERMINATION OF BRIDGE LENGTH FOR THE PURPOSE OF DEFINITION OF A BRIDGE

Figure 6-1A

4. **Special Feature Inspection.** This is an inspection scheduled at the discretion of the entity responsible for bridge inspection activities and is performed between regularly scheduled routine maintenance inspections. A Special Feature Inspection is typically used to monitor a specific known or suspected deficiency (e.g., foundation settlement or scour, member conditions, the public's use of a load-posted bridge).
5. **Initial Inspection.** This is the initial inspection of a bridge intended to collect the Structure Inventory and Appraisal (SI&A) data and all other relevant information required for the ISIS and to collect basic structural data (e.g., identification of structure type, fracture-critical members).

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6. Routine Maintenance Inspection. This is a regularly scheduled, intermediate-level inspection consisting of observations and/or measurements sufficient to determine the structural and functional conditions of the bridge; to identify any developing deficiencies and/or changes from the initial or previously recorded inventory conditions; and to ensure that the bridge continues to satisfy present service requirements. This inspection satisfies the NBIS requirements for inspection.
7. Inventory Rating. The capacity rating for a vehicle type used in the rating that will result in a live load level that can safely utilize a structure for an indefinite period of time.
8. Operating Rating. The capacity rating that will result in the absolute maximum permissible live load level to which the structure may be subjected for the vehicle type used in the rating. Allowing an unlimited number of vehicles to use a bridge at the operating level may shorten the life of the bridge.
9. National Bridge Inspection Standards (NBIS). The Federal regulations establishing requirements for inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of a State bridge inventory. The NBIS apply to all structures defined as bridges carrying roads open to the public.
10. National Bridge Inventory (NBI). The aggregation of structure inventory and appraisal data collected to fulfill the requirements of the National Bridge Inspection Standards, which require that each State prepare and maintain an inventory of all bridges subject to the NBIS.
11. National Bridge Inventory (NBI) Record. Data that has been coded according to the *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges* for each structure carrying highway traffic or each inventory route which passes beneath a structure.
12. Structure Inventory and Appraisal (SI&A) Sheet. The representation of the data recorded and stored for each NBI record in accordance with the *Guide*.
13. Sufficiency Rating. A numerical value from 0.0 to 100.0 which indicates a bridge's overall sufficiency to remain in service. The rating is calculated from the SI&A data and reflects the following factors:
  - structural adequacy and safety,
  - serviceability and functional obsolescence,
  - essentiality for public use, and
  - any special considerations.



## **6-2 BRIDGE INVENTORY**

### **6-2.01 National Bridge Inventory**

The National Bridge Inventory (NBI) is a national program that requires each State to prepare and maintain an inventory of all bridges on public roads that are subject to the National Bridge Inspection Standards (NBIS). The purpose is to maintain a national database on structures and applicable structural analyses data. This information is used by the FHWA to develop reports to submit to Congress on the status of the nation's bridges and by States in managing their bridge maintenance, rehabilitation, and replacement programs.

### **6-2.02 Illinois Structure Information System (ISIS)**

IDOT maintains a computerized bridge inventory system, designated as the Illinois Structure Information System (ISIS). This is part of the Illinois Highway Information System. The ISIS file contains information required by the NBIS including inspection data. The ISIS provides the base data to determine Illinois funding allocation from the Federal Highway Bridge Replacement and Rehabilitation Program (HBRRP). See Section 4-1.03 for more information on the HBRRP.

The ISIS data is available from the Structure Information Management System (SIMS). Local agencies may obtain the database file of local bridges for each county from IDOT's website and use the SIMS with the Microsoft Access database application program.

### **6-2.03 Inventory Requirements**

The bridge inventory must include the following:

- all structures carrying roads open to public travel, including unrestricted, privately owned structures, that meet the definition of a bridge (see Section 6-1.01); and
- all other structures where an opening length (measured along the centerline of the roadway) of less than or equal to 20 ft (6.1 m) and involving a highway, may be accepted into the system only if prior approval is given by the Central Office Planning Services Section - Data Management Unit. This Office does not encourage the input of these structures. However, they will be accepted on an "as-needed" basis.

Structure numbers should be assigned and the Inventory Inspection should be completed for non-highway railroad and pedestrian structures over roads open to the public. This establishes the structure in the ISIS for the purpose of inventorying its location and vertical clearance. NBIS inspections are not required for these pedestrian structures. However, regular maintenance inspections are encouraged.

The responsibility for reporting the required information for ISIS rests with the agency having jurisdiction of the road leading to and from the bridge. If there is no public road on the structure,

the reporting responsibility rests with the agency having jurisdiction of the road under the structure.

#### **6-2.04    Structure Number**

Each structure is identified by a 7 digit structure number composed of a 3 digit structure county number and a 4 digit structure sequence number. The structure number is assigned by the district or the maintaining agency from a block of numbers reserved for each agency. The structure number should be assigned no later than the time of submittal of the Preliminary Bridge Design and Hydraulic Report (PBDHR) or TS&L plans, as applicable, to IDOT.

Data for the old number will be retained in a historical file. Similarly, a bridge constructed using any portion of the same substructure will keep its same number. Completely new bridges erected at the same location on the same or new alignment that does not use any part of the old bridge will be assigned a new number. New structures are to be assigned numbers using the next available number by district scheme. There is no official Statewide scheme for the assignment of structure numbers according to jurisdiction.

Once the maintaining agency and IDOT have agreed upon a structure number for a bridge, that number is permanent and will not be changed for any reason even if there is a change in maintenance responsibility. This avoids confusion in record retrieval. To make the bridge numbering system effective in the field, one number tag should be painted or installed on each end of the bridge.

#### **6-2.05    ISIS Structure Reports**

Figure 6-2A presents the Structure Reports necessary to communicate information for entry into the ISIS. The forms for the initial recording of inventory, route, and inspection information may be copied from the *Structure Information and Procedure (SIP) Manual*, printed from the Structure Information Management System (SIMS), or from the district. Forms for reporting changes and information on existing structures can be obtained directly from SIMS or from the district.

#### **6-2.06    Sufficiency Rating**

Based upon the inventory, traffic, inspection, and load-rating data submitted to the Illinois Structure Information System, the Department generates a Sufficiency Rating (SR) for each structure. The Sufficiency Rating is between 0.0 and 100.0, with the lower numbers implying a higher priority of need for improvement.

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Report	Usage of Report
Inventory/Status Initial Report (R105-I)	Reporting inventory and bridge status information to the Illinois Structure Information System on new-to-system bridges.
Inventory Turnaround Report (S105)	Reporting revisions of inventory data to the Illinois Structure Information System. The inspector should have this form or Forms S114 and S110 at each NBIS inspection.
Inspector's Inventory Report (S114)	Form S114 is for reporting revisions of inventory data to the Illinois Structure Information System. The inspector should have this form or Form S105 and Form S110 at each NBIS inspection.
Key Route/Construction Initial Report (R111-I)	Reporting route information to the Illinois Structure Information System on new-to-system bridges.
Key Route Turnaround Report (S110)	Reporting revisions of key route data to the Illinois Structure Information System. The inspector should have this form and Form S114 or S105 at each NBIS inspection.
Inspection/Appraisal Initial Report (R104-I)	Reporting condition and appraisal ratings of new-to-system bridges to the Illinois Structure Information System.
Inspection/Appraisal Report (S104)	Reporting current inspection data to the Illinois Structure Information System.
Master Structure Report (S107)	Reports most information contained in the Illinois Structure Information System for each bridge. This form is not for reporting revisions to the System. The inspector should have this form at each NBIS inspection.
Bridge Inspection Report (BBS-BIR-1 and BIR-2)	<p>BBS-BIR forms are used for recording specific inspection notes and ratings for each bridge.</p> <p><u>BBS-BIR-1</u>: BIR-1 (MI or Multiple Inspection) can be used for up to 5 routine maintenance inspections.</p> <p><u>BBS-BIR-2</u>: BIR-2 is used for a single inspection and contains current ratings information.</p> <p>The inspector should have one or both of these forms at each NBIS inspection, and the original signed copy must be in the bridge file kept by the owner of the bridge.</p>
Bridge Record Card (BLR 06310)	Form BLR 06310 may be used as a record of initial construction, repairs, reconstruction, load posting and inspections. If this form is used, it is kept in the local agency's structure file.
Fracture Critical Inspection Form (BBS-BIR-FC 1)	Form BBS-BIR-FC 1 is used for recording results of fracture critical inspections. The inspection should have this form at each FC inspection.
Underwater Bridge Inspection Report (BBS-BIR-UW 1)	Form BBS-BIR-UW 1 is used for recording results of underwater inspections. The inspector should have this form at each UW inspection.

*Note: All forms listed are available from SIMS or from the district. BIR forms may be found on the IDOT website.*

**STRUCTURE REPORTS**

**Figure 6-2A**

**6-2.07**    **Updating**

New bridges or any conditions that require revision of existing structure information must be reported to the district promptly. The district must include the revision in the Illinois Structure Information System within 180 days after the change in status. The 180 days start when the structure is opened or reopened to unrestricted traffic or when other events occur that result in changes to inventory or inspection data for a structure.

### **6-3 BRIDGE INSPECTIONS**

The bridge owner (local agency) must have a systematic strategy for conducting field inspections and reporting its findings. It must be clear to the inspection team which structural elements to investigate and what to look for. The bridge inspection report should accurately and clearly record all findings and should include photographs of the overall structure and of any significant defects.

Per the NBIS, the owner of a bridge should have a bridge file for each structure. In addition, the local agency, as the owner of the structure, must have a systematic means of entering, storing, and retrieving all bridge inspection data. The file should contain a full history of the structure including:

- existing structure plans (if available);
- all inspections;
- recommendations for maintenance or repair work;
- any maintenance or repair work performed;
- calculations;
- significant correspondence (e.g., asbestos determination); and
- structure ratings.

The following Sections provide a detailed discussion on the required duties for a bridge inspection program among the local agencies.

#### **6-3.01 Local Agency Responsibility**

##### **6-3.01(a) Publicly Owned Structures**

In order to satisfy the requirements of the NBIS, the local agency is responsible for inspections of all structures on roads open to public travel that meet the definition of a bridge (see Section 6-1.01) for facilities under its jurisdictional responsibility.

Though not required by the NBIS, for structures under their jurisdiction and responsibility that do not meet the definition of a bridge or are not carrying highway traffic, local agencies are strongly encouraged to perform regular inspections to ensure public safety.

The responsible local agency may perform the inspection with qualified in-house personnel, or retain the services of a qualified inspector proficient in the performance of NBIS inspections and meeting the requirements described in Section 6-3.02.

### **6-3.01(b) Privately Owned Structures**

Privately owned structures, including those owned by government agencies that are not highway agencies, are subject to inspection and inclusion in the Illinois Structure Information System (ISIS); see Section 6-2.02. Therefore, it is the responsibility of the owners of these structures to have timely inspections performed according to the provisions of the NBIS. The local agency should work with the owner to:

- ensure the owner is aware when the NBI inspection is due, and
- obtain copies of the inspection forms to keep on file and for submission to the district for inclusion in ISIS.

In general, a local agency has a responsibility to post and warn the public of any hazards on a public highway carried by a structure. When it becomes apparent that the private owner (e.g., railroad, drainage or sanitary district, developer) of a bridge carrying a public highway will not or cannot perform the safety inspections required by the NBIS, the local agency having jurisdiction over the public highway leading to the bridge is responsible for performing the necessary inspection. If the private owner also has jurisdiction over the road leading to the bridge (e.g., private business that allows customers to use the road), the local agency may need to consider closing the public road leading to the private road until an inspection is performed and the bridge is considered safe.

### **6-3.02 Qualification Requirements for Inspection Personnel**

#### **6-3.02(a) Introduction**

The key element of a bridge inspection program is the qualifications of its inspection personnel. This includes the Program Manager of the overall organization and the field inspection personnel. Illinois' requirements for individuals managing and performing the required routine, biennial maintenance inspection of bridges are the same as those stated in the National Bridge Inspection Standards (23 CFR 650.307 and 650.309).

The Department, as clarification of the National Bridge Inspection Standards (NBIS), has developed the information, guidelines and procedures contained herein. For the purposes of the NBIS and this section, licensing as a Structural Engineer in Illinois is accepted in lieu of licensing as a Professional Engineer for satisfying NBIS qualification requirements.

#### **6-3.02(b) Program Manager**

The NBIS requires that all state departments of transportation designate an individual to function as the State Program Manager (PM) to provide overall leadership for the bridge inspection program. For the Illinois Department of Transportation (IDOT), the Federal Highway Administration (FHWA) has concurred that the Engineer of Structural Services of the IDOT

Bureau of Bridges and Structures (BBS) is qualified to function as the State Program Manager. The State PM can delegate program manager responsibilities to qualified individuals as needed to ensure compliance with the NBIS rules. In accordance with this authority to delegate program manager responsibilities, the IDOT BBS Unit Chief of Local Bridges functions under the State PM as the Local Bridge PM to oversee bridge inspections and the reporting of inspection and inventory data for local agency structures.

All local agencies (LAs) having responsibility for a structure in the NBIS must designate an Agency PM to ensure compliance with the NBIS and to provide guidance and management of their bridge inventory. If an LA does not have an employee who is qualified, they may hire a consultant to serve as their PM. If IDOT District personnel perform the NBIS inspections for an LA, the District or Region Bridge Maintenance Engineer (BME) will serve as the Agency PM. The BME should ensure the qualifications and provide oversight of the personnel for such structures in the District/Region.

### **6-3.02(c) Program Manager Qualifications**

On January 13, 2005, new rules became effective for the NBIS, as provided in Title 23, Code of Federal Regulations, Part 650, Subpart C, dated December 14, 2004 and are located at the FHWA website at <http://www.fhwa.dot.gov/bridge/nbis.htm>. NBIS Section 650.309 "Qualifications of personnel" states that a PM should:

1. Be a registered professional engineer, or have ten years bridge inspection experience; and
2. Successfully complete a FHWA approved comprehensive bridge inspection training course such as that provided by the 10-day National Highway Institute (NHI) course titled '*Safety Inspection of In-Service Bridges*'.

Those meeting the above experience and training requirements may be accepted by the State PM to function as an Agency PM. In addition, the FHWA has recognized that there are many experienced individuals who were overseeing NBIS activities prior to the effective date of the present NBIS rules, January 13, 2005.

The previous NBIS rules stated that the "individual in charge" of an agency's bridge safety inspection program was qualified to do so based solely on their licensing as a Professional Engineer. The intent of the current rules is to ensure that a PM has sufficient training and experience to oversee the bridge safety inspections conducted to satisfy NBIS requirements. Therefore, persons who were functioning as the "individual in charge" for an agency may continue to perform in the capacity of a PM for local agency NBIS activities when the following conditions are met:

1. Prior to January 13, 2005, the person was a licensed Professional Engineer functioning as an "individual in charge" with responsibility for the collection of bridge inventory data,

the performance of bridge inspections and the reporting of inspection information to satisfy NBIS requirements for a designated agency. This could have been either as an employee of the agency, or as an individual under contract to an agency.

2. The person certifies that they are knowledgeable of the requirements of the NBIS and the responsibilities of a PM for ensuring compliance.
3. The person certifies that they are familiar with the Department's "Illinois Highway Information System – Structure Information and Procedure (SIP) Manual", which provides the policies and procedures established by the Department for complying with the regulatory requirements of the NBIS.
4. The person has successfully completed the 3-day NHI course titled '*Bridge Inspection Refresher Training*', which is a condensed version of the 10-day course, within a reasonable time period.

The Department has established a database, as required by the NBIS, to track approval of PM qualifications. PM candidates must complete Form BBS 2610, *PROGRAM MANAGER QUALIFICATIONS*. This form shall be completed and returned to the BBS, Attn: Local Bridge Engineer, for any person proposed to serve as a local agency PM. This form may be obtained at the IDOT website at <http://www.dot.il.gov/bridges/bridgforms.html>.

#### **6-3.02(d) Team Leader**

Local agencies must have qualified personnel to function as a bridge inspection Team Leader (TL). The FHWA website, at <http://www.fhwa.dot.gov/bridge/nbis/index.htm>, provides information, in the responses to Q&A questions "Q309-3" and "Q309-6", to clarify how an agency may evaluate personnel that were functioning as a Team Leader prior to January 13, 2005. The guidelines provided below are consistent with the FHWA's interpretation of the new NBIS rules for evaluating TL qualifications.

#### **6-3.02(e) Team Leader Qualifications**

The qualifications of a potential TL will be first reviewed by the Agency PM who has oversight responsibility for the local agency structures. All candidates should be familiar with the requirements of the NBIS and IDOT's Structure Information and Procedure (SIP) Manual. If the Agency PM deems an individual's qualifications acceptable for functioning as a Team Leader, the Agency PM must forward the documentation of the individual's licensing, training, and experience to the Local Bridge PM, who will review prior to submittal for concurrence by the State PM.

The Department has established a database, as required by the NBIS, to track approval of TL qualifications. TL candidates must complete Form BBS 2620, *TEAM LEADER QUALIFICATIONS*. This form shall be completed and returned to the BBS, Attn: Local Bridge

Engineer, for any person proposed to serve as a local agency TL. This form may be obtained at the IDOT website at <http://www.dot.il.gov/bridges/bridgforms.html>.

The NBIS provides the following requirements for evaluating engineers and for technical personnel qualifications to function as a TL:

1. Team Leader: An individual must be approved by the State PM to function as a Team Leader. An individual approved by the State PM to function as a PM is also qualified as a Team Leader.
2. Professional Engineer: An individual who is licensed in Illinois as a Professional Engineer, and has successfully completed a FHWA approved comprehensive bridge inspection training course, is qualified to function as a Team Leader. Unless otherwise approved by the State PM, a comprehensive bridge inspection training course is considered to be the 10 days of training that has been routinely provided by IDOT through a course offered by the National Highway Institute. Based on evidence of professional licensing and successful completion of approved comprehensive bridge inspection training, a Professional Engineer can be accepted by the State PM to function as a TL.
3. Engineering Personnel: For the purpose of this section, Engineering Personnel are considered to be graduates of an engineering program, approved by the Accreditation Board of Engineering and Technology, who have passed the "Fundamentals of Engineering" exam (Engineer In Training exam), but are not yet licensed as Professional Engineers. To be considered for assignment as a TL, Engineering Personnel must have successfully completed a FHWA approved bridge inspection training course. Based on the guidelines provided by the FHWA, Engineering Personnel can function as Team Leaders after the State PM has evaluated their training and experience, and determined that they are qualified. The criteria used for the evaluation of experience is the same as that provided below for Technical Personnel, except the individual is required to have a total of two years of bridge related experience accumulated over the course of their career, rather than five years.
4. Technical Personnel: For the purpose of this section, Technical Personnel are considered to be individuals functioning within the local agency as:
  - a. "Engineering Technicians" or,
  - b. "Civil Engineers" who are not licensed professional engineers and have not passed the "Fundamentals of Engineering" exam (Engineer In Training exam). Technical Personnel must have successfully completed a FHWA approved bridge inspection training course to function as a Team Leader.

Based on the guidelines provided by the FHWA, Technical Personnel can function as Team Leaders after the State PM has evaluated their training and experience and determined that they are qualified based on one of the following:

- Criteria #1: An individual having accumulated at least five years of bridge related experience over the course of their career through the performance of NBIS bridge safety inspections, bridge design, bridge maintenance, or bridge construction activities, with more than 30 months of the accumulated bridge related experience obtained through the performance of NBIS bridge safety inspections, is qualified to function as a Team Leader. Technical Personnel meeting these requirements have the “desired minimum bridge inspection experience level” preferred by the FHWA for acceptance as Team Leader, and in-depth evaluation of the individual’s experience by the State PM to verify qualifications is not required. However, Form BBS 2620 must be submitted to the Local Bridge PM for documentation, and the performance of the Team Leader is subject to review by the Agency PM to ensure the quality of inspections. Assignments must be consistent with the experience of the individual.
- Criteria #2: An individual having accumulated at least five years of bridge related experience over the course of their career through the performance of NBIS bridge safety inspections, bridge design, bridge maintenance, or bridge construction activities, with more than 30 months of the accumulated bridge related experience obtained through the performance of various bridge inspections activities, is qualified to function as a Team Leader, if the State PM has evaluated and approved the potential Team Leader’s overall experience as acceptable. A portion of the individual’s bridge inspection experience must have been acquired through the performance of NBIS bridge safety inspections with the remainder of the individual’s bridge inspection experience derived from inspections associated with bridge design, bridge construction inspections, and bridge maintenance inspections. When evaluating an individual’s experience, all PMs involved in the evaluation process must, at a minimum, consider the factors listed under “Evaluation of Experience Criteria” provided in this section.
- Criteria #3: An individual having less than five years of bridge related experience accumulated over the course of their career through the performance of NBIS bridge safety inspections, bridge design, bridge maintenance, or bridge construction activities, with a portion of their accumulated bridge related experience obtained through the performance of NBIS bridge safety inspections, is qualified to function as a Team Leader only if both the State PM and the FHWA concur that the individual’s experience is acceptable. This criterion should only apply to special situations involving highly qualified individuals performing NBIS bridge safety inspections that require specialized knowledge or training on unusual or complex bridges.

Note that in all cases, a portion of the experience accumulated by Technical Personnel must have been derived from the performance of NBIS safety inspections in order to be considered qualified to function as a Team Leader.

5. Evaluation of Experience Criteria: When evaluating the experience of Technical Personnel to function as a Team Leader, the Program Manager must consider the following:
  - a. The relevance of the individual’s actual experience (i.e., has the experience that was not acquired directly through the performance of NBIS safety inspections

- enabled the individual to develop the skills needed to properly lead a bridge safety inspection team?).
- b. The individual's exposure to the problems or deficiencies common in the types of bridges being inspected by the individual.
  - c. The complexity of the structures being inspected in comparison to the knowledge and skills that the individual has gained through their experience.
  - d. The individual's understanding of specific data collection needs and requirements.
  - e. The individual's demonstrated ability, through a formal certification program, to lead bridge safety inspections.
  - f. The level of oversight and supervision under which the individual will function as Team Leader.

Item "e" of the "Evaluation of Experience Criteria" refers to a "formal certification program". In order to track the experience level of bridge inspectors, to document the evaluation and approval of experience to function as a Program Manager or as a Team Leader and to establish categories of certification for various bridge types, the BBS tracks and documents bridge inspection experience on a database, as well as a certification process to be followed by Program Managers. The BBS notifies the applicant of the determination of their application, and coordinates the development of the database and certification process with the local agencies, through the Bureau of Local Roads and Streets.

### **6-3.03    Types of Bridge Inspections**

#### **6-3.03(a)    Routine NBIS Maintenance Inspection**

All structures defined as a bridge in accordance with NBIS (see Section 6-1.01) and carrying public roads must have Routine Maintenance/Safety Inspections performed in accordance with the NBIS. The coding of inventory and inspection items is according to the guidelines of the ISIS as indicated in the *Structure Information and Procedure (SIP) Manual*, which is available from the IDOT, Office of Planning and Programming. The results must be recorded on the Illinois "Bridge Inspection Report," Form BBS-BIR. Form BBS-BIR must be kept in the individual structure file by the local agency with ownership of the bridge or the responsibility for inspection if ownership is by a private sector. (Inspection results in the form of numerical condition and appraisal ratings will be reported to the district on the Inspection/Appraisal Report (S104). These forms are available from the district or the *SIP Manual*.)

The Routine NBIS Inspection typically is performed at intervals not exceeding 2 years. Examples of structures requiring more frequent inspections include:

- unique structure types,
- those structures having details with unknown performance history,

- those structures with potential foundation or scour problems,
- non-redundant structures, and
- bridges with structural problems.

The NBIS, however, permits a State to implement policies allowing for inspections of certain bridges at greater than a 2 year interval, if properly justified by the State and approved by FHWA. Inspection intervals of 4 years are permitted for structures that meet all of the following criteria:

- The structure material and/or type is not included in Figure 6-3A.
- The condition appraisals for Deck, Superstructure and Substructure, or Culvert are “7” or greater.
- The structure must be capable of carrying Illinois legal loads at the inventory (design) stress level. (Inventory Rating is approximately HS-20 (MS-18) or greater for bridges or approximately HS-15 (MS-13.5) or greater for concrete culverts under fill). Eligible structures cannot have any legal load restrictions.
- Vertical clearance and vertical underclearance from over another roadway is 14 ft-0 in (4.2 m) or greater (if applicable).
- The longest span is not greater than 100 ft (30 m).
- Bridges will not be considered for the 48 month inspection cycle immediately following construction, reconstruction, rehabilitation, or major repairs. One Routine NBIS Inspection must have been performed within 24 months, but no sooner than 12 months, of project completion.
- Annual Average Daily Traffic (AADT) is 30,000 or less and Average Daily Truck Traffic (ADTT) is 3000 or less (the ADT and ADTT limits do not apply to culverts with 2 ft (600 mm) or more of fill depth).
- The age of the structure is not greater than 50 years unless the structure has been reconstructed within the past 30 years.
- All structural members are load-path redundant (i.e., no truss or two girder-type structures, tied arches, cable stayed, suspension, etc.).
- The Scour Critical Analysis Rating is “5” or higher.
- The bridge is not on the list of Strategic Highway Network (STRAHNET) system, as indicated by an asterisk in the last, or 20<sup>th</sup>, field position of ISIS Item 6, “Feature Crossed.”
- The structure must not be under the primary maintenance responsibility of a Federal agency.

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ISIS Item 43	Material	Type
x03		Deck Girder
x08	All	Orthotropic Deck
x09	All	Deck Truss
x10	All	Thru & Pony Truss
x12	All	Thru Arch
x13	All	Suspension
x14	All	Stayed Girder
x15 – x17	All	Movable
x24	All	Thru Girder
x28	All	Segmental Box Girder
x30 – x70	All	Specific Truss Types
x00	All	Other
8xx	Masonry	All
9xx	Aluminum, Wrought Iron, Cast Iron	All
0xx	Other or Varied	
311	Steel	Deck Arch
319	Steel	Culvert

("x" = any code)

**BRIDGE TYPES NOT ELIGIBLE FOR A FOUR-YEAR INSPECTION INTERVAL**

**Figure 6-3A**

Bridges with repair histories that indicate a strong probability of future problems should not be included among the candidates for the 4 year NBIS inspection interval. This determination is made at the discretion of the agency with jurisdictional responsibility for any structures that otherwise fall under the eligibility guidelines for 4 year inspection.

The eligibility of each structure should be reviewed following any revision of applicable inventory and inspection data. Any formerly eligible structures that no longer meet the inspection interval extension criteria will revert to a maximum 2 year interval.

The 4 year inspection interval is optional, representing a maximum, and does not preclude inspections at lesser intervals. Structures that are eligible for the 4-year NBIS inspection interval may, at the discretion of the local agency with jurisdictional responsibility, be inspected at lesser intervals. Any such inspections are entered into the ISIS by IDOT after being reported by the local agency to the district. However, the maximum inspection interval may remain at 2 years when a local agency informs IDOT in writing that it wants all of its structures excluded from consideration for a 4 year interval even though they may otherwise qualify.

A structural condition rating of "3" or "2" indicates a "serious" or "critical" situation usually requiring follow-up measures (e.g., repair, reduced load limit, temporary support, special inspection at a 6-month or less interval, closure of the bridge). A structural condition rating of

“1” or “0” indicates closure of the bridge. When a condition rating is reduced to this level, the deficiency must be described under Item 90B “Inspection Remarks” on Form BBS-BIR-1 or BBS-BIR-2 and Report S104, and specifically reported to the highway authority responsible for the maintenance of the bridge so that immediate follow-up measures may be initiated. When follow-up has been completed, Form BBS-BIR-1 or BBS-BIR-2 must be revised, and a new Report S104 submitted to the district. The IDOT Bureau of Bridges and Structures must also be notified for final concurrence with the measures.

### **6-3.03(b) Fracture Critical Member Inspection**

Fracture Critical Member (FCM) inspections are performed on steel bridge tension members, tension components of members or other member susceptible to a sudden failure that could be expected to result in collapse of the bridge or a portion of the bridge. These inspections shall consist of close-up investigations of all fracture critical members contained within the structure. Detailed guidelines for identifying and inspecting FCM's are contained in the FHWA publication, *Inspection of Fracture Critical Bridge Members* (FHWA-IP-86-26). Other similar components will be determined on a case-by-case basis by the Bureau of Bridges and Structures. All bridges requiring a FCM inspection are identified in the Fracture Critical Member Inventory within the ISIS. While more than one Fracture Critical Bridge Type (Item 92A1) may be indicated for a structure, only one inspection report and one Fracture Critical Appraisal Rating should be recorded to cover all identified members.

A Fracture Critical Member *Routine Visual* inspection is required for all fracture critical member bridges at a 24 month maximum interval. This inspection shall be performed as a part of the Routine NBIS Inspection with special attention given to assessing the condition of the FCM's. A Fracture Critical Inspection Interval (Item 92A) of 12 months would be required if the Fracture Critical Appraisal Rating (Item 93A1) for a structure were coded “4” or lower. Structures with FCM's shall also receive an in-depth inspection at a 60 month interval which may range from a close-up, hands-on inspection using standard, readily available tools to a special, detailed inspection using more sophisticated non-destructive testing methods that require specialized training.

All Fracture Critical Member Inspections must be reported using the Fracture Critical Inspection Bridge Inspection Report (BM-BIR-FC 1) form. New and newly rehabilitated fracture critical bridges shall receive an initial in-depth Fracture Critical Bridge Member Inspection within 90 days of opening to traffic.

In addition to the inspector qualification requirements included in the previously mentioned inspection regulations and *Manuals*, inspections shall be performed only by individuals qualified to be inspection team leaders who have successfully completed a 2 day course on the inspection of fracture critical members. Alternatively, if that course is not available, the 2 day fracture critical member training course requirement will be considered as satisfied by attendance at a 3 day Bridge Inspector's Refresher Course or the 10-day comprehensive Bridge Safety Inspector's Course conducted after February, 1998. Special FCM inspections requiring

Ultrasonic Testing (UT) must be performed by individuals trained, at least, as a Level II Nondestructive Test (NDT) inspector.

Additionally, in-depth inspections are required at a maximum interval of 5 years using an extent of inspection appropriate for the member condition and likelihood of fatigue cracking or brittle fracture. The two types of in-depth inspections are as follows:

1. Normal. An arms length, hands-on inspection using standard, readily available tools.
2. Special. A detailed inspection, as needed, using more sophisticated, nondestructive testing methods that require specialized training.

The in-depth inspection interval must be reduced to a 2 year interval or less when the Fracture Critical Appraisal Rating (Item 93A1) is lower than "5." The condition rating of the superstructure (Item 59) or the substructure (Item 60) may be higher than the fracture critical member located in that portion of the structure. Reduction of a rating to less than "4" requires an additional thorough structural analysis of the structure.

The type and frequency of in-depth inspection will be determined by the engineer overseeing the bridge inspection, in consultation with specialists in the field if necessary, and recorded on the Form BBS-BIR-FC 1. Fracture Critical Member inspections are to be performed only by qualified licensed professional or structural engineers or individuals qualified to be inspection team leaders for the Routine NBIS Maintenance Inspections, who have completed a Fracture Critical Member Inspection course. The "Special" in-depth inspections that require ultrasonic testing (UT) must be performed by individuals trained as Level II Nondestructive Test (NDT) inspectors.

Critical findings must be investigated and necessary action taken immediately to protect public safety and the structure. Routine maintenance needs discovered during the inspection will be scheduled for remedial work. The required follow-up work and its completion should be recorded in the space provided on the Fracture Critical Inspection Report Form.

### **6-3.03(c) Underwater Inspection**

A special inspection of underwater portions of structures must be performed for certain structures as shown in Figure 6-3B. The findings of this inspection are to be recorded on the Underwater Inspection Bridge Inspection Report form (BM-BIR-UW 1).

The special Underwater Inspection should include evaluation of the substructure units and adjacent streambed areas based on visual observation or by sounding and recording of channel elevations with depth-finding equipment as considered appropriate by the District Bridge Maintenance Engineer. As serious bridge deficiencies are discovered or suspected, more thorough evaluation techniques should be employed. These may include survey measurements of the elevation and attitude of substructure units, visual or tactile observations by divers, and soil borings. The findings of the Underwater Inspection should be taken into account in the

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Substructure Condition (Item 60) appraisal, which may be no higher than the Underwater Appraisal Rating (Item 93B1).

New structures and structures will newly rehabilitated substructures shall receive an initial Underwater Inspection if required according to the Underwater Inspection table. The results of this initial Underwater Inspection shall be recorded in the MMIS no more than 90 days after opening to traffic. Underwater highway bridge elements are included during the evaluation of the substructure as part of the Routine Inspections.

Underwater Inspection		
Category	Category Description	Required Inspection Interval
1	Stream crossings where debris and/or erodible soils are a known problem.*	1 year and following significant storms.
2	Water crossings with substructure units submerged in a minimum of 4 ft (1.2 m) of water at all times.	5 years
3	Stream and river crossings where flow is restricted and velocities exceed the erosion resistance characteristics of the soil at substructure units.	5 years
4	Water crossings supported by spread footings not adequately keyed into rock or protected from the effects of streambed scour.	2 years and following significant storms (1 year for non-redundant load path structures).
5	River crossings with large drainage areas (greater than 5000 mi <sup>2</sup> (13,000 km <sup>2</sup> )).	5 years
6	Substructure elements that require scour monitoring as determined by a scour critical evaluation.	As required according to the scour critical evaluation.

\* Structures appraised at 4 or less for ISIS Item 61, Channel and Channel Protection, should be included under Category 1.

**REQUIRED SPECIAL UNDERWATER INSPECTIONS**

**Figure 6-3B**

While a special Underwater Inspection is required for certain substructure elements, inspection of other structures and substructure elements that are in the water must be inspected as a part of each routine NBIS Inspection. The findings will be applied toward the appraisal of Item 60.

**6-3.03(d) Special Feature Inspection**

A Special Feature Inspection of critical bridge elements is required when conditions approach the point where further deterioration or deflection of those elements may require reduced posting or closure. The actual required inspection frequency should be determined based on the seriousness of conditions at the bridge. The Special Feature Inspection will only need to be performed for the critical elements identified and not for the entire structure, unless specified. The inspection should be reported to the district and the inspection date recorded in the ISIS. The local agency must keep the Special Feature Inspection records with the individual structure file.

A Special Feature Inspection should be considered under the following circumstances at the indicated maximum interval:

1. ISIS Condition Rating of Superstructure (Item 59), Substructure (Item 60), Channel (Item 61) or Culvert (Item 62) is "2" — 6 Months.
2. The ISIS Scour Rating (Item 113) is "3" or less – one month and after heavy rainfall events.
3. Unusual movement of the structure, or other critical conditions, that require monitoring have been identified.

**6-3.03(e) Damage/Interim Inspections**

Damage and Interim Inspections are inspections held between regularly scheduled Routine Maintenance Inspections. They may be required for various reasons (e.g., foundation settlement, scour, environmental conditions, man-inflicted damage) and are administered on a case-by-case basis. A routine NBIS form (BBIS-BIR 1 or 2) should be completed and submitted to the district.

**6-3.03(f) Scour Inspection of Existing Structures**

During the routine NBIS inspection, signs of scour around substructure units should be investigated and noted on the inspection form. This inspection should be performed even if the coding for Item 113 indicates that the foundation is stable for scour. When scour is present, measures for repair or stabilization should be performed immediately. The coding for Item 113 in ISIS should be revised to reflect the change in scour condition.

**6-3.03(g) Inspection References**

Manuals intended for use by inspection personnel, in addition to the *Bridge Inspection Procedures Manual*, include:

1. *Bridge Inspector's Training Manual 90*, published by the US Department of Transportation, contains excellent information on bridge inspection. Copies may be obtained from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402.
2. *Culvert Inspection Manual*, published by the US Department of Transportation (Report No. FHWA-IP-86-2), provides guidelines for performing maintenance inspections of all types of culverts. Copies may be obtained from the US Government Printing Office.
3. *Inspection of Fracture-Critical Bridges*, published by US Department of Transportation (Report No. FHWA IP-86-26), provides practical procedures for the inspection and rating of bridges with fracture-critical members. Copies may be obtained from the US Government Printing Office.
4. *Manual for Condition Evaluation of Bridges*, published by the American Association of State Highway and Transportation Officials, provides additional information on bridge inspection and rating. Copies may be obtained from AASHTO, 444 North Capitol Street, NW, Suite 225, Washington, D.C. 20001.
5. *Manual for Underwater Inspection of Bridges*, published by US DOT (Report No. FHWA – DP-80-1), provides guidelines for performing underwater bridge inspections. Copies may be obtained from the US Government Printing Office.
6. *Manual for Evaluating Scour at Bridges*, published by US DOT (Report No. FHWA – HI-96-031), provides guidelines for evaluating streambed scour at bridges. Copies may be obtained from the US Government Printing Office.

#### **6-3.04    Reporting Requirements**

This Section discusses the process for entering field inspection results into the ISIS. See Figure 6-2A for a list of inspection report forms.

##### **6-3.04(a)    New Structure, or Initial Inspection of Old Structure not in ISIS**

The following applies:

1. Complete the Inventory/Status Initial Report (R105-I) and the Key Route/Construction Initial Report (R111-I) and submit it to the district. If a bridge has been replaced, then also indicate in the submittal the structure number of the replaced structure so that the replaced bridge can be marked for deletion.
2. Complete the Bridge Inspection Report (Form BBS-BIR-1 or BBS-BIR-2). When the initial NBIS Maintenance Inspection has been performed, the local agency may also use

the Bridge Record Card (Form BLR 06310). These forms are retained in the individual structure files in the local agency's office. The Inspection/Appraisal Initial Report (R104-I) should be completed and submitted to the district.

3. The scour analysis, if applicable, needs to be filled out and submitted at the same time as the other two initial reports.

#### **6-3.04(b) Re-inspection of Structures on File in Structure ISIS**

The following applies:

1. Complete the Bridge Inspection Report (Form BBS-BIR-1 or BBS-BIR-2). Update the Bridge Record Card (Form BLR 06310), if it is maintained by the local agency.
2. Make all necessary changes in red directly on Report S104, S105, or S114 and submit them to the district. A new Master Structure Report (S107) will be returned after the corrected data has been entered in the system. Copies of Reports S104, S105, and S107 for each structure in the inventory are available either from the district or can be printed from *SIMS*, which can be downloaded from the IDOT website.

#### **6-3.04(c) Reconstruction of an Existing Structure**

Any reconstruction, rehabilitation, or major repair of an existing bridge currently in the Illinois Structure Information System (ISIS) must be recorded in the ISIS within 180 days of reopening the bridge to unrestricted traffic. Work that changes the inventory data of a bridge open to traffic must also be recorded within 180 days of the completion of the work. A bridge reconstructed using the same abutments or piers keeps the same structure number. The following applies:

1. Complete Form BBS-BIR-1 or BBS-BIR-2 and update Form BLR 06310, if maintained by the local agency.
2. Revise and submit Reports S104, S105, and S114 as described in Section 6-3.04(b).



## 6-4 LOAD RATING AND POSTING

### 6-4.01 Requirements

All bridges must be rated according to their load-carrying capacity. This includes the Inventory Rating, Operating Rating, and the ratings for the Illinois Legal Loads as defined in the *Illinois Vehicle Code* (625 ILCS 5/15-111); see Section 6-1.01 for definitions. These ratings provide an indication of the bridge's capacity to safely resist the loads it is likely to be subjected to. This information assists in the determination of necessary posting, the issuance of special overload permits, and the scheduling for rehabilitation or replacement. These ratings must be performed by IDOT or receive IDOT's concurrence, in accordance with the *Illinois Vehicle Code* (625 ILCS 5/15-317(b)). New or reconstructed bridges approved by IDOT are considered as meeting this requirement.

According to IDOT's load rating initiative, as described in Circular Letter 96-11, re-evaluation of load-carrying capacity must be performed when significant deterioration in structurally critical areas has occurred since the prior rating. Such deterioration is indicated when the ISIS Superstructure (Item 59), Substructure (Item 60), or Culvert (Item 62) is reduced to a "4" or less, or when the Condition Rating of Deck (Item 58) falls to "3" or less.

In addition, re-rating is performed at a maximum 10 year interval for bridges meeting any of the following criteria:

- a Condition Rating of "3" or less for Items 59, 60, or 62;
- a Condition Rating of "2" or less for Item 58; or
- posting is required *and* either Item 59, 60, or 62 is "4" or Item 58 is "3."

Re-rating of bridges not meeting the above criteria, although not specifically required, may be requested by the local agency.

### 6-4.02 Responsibilities

All bridges must be rated for load capacity by IDOT or by a qualified Illinois licensed structural engineer with IDOT's concurrence. Generally, structures do not need to be re-rated unless they have deteriorated or have been repaired or modified.

#### 6-4.02(a) Load Rating by IDOT

IDOT will rate bridges upon request by the local agency or upon its own initiative. A request for rating should state any unusual or notable conditions. The local agency should provide a copy of the "as-built" construction plans or, if plans are not available, a dimensioned sketch of the bridge and its significant structural members.

Rating requests may be made in writing through the district. A representative of the Bureau of Bridges and Structures will schedule a field investigation of each structure to determine actual conditions of the bridge which affect the load-carrying capacity.

#### **6-4.02(b) Load Rating by Others**

Structure ratings performed by others must receive the concurrence of IDOT. A summary report for all bridges rated should detail the procedures, findings, inventory and operating ratings, and posting recommendations based on a field inspection and analysis performed by an Illinois licensed structural engineer in accordance with provisions of the current *AASHTO Manual for Condition Evaluation of Bridges*. The structural engineer's seal must be affixed to the summary letter and IDOT may request computations. Excerpts from detailed inspection reports or other similar submittals will not be accepted.

#### **6-4.02(c) Reporting**

The local agency should submit the summary report to the district for forwarding to the Bureau of Bridges and Structures. The local agency should accept the consultant's findings prior to submittal of the report.

#### **6-4.03 Weight Limit Posting**

When a structure cannot carry the legal load, the *Illinois Vehicle Code*, (625 ILCS 5/15-317) requires that IDOT ensure that suitable signs are erected and maintained that inform the public of the maximum weight limit. The agency having jurisdiction over the roadway is responsible for the posting of signs, regardless of structure ownership or maintenance responsibility.

When IDOT determines that a structure carrying traffic on a public road is not capable of carrying the legal loads as defined in 625 ILCS 5/15-111, it will inform the local agency. Upon notification from IDOT of a required load posting, the local agency shall erect signs as soon as possible, but no later than 30 days after notification. When a structure is to be closed, the local agency should immediately erect barricades that will prohibit traffic access to the structure. Those barricades are to remain in place until permanent closure measures can be installed.

IDOT annually monitors the bridges that are listed in the ISIS as requiring load postings or closures. The local agency will be notified when bridges are not properly signed. The local agency then has 30 days to rectify the deficiency. When satisfactory progress is not made, IDOT will take the necessary action to bring the location into compliance. The local agency will be billed by IDOT for the expense incurred.

See *ILMUTCD* for proper signing at bridge closures.