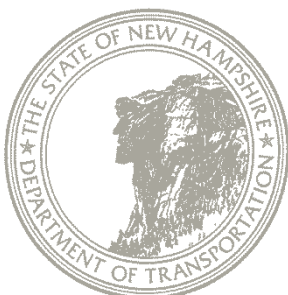




# Bridge Inspection Manual

March 2017 – v 1.0



**BUREAU OF  
BRIDGE DESIGN**



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1.1 Background

The general requirements for the inspection, evaluation, and load rating of the nation's bridges are defined by the National Bridge Inspection Standards (NBIS) in the Code of Federal Regulations, 23 CFR § 650C (refer to Appendix A). Each State is required to conduct biennial bridge inspections of its state and local bridges carrying traffic on public highways, and to record structure inventory and appraisal information in a specified format. The Federal Highway Administration (FHWA), U.S. Department of Transportation, is assigned the responsibility for collecting and storing the data reported by the states, and for maintaining the National Bridge Inventory.

The NBIS stipulates that each state highway department perform inspections, prepare reports, and determine load ratings in accordance with the provisions of the AASHTO *Manual for Bridge Evaluation* (MBE) and the FHWA *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges* (Coding Guide). Furthermore, other FHWA Manuals and Technical Advisories and AASHTO Specifications, Codes, and Guidelines serve as source material for state highway departments to conduct operations in compliance with the NBIS.

The New Hampshire Department of Transportation (hereafter referred to as NHDOT or “the Department”) has established a program to satisfy the requirements of the NBIS. Certain procedures were contained in the *State of New Hampshire Policy Manual for*

*Bridge Inspectors*, 1991, and other practices have been established by NHDOT policy, written and unwritten, or persist based on historic practice. This Manual documents and formalizes NHDOT policies and procedures for administering the bridge inspection program to comply with NBIS requirements, defines the organizational structure and outlines responsibilities for the Bureau of Bridge Design, Existing Bridge Section to carry out the stated policy. In addition, this Manual is intended to compile available information to produce state-of-the-art guidance on inspection, condition evaluation, and load rating of bridges in New Hampshire.

## 1.2 Purpose

The purpose of this Manual is to define the procedures and practices of the Bridge Inspection Program administered by the NHDOT Bureau of Bridge Design (BOBD) for determining the physical condition, load capacity, and maintenance needs of structures contained in its bridge inventory. This bridge inventory includes:

1. All publicly owned and maintained “bridges” carrying highway traffic. Federal definition bridges are defined in the NBIS as structures spanning more than 20 feet, while State-definition bridges are structures with spans between 10 and 20 feet (refer to Section 1.4 for more specifics);
2. Various other non-highway bridges owned and maintained by the State (e.g. bypassed historic structures, pedestrian and railroad bridges);
3. Bridges or portions thereof serving other uses crossing highways open to public travel; and
4. Various other bridges for which the State has established a vested interest.

The provisions of this Manual are intended to satisfy various requirements set forth in the *Metrics for the Oversight of the National Bridge Inspection Program* (a.k.a. the “23 Metrics”) by accomplishing the following:

- Establish policy for NHDOT bridge inspection, evaluation and load rating program;
- Serve as a standard and provide uniformity in the execution of the program;
- Define program responsibilities for operating units within NHDOT and for liaison with outside agencies;
- Provide bridge inspection, evaluation, load rating, and reporting procedures;
- Set guidelines for interpretation and implementation of AASHTO and FHWA codes and standards;
- Establish formal quality control (QC) and quality assurance (QA) procedures; and

- Assist in training personnel to perform the various tasks required under the program.

### 1.3 Program Objectives

The objectives of NHDOT's bridge inspection, evaluation, and load rating program are:

- To fulfill the requirements of the National Bridge Inspection Standards (NBIS);
- To ensure prompt discovery of any deterioration, defect, or structural deficiency that could be hazardous to the traveling public;
- To maintain an up-to-date inventory that records the condition of all qualifying state-owned bridges carrying traffic on Class I, II, and III public highways as defined in RSA 229:5 by conducting periodic inspections as required by RSA 224:22;
- To maintain an up-to-date inventory that records the condition of all qualifying municipality-owned bridges carrying traffic on Class IV and V public highways as defined in RSA 229:5 by conducting periodic inspections as required by RSA 224:23;
- To maintain an up-to-date inventory that records the condition of other bridges for which the State feels it has a vested interest. These are determined on a case-by-case basis and may include state-owned pedestrian and railroad bridges, bridges constructed using Department funds which are not owned by the State, portions of bridges not owned by the State which cross Class I, II, and III highways maintained by NHDOT, and other miscellaneous structures considered important by NHDOT to the transportation network;
- To establish and maintain the information required by the AASHTO Bridge Management Software (BrM);
- To determine the extent of minor deterioration to assist with planning routine maintenance and repair work;
- To determine the extent of major deterioration for guiding decisions relative to bridge rehabilitation and replacement; and
- To provide information for re-evaluation of live load capacity to guide posting and closure decisions.

Bridges on Class VI highways are specifically *excluded* from the bridge inventory. New Hampshire State law (RSA 224:22 and 224:23) requires inspection of bridges on Class I, II, III, IV, and V Highways only, specifically omitting Class VI Highways. Additionally, Federal regulations apply only to bridges on "public roads" which are:

1. Under the jurisdiction of a public authority, **and**
2. Maintained by a public authority, **and**
3. Open to public travel.

All Class VI Highways meet the first requirement of jurisdiction and some Class VI Highways may meet the requirement of being open to public travel. By definition, however, Class VI Highways are not maintained by a public authority. Since all three requirements must be met to be judged a “Public Road” under Federal law, the NBIS as stipulated in 23 CFR 650 § 307 do not apply to bridges on Class VI Highways.

Therefore, the Bureau of Bridge Design does not inspect bridges known to be on Class VI Highways. Bridges already in the inventory are removed if they are found to be located on sections of Class VI highways. The Municipal Highways Engineer in the Bureau of Planning and Community Assistance should be consulted to verify Class VI status prior to removal from the inventory.

The provisions of this manual may be applied to cover bridges and/or culverts, as assigned, outside the scope of this manual if supplemented with the additional required information and rating criteria.

## 1.4 Definitions

AASHTO - American Association of State Highway and Transportation Officials, 444 North Capitol Street, N.W., Suite 225, Washington, DC 20001.

BIPR - Bridge Inspection Photo Reviewer. A database created by NHDOT which serves as a library for all digital inspection photos for bridges and culverts in the inspection inventory, as well as other miscellaneous structures of interest.

BOPR - Bridge Overweight Permit Review. Software developed by the NHDOT to be used by NHDOT staff and the general public to analyze bridges for overweight permits. It includes a database of load rating information for all public highway bridges included in the bridge inventory.

Federal-Definition Bridge - Per the NBIS, is 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 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.

State-Definition Bridge - Per RSA 234:2, is a structure, having a clear span of 10 feet or more (up to 20 feet) measured along the center line of the roadway at the elevation of the bridge seats, spanning a watercourse or other opening or obstruction, on a public highway

to carry the traffic across, including the substructure, superstructure, and approaches to the bridge. This includes multiple culverts with an overall combined span of 10 feet or more (up to 20 feet) and a distance between culverts not exceeding ½ the diameter of the smallest culvert. NHDOT policy is to apply the requirements of the NBIS to all State-definition bridges for uniformity and consistency of the inspection data.

BMS - Bridge Management System. A system designed to optimize the use of available resources for the inspection, maintenance, rehabilitation, and replacement of bridges.

BOBD - Bureau of Bridge Design.

BOBM - Bureau of Bridge Maintenance.

BrM - AASHTOWare Bridge Management software. The Bridge Management System utilized by the Bureau of Bridge Design.

Department - New Hampshire Department of Transportation. See also “NHDOT”.

FHWA - Federal Highway Administration; part of the U.S. Department of Transportation. FHWA is responsible for evaluating the compliance of each state with the requirements of the NBIS in accordance with the *Metrics for the Oversight of the National Bridge Inspection Program (23 Metrics)*.

NBIS - National Bridge Inspection Standards. Federal regulations establishing requirements for inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of bridge inventory records. The NBIS apply to all structures defined as bridges (Federal-definition) located on or over all public roads.

NHDOT - New Hampshire Department of Transportation.

NICET - National Institute for Certification in Engineering Technologies.

RSA - Revised Statutes Annotated. Codified laws of the State of New Hampshire.

## 1.5 Standard References and Guides

The primary references for use in conjunction with this manual are the most current editions of the following manuals including any interims and recent revisions, except as noted below:

- AASHTO *Culvert and Storm Drain Inspection Manual*, American Association of State Highway and Transportation Officials
- AASHTO *LRFD Bridge Design Specifications*, American Association of State Highway and Transportation Officials.

- AASHTO *LRFD Movable Highway Bridge Design Specifications*, American Association of State Highway and Transportation Officials.
- AASHTO *Manual for Bridge Element Inspection*, American Association of State Highway and Transportation Officials.
- AASHTO *Manual for Bridge Evaluation*, American Association of State Highway and Transportation Officials (AASHTO MBE).
- AASHTO *Movable Bridge Inspection, Evaluation, and Maintenance Manual*, American Association of State Highway and Transportation Officials.
- AASHTO *Standard Specifications for Highway Bridges*, American Association of State Highway and Transportation Officials, various editions.
- *Bridge Inspector's Reference Manual*, Federal Highway Administration, Publication No. FHWA NHI 12-049 and FHWA NHI 12-050 (BIRM).
- *Inspection of Fracture Critical Bridge Members*, Federal Highway Administration, Publication No. FHWA IP 86-26, September 1986.
- *Manual on Uniform Traffic Control Devices for Streets and Highways*, Federal Highway Administration.
- *Metrics for the Oversight of the National Bridge Inspection Program*, Federal Highway Administration, Publication No. HIBS-30.
- *National Design Specification for Wood Construction with Commentary*, American National Standards Institute/American Wood Council (ANSI /AWS).
- NBIS or 23CFR § 650. *Code of Federal Regulations, 23 Highways Part 650, Subpart C – National Bridge Inspection Standards*, United States Department of Transportation.
- *New Hampshire Statewide Bridge Scour Project; Scour Evaluation and Plan of Action Manual*, December 2012 (NH Scour Manual).
- *NHDOT Bridge Design Manual v2.0*, January 2015 (Includes Draft and Finalized Chapters).
- *New Hampshire Revised Statutes Annotated, Title XX: TRANSPORTATION, Ch. 234.*



- *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*, Report No. FHWA-PD-96-001, Federal Highway Administration, December 1995 (Coding Guide).
- *AITC Timber Construction Manual*, American Institute of Timber Construction, 6<sup>th</sup> Edition, 2012.
- *Underwater Bridge Inspection*, Federal Highway Administration & National Highway Institute, Publication No. FHWA NHI 10-027.
- The latest applicable Design Memorandums released by the NHDOT Bureau of Bridge Design. Available through the online document library of the NHDOT Bureau of Bridge Design.

## 1.6 Condition Evaluation

The condition evaluation establishes the physical and functional condition of the bridge components including the extent of deterioration and other defects. The evaluation forms the basis for load rating of the bridge, maintenance actions, and repair/rehabilitation programs. The repeating inspection cycle provides a continuous record of bridge condition and rate of deterioration over time (See Section 5.2 of this manual for inspection types).

The primary responsibilities for a bridge inspector are ensuring public safety and protecting public investment. If defects are discovered that present a hazard to safe passage over or under the structure, or threaten the integrity of the bridge, the Department's critical finding notification procedures, as described in Section 3.7 of this manual, shall be initiated immediately.

The condition rating for each major bridge element (e.g. deck, superstructure, substructure, or culvert) are to be evaluated in accordance with the 0-9 numeric coding system presented in *FHWA's Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges* and the *Bridge Inspectors Reference Manual* (hereafter typically referred to as the *Coding Guide* and the *BIRM*, respectively). For bridges crossing over waterways, additional ratings for waterway adequacy and channel condition are collected on a similar numeric coding system.

Element-level condition information is collected and evaluated in accordance with the most recent version of *AASHTO Manual for Bridge Element Inspection*.

## 1.7 Load Rating

Load ratings are computed and updated as part of the Department's Bridge Inspection Program, as necessary. Load rating is the procedure through which an engineer determines the live load carrying capacity of a new or existing bridge utilizing any and all available information including as-built plans, shop drawings, design calculations, and bridge inspection findings. Assessing the effects of damage, deterioration, and other defects on the structural integrity of a bridge for load rating requires sound engineering judgment and experience.

The *AASHTO Manual for Bridge Evaluation (MBE)* recognizes load ratings at two levels, Inventory and Operating. The Inventory Level rating generally corresponds to the design level of stress, and represents the live load that can safely use the bridge for an indefinite period of time. The Operating Level rating indicates the maximum permissible live load on the bridge and should never be exceeded.

The *AASHTO MBE* provides general guidance and direction for load rating procedures. NHDOT's practices and procedures for conducting load ratings are contained in Chapter 6 of this manual.

## 1.8 Quality Control and Quality Assurance (QC/QA)

NHDOT's Quality Control (QC) and Quality Assurance (QA) Plan provides a systematic approach to ensure the quality and consistency of data produced by the bridge inspection program. Quality Control procedures are intended to maintain the quality of a bridge inspection and load rating at a high level of accuracy and consistency. Quality Assurance uses sampling and other measures to assure the adequacy of quality control procedures in order to verify or measure the quality level of the entire bridge inspection and load rating program.

These procedures include, but are not limited to, qualifications of the bridge inspection staff, sampling to verify the quality of field inspections, review of load rating calculations and methodology, continual investment in staff training through professional development, review and validation of data collected and entered into the Bridge Management System (e.g. BrM), and the identification/resolution of data errors. The goal of this plan is to continuously improve the quality of the bridge inspection process.

Chapter 4 of this manual provides detailed discussion of the QC/QA plan implemented by the Department.

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2.1 Organization

The Existing Bridge Section of the NHDOT Bureau of Bridge Design is responsible for administering the bridge inspection program for all bridges in the State of New Hampshire, maintaining and updating bridge inventory records using the Department’s Bridge Management System, assuring the accuracy and appropriateness of load ratings, and ensuring that appropriate weight limit postings are implemented, as necessary, for all bridges in the inventory. The Existing Bridge Section is further responsible for satisfying

all FHWA reporting requirements as detailed in the *23 Metrics* to maintain compliance with the NBIS. An organizational chart for the Bridge Design personnel involved with the bridge inspection program can be found in Appendix A of this manual.

## 2.2 NBIS Program Requirements

The National Bridge Inspection Standards establish minimum qualifications for the following defined roles within a bridge inspection organization.

### 2.2.1 Program Manager

*2.2.1.1 Description* - The Program Manager is the individual in responsible charge of the bridge inspection program and provides overall leadership within the bridge inspection program and guidance to bridge inspection team leaders when requested.

*2.2.1.2 Qualifications* - Minimum qualifications for a Program Manager are presented in the Code of Federal Regulations, Title 23, Part 650, Subpart C, Section 650.309 (23 CFR 650.309, see Appendix A).

*2.2.1.3 Responsibilities* - The Program Manager is assigned the duties and responsibilities for bridge inspection, reporting, and inventory.

### 2.2.2 Load Rating Engineer

*2.2.2.1 Description* - The Load Rating Engineer oversees load ratings for all bridges in the inventory using information available in existing bridge plans supplemented with data from field inspections.

*2.2.2.2 Qualifications* - The individual in this position must be a registered Professional Engineer in the State of New Hampshire.

*2.2.2.3 Responsibilities* - The load rating engineer is charged with overall responsibility for load rating bridges captured in the NHDOT bridge inventory (municipal and state-owned) in accordance with the most current guidance contained in the AASHTO Manual for Bridge Evaluation. This responsibility includes conducting load ratings, overseeing load ratings by other staff, and review and acceptance of load ratings by external parties including consultant engineers and fabricators to ensure the load ratings utilize appropriate methodology and represent the current condition of each structure. This individual is also responsible for ensuring the Department's Bridge Overweight Permit Review (BOPR) software correctly utilizes the most up-to-date load rating information for each bridge in the inventory, ensuring safe decisions are made regarding overweight permit applications.

### **2.2.3 Team Leader**

*2.2.3.1 Description* - A Team Leader is the individual who performs the field inspection of an individual bridge.

*2.2.3.2 Qualifications* - Minimum qualifications for a Team Leader are presented in 23 CFR 650.309 (see Appendix A).

*2.2.3.3 Responsibilities* - A team leader is responsible for planning and preparing for inspections, including review of on-file bridge data and evaluation of bridge site conditions (such as confined spaces, nondestructive evaluation and traffic control). While performing the field inspection, the team leader is responsible for all judgments made concerning a bridge's condition, including recognizing and reporting any critical findings, and maintaining safe inspection practices throughout the entire bridge inspection. The team leader finalizes the bridge inspection report after each bridge inspection, ensuring the information in the BMS is updated to match the inspection findings. Team leaders also periodically assist with transferring inspection information to the Chief Bridge Inspector, either by bringing the information to the John O. Morton Building in Concord (NHDOT headquarters), meeting with the Chief Bridge Inspector out in the field, or emailing data files for specific bridges when immediate travel to Concord is impractical but the data is urgently needed by the Existing Bridge Section office staff.

At least one team leader is required to be present at all times during each initial, routine, in-depth, fracture critical member (FCM) and underwater inspection per the NBIS for structures meeting the Federal bridge definition.

### **2.2.4 Underwater Bridge Inspection Diver**

*2.2.4.1 Description* - This individual is a trained diver who inspects the substructure units and foundations below the water surface.

*2.2.4.2 Qualifications* - Minimum qualifications for an inspection diver are presented in the 23 CFR 650.309 (see Appendix A).

*2.2.4.3 Responsibilities* - The underwater bridge inspection diver is responsible for evaluating the physical condition of the substructure units and foundations when above-water inspection methods (often probing) cannot adequately determine the condition of the members below the water surface. The level of responsibility required from an underwater bridge inspection diver may even be greater than that of an above-ground inspector, since the underwater bridge inspection diver is often the only individual who will evaluate the condition of a member submerged below the water's surface.

In addition to the inspection of underwater members, the underwater bridge

inspection diver is often surrounded by a combination of hazards. Examples of these hazards include increased stream velocity, poor visibility due to dark and polluted water, marine traffic, floating timber, and debris accumulation at the substructure unit(s). Therefore, the underwater bridge inspection diver has a responsibility to safety and awareness of his or her surroundings throughout the entire underwater inspection.

## 2.3 Existing Bridge Section Organization

The Existing Bridge Section of the Bureau of Bridge Design consists of multiple positions, including engineers and inspectors, each with defined roles and responsibilities. A comprehensive outline of specific job-related responsibilities, including those outside of bridge inspection, is presented in the Supplemental Job Description (SJD) for each position. The SJD's are available in Appendix A of this manual or upon request from the Human Resources Division of the New Hampshire Department of Administrative Services. The following personnel are integral to the Department's bridge inspection program.

### 2.3.1 Chief, Existing Bridge Section (Position #21125)

*2.3.1.1 Description* - Supervises the staff of the Existing Bridge Section to administer the bridge inspection program for the State of New Hampshire, oversees the bridge inspection activities of consultant firms, reviews and approves bridge load ratings, and maintains the bridge inventory data and inspection files utilizing the Department's Bridge Management System in compliance with the NBIS. This position serves in the capacity of Program Manager and Load Rating Engineer as defined in Section 2.2.

*2.3.1.2 Qualifications* - Minimum qualifications for this position are defined in the Class Specification for a Civil Engineer VI, available from the Human Resources Division of the New Hampshire Department of Administrative Services. This position must also meet the minimum qualifications established in 23 CFR 650.309 for a Program Manager and Load Rating Engineer.

### 2.3.2 Bridge Inspection Engineer (Position #20050)

*2.3.2.1 Description* - Manages, evaluates, and coordinates the activities of the Bridge Inspection staff and Bridge Management System.

*2.3.2.2 Qualifications* - Minimum qualifications for this position are defined in the Class Specification for a Civil Engineer V, available from the Human Resources Division of the New Hampshire Department of Administrative Services.

**2.3.3 Entry-Level Bridge Engineer (CEI-III) (Position #20054)**

*2.3.3.1 Description* - Provides structural engineering services to assist with evaluating bridge load ratings, implementing inspection and inventory procedures, and updating bridge inspection records utilizing the Department's Bridge Management System.

*2.3.3.2 Qualifications* - Minimum qualifications for this position are defined in the Class Specification for a Civil Engineer I-III, available from the Human Resources Division of the New Hampshire Department of Administrative Services.

**2.3.4 Chief Bridge Inspector (Position #21301)**

*2.3.4.1 Description* – Supervises bridge inspectors, assists with coordinating inspection activities of the bridge inspection teams, reviews bridge inspection field data for accuracy and completeness, and administers the QC/QA program to maintain the quality and integrity of bridge inspection activities.

*2.3.4.2 Qualifications* - Minimum qualifications for this position are defined in the Class Specification for a Chief Bridge Inspector, available from the Human Resources Division of the New Hampshire Department of Administrative Services.

**2.3.5 Bridge Inspector**

*2.3.5.1 Description* - Assists or serves as the Team Leader for conducting bridge and culvert inspections in accordance with National Bridge Inspection Standards. Upon meeting the qualifications for a Team Leader presented in the NBIS and subject to the approval and satisfaction of both the Administrator of the Bureau of Bridge Design and the Chief of the Existing Bridge Section, bridge inspectors may be promoted to Team Leader status.

*2.3.5.2 Qualifications* - Minimum qualifications for this position are defined in the Class Specification for a Bridge Inspector, available from the Human Resources Division of the New Hampshire Department of Administrative Services. The minimum qualifications for a Team Leader are identified in 23 CFR 650.309.

**2.3.6 Consultant Inspection Teams**

Consultants utilized by the Department for bridge inspection activities shall maintain a sufficiently sized staff of competent field and office personnel with qualifications meeting the requirements of the NBIS and additional requirements as stipulated in the scope of work for each inspection contract.

## 2.4 Internal Coordination with NHDOT Bureaus

The Existing Bridge Section routinely coordinates with most NHDOT Bureaus to achieve its goals and meet its responsibilities. Bridge inspectors regularly coordinate directly with other NHDOT Bureaus to schedule use of inspection equipment (i.e. truck-mounted Servi-Lift, spider staging). This practice is encouraged to facilitate efficiency and expediency within the inspection program.

## 2.5 Coordination with External Agencies

The following is a non-exhaustive list of various outside agencies that the Existing Bridge Section commonly coordinates with as part of its inspection activities:

- Federal Highway Administration (FHWA)

- State of NH Department of Resources and Economic Development (DRED)

- State of NH Department of Safety

- State of NH Department of Justice (Attorney General's Office)

- Railroad Owners

- Municipalities (Road Agents, Town Engineers, Town Managers)

Coordination with State and Federal agencies is typically handled by office personnel. However, bridge inspectors do often communicate directly with municipal officials regarding issues of local concern and with railroad personnel regarding right-of-way access and scheduling for railroad flagmen. This practice is encouraged in an effort to facilitate efficiency and expediency within the inspection program. Deviation from this protocol occurs as needed to allow the Existing Bridge Section to achieve its goals.

## 2.6 Consultant Coordination

The Consultant Design Chief, Bureau of Bridge Design, is responsible for managing and overseeing consultant inspection contracts. The Existing Bridge Section often assists the Consultant Design Chief on a project specific basis, providing guidance pursuant to its expertise with bridge inspection activities.



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The inspection practices contained within this section have been set forth by the Department. Note that this section is intended to provide a summary of the Department's standard inspection practices (where applicable) and is not considered all-inclusive of State or Federal policy.

**3.1 Inspections by NHDOT Personnel**

**3.1.1 General**

The bridge inspectors shall generally work in two man teams for safety and to promote higher quality inspections (two sets of eyes are better than one). Each team is assigned inspection responsibility for a specific territory within the state, established to provide an equitable number of bridges balanced with travel demands for optimum efficiency. Bridge inspection territories (turf) are adjusted periodically and inspector teams may be shuffled or reconfigured as needed to maintain this balance. A “Bridge Inspection Regions” map depicting the bridge inspection team turf assignments with contact information for all members of the Existing Bridge Section is available in Appendix B for reference. Occasionally, bridge inspection teams will assist each other to resolve scheduling crunches and maintain compliance with required inspection intervals. Other times, the Chief Bridge Inspector is available to inspect bridges solo or fill in for an absent inspector when a two man inspection team is essential.

**3.1.2 Planning and Scheduling**

Inspection work, for the most part, is done during the warmer months of the year when bridge elements are not obscured by snow banks and snow pack, usually mid-March through early December and is loosely referred to as the “inspection season”. Winter weather is not conducive to thorough inspections or to maintaining a dependable inspection frequency for maintaining compliance with the NBIS. Special circumstances such as bridge hit collisions, late construction wrap-up, or special requests may require inspections outside of this seasonal window.

Winter work for the bridge inspectors is performed at various indoor facilities throughout the state as assigned. Currently the inspections teams utilize NHDOT Highway Maintenance District facilities in Twin Mountain (A-Team), New Hampton (B and C-Teams), and Durham (D-Team). The primary responsibilities for the bridge inspectors during the winter slowdown are to:

- Finalize entry of inspection data from the previous inspection season;

- Establish and coordinate scheduling of anticipated inspection activities and necessary equipment for the upcoming inspection season; and
- Engage in training and professional development activities (e.g. Bridge Inspection Refresher Training).

Underwater Diving, Fracture Critical Member (FCM), and In-Depth inspections (see Chapter 5 for detailed discussion) require careful planning and coordination among the inspection teams to share the limited specialized inspection equipment necessary for access; for example, the spider staging available through the Bureau of Bridge Maintenance and Under-Bridge Inspection Vehicle (UBIV/snooper) maintained and operated by the Bureau of Mechanical Services. The engineering staff of the Existing Bridge Section and the Chief Bridge Inspector will coordinate with the consultant divers to schedule the underwater diving inspections due in the coming year. The primary goal for all the planning and preparation is to achieve compliance with the inspection intervals stipulated by the NBIS and occasionally more restrictive self-imposed NHDOT requirements. These are presented in Chapter 5 of this manual. The planning that takes place during the winter months is an essential component of a successful bridge inspection program.

The “Fracture Critical Bridge List”, “Scour Critical Bridge List”, and “Underwater Bridge Inspection/Dive List” are maintained and continually updated by the Chief Bridge Inspector and engineering staff to incorporate additions and removals to each list, track most recent inspection dates, and program anticipated future inspection schedules. These lists are useful for maintaining compliance with NBIS requirements for the specific non-routine inspection types (FCM, underwater, scour monitoring, etc.).

The inspection teams are responsible for managing their own respective lists of bridges requiring the use of the UBIV/snooper or spider staging for In-Depth inspections (not an explicit requirement of the NBIS).

### **3.1.3 Document Review**

The inspectors’ familiarity with the bridges in their assigned region is important institutional knowledge that promotes efficiency and consistency in the inspection planning process. Periodically, it may be necessary for the inspectors to contact the engineers in the office to review available bridge plans (many are available electronically). The engineers can help assess the significance of deficiencies in regard to the overall bridge condition and provide technical guidance to help the inspectors understand the significance of their field observations. Generally, however, bridge inspectors will not need immediate access to bridge plans to conduct their inspections in an effective manner.

Review of the data entered in the BMS and photographs can offer considerable insight into how a bridge is aging by tracking major deficiencies, problem areas, repairs and

maintenance operations, and bridge collision damage noted during previous inspection events. A thorough review of the last inspection report not only gives the inspector a "feel" for the bridge, but helps to ensure completeness of the inspection and consistency in the evaluation structure condition.

### **3.1.4 Inspection Tools and Equipment**

Each team performing general bridge inspections must have proper tools available at the site. Additional equipment may be required and should be available on an as-needed basis. All tools must satisfy OSHA requirements.

Several factors play a role in what type of equipment is needed for an inspection; bridge location, bridge type, and type of inspection to be performed are the primary factors in determining equipment needs.

Each team should be equipped with the following:

- Work-zone protection and traffic control equipment, including signs, traffic cones and flags;
- Personal safety equipment including first-aid kit, hard hats, vests, goggles, face shields, full body harnesses, and lanyards Personal protective equipment such as rain suits, work gloves, rubber boots, etc;
- Basic access equipment such as a step ladder, rope, chest and/or hip waders;
- Tools for cleaning, including a whisk broom, wire brush, scraper, shovel and broom;
- Tools for inspection, including chipping hammers, small sledge hammers, ball peen hammers, screwdrivers or awls, increment borer, magnifying glass, binoculars, flashlights, mirrors, tool belt, etc.
- Tools for measuring, such as measuring tapes, a plumb bob, protractor, levels, rulers, calipers, ultrasonic thickness gauge (UT gauge/D-meter), crack size gauge, scour probing rods, vertical clearance rod, weighted sounding lines, thermometer, laser distance measuring device, tilt meter, etc.
- Tools for documentation, such as a digital camera, triangles, straight edges, magnetic compass, standard inspection forms, sketch paper, laptop computer with necessary software (e.g. BrM, BIPR, Microsoft Office), etc.
- NHDOT supplied cell phone and emergency contacts list;
- Consumable supplies, including lumber crayons, chalk, camera batteries, disposable dust/nuisance respirators, etc.

Each team has access to the following equipment as-needed:

- Inspection vehicle with extendable bucket lift (assigned to the D Team);
- Under Bridge Inspection Vehicle (i.e. snooper or Servi-lift),

- Equipment for working over water, such as personal flotation devices, ring buoys with attached line, inner tubes, and a non-motorized rowboat (Jon boat); and
- Dye-penetrant test kits for non-destructive crack detection in steel members

Each inspection team shall be equipped with the following reference materials:

- NHDOT *Bridge Inspection Manual*\*
- FHWA *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges* (Coding Guide).
- FHWA *Bridge Inspector's Reference Manual* (BIRM)\*
- AASHTO *Manual for Bridge Element Inspection* (most recent version)
- NHDOT *Scour Evaluation and Plan of Action Manual* (5 volumes)\*
- FHWA *Manual on Uniform Traffic Control Devices for Streets and Highways* (MUTCD)\*
- NHDOT Scour Critical Bridge List (Available using the “*Scour Critical Bridges*” filter in BrM)\*
- NHDOT Fracture Critical Bridge List (Available using the “*Fracture Critical Bridges*” filter in BrM)\*
- Fracture Critical Member (FCM) Identification sheets\*
- Sheets for recording drop line readings at scour critical bridges\*
- Spider Staging Inspection List (specific to each inspection region)
- NHDOT Aerial Lift (UBIV) Inspection List (specific to each inspection region)

These documents shall be available for reference in the field. References appended with an asterisk (\*) are stored electronically on the inspector field laptops. FCM ID sheets and Scour Critical Plans of Action are available through the BIPR program for bridges classified as Fracture Critical and Scour Critical, as appropriate.

### **3.1.5 Maintenance and Protection of Traffic**

From time to time, in order to properly conduct an inspection it may be necessary to implement temporary shoulder and/or lane closures on a roadway to gain access to targeted bridge components with a UBIV, van mounted lift, man lift, etc. The traffic control sign package layout utilized for this purpose shall be in conformance with the current edition of the *Manual for Uniform Traffic Control Devices (MUTCD)*.

Generally, it is the responsibility of each inspection team to coordinate with the relevant entities to coordinate traffic control. Standard practice is to utilize personnel from the appropriate Highway Maintenance District or, occasionally, Bridge Maintenance to serve as flaggers for traffic control on moderate volume low speed highways. On higher volume roadways, such as Interstate Highways and arterials, implementing a lane closure

for the snooper requires State Police presence with vehicles and flashing lights. Lane closure on limited access high speed roadways will also typically require the deployment of temporary impact attenuators (generally truck-mounted attenuators). Securing personnel for traffic control when inspecting municipally owned bridges should be coordinated with the municipality. Many of the NH cities require the use of local law enforcement for traffic control, while others are willing to lend the use of their own Public Works employees.

### **3.1.6 Bridges Under Construction**

NHDOT inspectors shall exercise caution when visiting a bridge which is currently under construction so as not to place themselves in dangerous situations and/or inhibit the activities of the contractor. For bridges that are completely closed to traffic, the inspectors create a new inspection event in the BMS and indicate “Construction Work in Progress” or (i.e. CWIP) in the “Inspection Notes” section, and representative photographs showing construction activity should be taken for the inspection file. For bridges which continue to carry traffic during a reconstruction project, the portion of the bridge carrying traffic should be inspected in accordance with NBIS requirements as much as practicable. For an existing bridge that is to be replaced with a new bridge on an altered roadway alignment, the existing bridge is to be inspected in accordance with the NBIS as long as it remains in service and open to traffic. When a temporary bridge is used during construction, the inspectors need to conduct an NBIS inspection of the temporary structure and update the inventory data as applicable in accordance with the Coding Guide (refer to discussion explanation for NBI Item 103). In certain cases, the scope of an inspection during active construction conditions may be limited due to access constraints. These restricted circumstances should be clearly documented in the event FHWA requires explanation for a delayed inspection, particularly regarding Fracture Critical Member and Underwater Diving inspections.

While a bridge is under construction, the contractor assumes responsibility for ensuring safety within the construction work zone, including responsibility for the safety of the bridge. In situations where it is necessary to inspect a bridge during active construction, the Existing Bridge Section office staff will coordinate with the NHDOT Contract Administrator and the contractor to establish a scope, schedule, and necessary safety requirements to accommodate the proposed inspection activities. Appropriate language should be provided in the construction contract stipulating the requirements for bridge inspection activities, and further indicate whether the bridge owner or contractor bears responsibility for conducting bridge inspections for the duration of the project.

The use of a temporary bridge to carry traffic during construction warrants extra consideration. In these situations, NBI Item 103 should be coded as “Temporary (“T”) in the BMS and other affected NBI items coded accordingly per the discussion provided in the *FHWA Coding Guide* for Item 103.

## 3.2 Inspections by Consultants

### 3.2.1 Document Review

The first step in preparing for a bridge inspection is to review the available information contained in the bridge inspection files and any available plans on file (scanned copies on the server or paper copies stored in the NHDOT Plan File tubs), such as:

- Original bridge plans and shop drawings, where available (As-Built plans preferred)
- Bridge rehabilitation plans
- Previous inspection reports including underwater inspection reports and in-depth inspection reports from consultants
- Bureau of Bridge Maintenance repair and maintenance records
- Correspondence located in the bridge inspection folder
- Inspection photos in the bridge inspection folder
- Scour Critical Plan of Action as applicable
- Fracture Critical Member (FCM) Identification sheets as applicable

#### 3.2.1.1 Plans

Bridge plans contain information such as material specifications, design material strengths, design loads, structural framing, geometric information, and may possibly indicate intended construction methods. Member types and sizes, connection details, intended bearing details or deck joint configurations, and selected foundation type(s) are all useful pieces of information, all of which should be available on the plans. The inspector should be able to recognize and question details in the field which disagree with the information shown on the plans. The Existing Bridge Section will assist consultants in obtaining any and all available plans for bridges to be inspected as part of the scoping effort early in the process. In most cases, scanned or electronic plans are already available, or plans can be pulled from the plan file tubs at the John O. Morton building in Concord.

#### 3.2.1.2 Previous Inspection Reports

Previous inspection reports make the inspector aware of previously identified areas of concern at the bridge. Additionally, previous inspection reports also provide a standard with which to gauge the progress of any previously noted deficiencies and provide a general sense of how the structural condition is changing over time. Special equipment or access requirements necessary to complete the inspection should be indicated in the "Structure Notes" of inspection reports. Overall, a thorough review of the most recent inspection report (and possible review of earlier reports) not only gives the inspector a "feel" for the bridge, but helps to ensure completeness in the planned inspection effort

and consistency in the evaluation ratings.

### 3.2.1.3 Bridge Maintenance and Repair Records/Correspondence

Maintenance and repair records provide the inspector with information of any repairs requested or repairs performed. While performing a bridge inspection, the team leader and inspector(s) should evaluate the completeness and quality of any repair work conducted.

## 3.2.2 Pre-Inspection Field Review

Any and all field reviews are the responsibility of the Consultant. Field reviews may be necessary for structures subject to ever-changing conditions. Possible reasons to conduct field reviews include, but are not limited to, the following:

- Significant precipitation;
- Freeboard Height;
- Tidal waters;
- Maintenance and protection of traffic; and
- Access equipment requirements.

## 3.2.3 Necessary Inspection Equipment

Document review and field review are important considerations in the planning and scheduling process, all of which are intended to help the inspector become familiar with the bridge prior to the actual inspection. Another key consideration when planning and scheduling a bridge inspection is determination of the requisite inspection equipment and access requirements. The following items should be considered:

- Will traffic control be required to manage the work zone? If so, does the Department have a pre-approved Traffic Control Plan (TCP)? Consultants should follow any requirements from a pre-approved TCP. If one is not available or deemed unsuitable, will a proposed TCP be submitted to the Department with sufficient time for approval?
- Does a formalized Traffic Management Plan (TMP) need to be implemented due to significant impacts imposed on the traveling public? If so, the Department's *Guidelines for Implementation of the Work Zone Safety and Mobility Policy* should be consulted.
- Traffic control measures to be instituted as part of the TCP and/or TMP shall be coordinated with the Consultant Design Chief in the Bureau of Bridge Design as stipulated in Section 2.6 and in accordance with the applicable project scope and Prosecution of Work. Some issues to consider include requirements for highway



flaggers, railroad flaggers, use of uniformed officers with patrol cars, impact attenuators, extent and duration of lane closures, total bridge closure, etc.

- Will access to any locked or gated areas be required? Is it necessary to obtain security clearance (e.g. NH Port Authority in Portsmouth)?
- Will the inspection utilize Unmanned Aerial Systems (i.e. drones)? Does the operator have the required licensure/certification? What restrictions pertain to use of a UAS at the inspection site(s)?
- Does the structure contain hatches (box beams), fenced in areas, machinery rooms (moveable bridges), or other areas where a key or special access requirements exist to inspect the structural or mechanical elements? Will “lock out/tag out” procedures be necessary?
- Will special equipment such as a bucket truck, man lift, under bridge inspection vehicle (UBIV), scaffolding, rigging, or boats be required for the inspection? If so, what size of equipment will be required? Have the appropriate entities been contacted for this request with sufficient advance notice? Bridges subject to weight limit postings require structural evaluation in coordination with the Existing Bridge Section engineering staff prior to placing heavy inspection vehicles on the bridge.

### 3.3 Weather and Environmental Considerations

Proper planning and scheduling of bridge inspections must also consider the weather. Inspections that are performed during adverse or uncomfortable weather conditions may lead to heightened safety risks, loss of efficiency, increased time in the field, a rushed or hastened inspection resulting in a poor quality effort.

Seasonal problematic weather conditions include the inspection of large, open structures over water during the middle of winter. Though NHDOT inspectors do not routinely perform bridge inspections during the winter, Consultants occasionally schedule inspections during this time with prior approval from the Bureau of Bridge Design. This geography-weather combination often produces cold temperatures that negatively impact inspection personnel and may also inhibit climbing, while potential snow/ice conditions may preclude traffic control operations. Conversely, inspecting box beam or box girder members, where the interior must be accessed during hot summer months, should be avoided, as the temperatures inside these members can easily reach unhealthy levels.

When confined space entry is required as part of an inspection, the consultant shall submit a “Confined Space Inspection Plan”. This plan should describe the bridge elements requiring confined space entry, provide a general hazard analysis, identify intended entrance and exit points, safety measures to be followed, and list relevant

appropriate emergency response contact information. The team leader and any inspectors entering identified confined spaces are required to have attended an approved confined space entry training course.

### **3.4 Entry on Private on Private Property**

Entry onto private property for the purpose of inspecting bridges and structures should not, for the most part, be required. Inspectors should, however, understand the rights of property owners and the restrictions pertaining to entry of private property. Inspectors may politely discuss the issue with affected property owner and request permission to enter their property for the purposes of conducting a bridge inspection. In all cases, the wishes of the property owner must be respected.

### **3.5 Media/Public Relations**

The Department employs a Public Information Officer whose responsibilities include communicating and interacting with the media and other interested public agencies and/or parties. Consultants and staff in the field should engage with the public and/or media in a courteous manner. Any questions that arise during the course of an inspection should be referred to the Chief of the Existing Bridge Section. It will be the responsibility of the Chief to deal with information requests and refer questions to higher ranking individuals within NHDOT or the Department's Public Information Officer as necessary.

### **3.6 Inspection Timelines**

#### **3.6.1 Bridge Inspection Intervals**

The Department adheres to the inspection interval requirements for public highway bridges as set forth in the NBIS. Refer to Chapter 5 for more detailed discussion on the types of inspection activities performed on bridges within the state, their respective inspection frequencies, and the procedures to be followed.

#### **3.6.2 Decreased Bridge Inspection Interval**

The Department chooses to inspect bridges of concern on a reduced inspection interval (more restrictive than required by the NBIS). The Department's "Red List" bridges require interim inspections due to one or major structural elements identified as being in poor condition (i.e. deck, superstructure, substructure, or culvert condition rating of 4 or less) or posted weight limits. Refer to Chapter 5 for more information regarding Red List bridge inspections.

### **3.6.3 Increased Bridge Inspection Interval**

In specific situations, the NBIS inspection frequencies and requirements may be too stringent for some structures, particularly newly constructed bridges. Using good engineering judgment, the Department may seek approval from FHWA to lengthen the required inspection interval (decreased inspection frequency) for specific structures, by submitting a written request explaining the rationale for the recommendation(s). The Department, at present, does not currently pursue approval to increase the required inspection intervals for any structures in the bridge inventory.

### **3.6.4 Inspection Data Review Timeframes**

Inspection data from the field should be reviewed and the finalized inspection reports produced within ninety (90) days from the date of inspection for all State-owned (e.g. NHDOT, Turnpikes Bureau, NHDRED, NHDES) federal-definition bridges, and within 180 days for all federal-definition bridges owned by other entities (e.g. municipalities, village districts, counties, railroads, etc.) in accordance with the NBIS. The Existing Bridge Section strives to adhere to these same review and processing timeframes for State-definition bridges. These “State-definition” bridges are not reported to the NBI; therefore strict adherence to the processing timelines is not mandatory for these structures. Review of inspection data for Federal-definition bridges shall be given higher priority.

### **3.6.5 Overhead Sign Support Structure (OHSS) Inspections**

The Department has not adopted an official inspection interval for OHSS routine inspections. Inspection of overhead sign structures is the responsibility of bridge inspectors when the sign structure is mounted on the bridge. Otherwise, inspection of these structures falls under the purview of the NHDOT Bureau of Traffic. Inspectors should refer to procedures and guidance presented in the FHWA *Guidelines for the Installation, Inspection, Maintenance and Repair of Structural Supports for highway Signs, Luminaries, and Traffic Signals* and the State of New York Department of Transportation *Overhead Sign Structure Inventory and Inspection Manual*.

## **3.7 Critical Finding Procedures**

Critical findings are structural or safety-related deficiencies requiring immediate follow-up action. These situations often require installation of missing weight limit posting signs, reducing a weight limit posting (i.e. “down-posting”), implementing a traffic restriction, or complete bridge closure in order to ensure the safety of the traveling public. Some examples of critical deficiencies include:

- Signs of obvious distress (significant impact damage) in primary members where the

members may not be capable of safely carrying the imposed loads, and partial or total failure of the bridge is a possibility;

- Existing cracks in primary steel members that have propagated since the last inspection or newly developed cracks located at fatigue sensitive locations and/or tensile areas;
- Suspected cracks or heavy section losses on fracture critical members;
- Significant section loss and/or cracking in primary load carrying members that would result in load restriction if not corrected;
- Hole(s) through the bridge deck and/or sidewalk where the size and location of the hole(s) pose an immediate safety hazard to the public (potholes not considered critical);
- Significant loss of bearing support that warrants immediate attention;
- Major distortion/bowing/buckling/crippling of primary steel members;
- Obvious sagging or unusual deflection of any primary members;
- Signs missing from either roadway approach to a bridge indicating a load posting restriction (Applies to tonnage postings only- 'E-' and 'C-' series legal load posting signs are not considered critical findings but still require corrective action);
- Loose items such concrete deck soffit delaminations over traffic or loose masonry facing on wingwalls and copings that pose an immediate falling hazard to the public;
- Significant undermining and/or scouring of a substructure which could cause the substructure unit to become unstable leading to collapse of a portion of the bridge;
- Major damage or deterioration rendering the bridge barrier system ineffective or hazardous to public safety;
- NBI condition rating lowered to 3 or less for any of Item 58 (Deck), 59 (Superstructure), 60 (Substructure), or 62 (Culvert);
- Loose expansion joint components that pose an immediate safety hazard (e.g. steel joint armor sticking up from plow damage);
- Temporary structural support systems that do not appear to be functioning for their intended purpose; or
- Any situation where the structural integrity and/or stability of the bridge is such that the safety of motorists, bicyclists, or pedestrians is jeopardized.

### **3.7.1 Reporting a Deficiency**

The individual (NHDOT bridge inspector or Consultant inspector) who discovers a critical deficiency shall:

- Report the finding immediately to the Chief Bridge Inspector and/or the Existing Bridge Section Engineers. Generally, a phone call is the most effective method. Pertinent information to make note of includes the bridge ID (Town & bridge number), road name/route number, feature(s) crossed, structure type, nature and extent of the defect or hazard, location of the deficiency on the structure, and urgency of the situation. The Bureau of Bridge Design can be reached by dialing (603) 271-2731.
- Assist the Existing Bridge Section personnel as needed to determine an appropriate course of action.
- NHDOT bridge inspectors are permitted to block the roadway using their inspection vehicles when sound judgment indicates immediate closure of a bridge is necessary to protect the public from an extreme hazard, such as an imminent collapse. The inspector are further advised to set up warning signs/devices to alert oncoming vehicles to the obstruction ahead if possible.
- Complete the collection and recording of field inspection data, take appropriate photographs and/or create sketches of the deficiency(ies) responsible for the critical finding.
- Submit the information to the Existing Bridge Section within 24 hours, preferably the same day. It is advisable for the southern NHDOT inspection teams, who are close to Concord (B, C, & D), to travel directly to the John O. Morton Building to transfer inspection data as soon as possible. Since the A Team territory covers the northernmost part of the state where many locations are more than 2 hours away from Concord, it may make more sense to transfer their inspection data electronically via email.

### **3.7.2 State-Owned Bridge Critical Finding Procedures**

For critical findings on State-owned bridges, the *Existing Bridge Section* shall:

- Take action to ensure safety of the traveling public;
- Determine an appropriate course of action which may include bridge closure, a traffic restriction, updating the load rating to determine any posting requirements, and/or coordinating with Bridge Maintenance to repair the bridge;

- Coordinate with the Bureau of Traffic to replace missing load posting signs, or to institute a lower posting if a revised load rating indicates the need for a reduced posting;
- Discuss needed repairs or other corrective actions for the subject bridge with the Bridge Maintenance Engineer and/or Assistant Bridge Maintenance Engineer (BOBM). The discussion shall establish a required timeline for completing the repairs considering the severity of the deterioration, impact on the traveling public from reduced or impaired serviceability, and safety risks posed to users if the bridge remains open while awaiting repairs. In most cases this is easily handled with a face-to-face meeting given the proximity of the Existing Bridge Section and the Bureau of Bridge Maintenance in the John Morton Building;
- Following the discussion, summarize the specific deficiencies to be addressed, proposed repair measures, priority of the repairs, and the agreed upon timeline in an email addressed to all concerned parties in both bureaus (and possibly other bureaus). This email shall serve as documentation and as an official tracking mechanism for the critical finding;
- Coordinate with NHDOT District Engineers, the Bureau of Traffic, the NHDOT Transportation Management Center (TMC), the NH State Police, or others as necessary to provide safe traffic control operations and disseminate information to the public when implementing full or partial roadway closure on a major highway bridge, such as an interstate or other major arterial subject to high-speed traffic and/or significant traffic volume;
- Keep the FHWA Division Bridge Engineer (DBE) apprised of critical findings throughout the process as they are discovered, managed, and resolved. CC'ing the DBE on all correspondence related to critical finding is acceptable notification.

The *Bridge Maintenance Engineer* shall:

- Inform the Existing Bridge Section via email or through Inter-Department Mail when repairs have been completed to resolve the critical finding. A follow-up bridge inspection will usually be conducted following completion of significant repairs to update the NBI condition rating(s) accordingly and close out the critical finding.

### **3.7.3 Municipality-Owned Bridge Critical Finding Procedures**

For critical findings on municipality-owned bridges, the *Existing Bridge Section* shall:

- Take action to ensure safety of the traveling public.
- Determine an appropriate course of action which may include updating the load rating to determine any load posting requirements, implementing a bridge closure or traffic restriction, and/or conduct a preliminary assessment of viable repair alternatives worthy of suggestion.
- Prepare a “*Critical Deficiency Memorandum*” or “*Bridge Deficiency Memorandum*” and send with supporting information (pictures, load rating calculations, etc.), to the Municipal Highways Engineer in the Bureau of Planning and Community Assistance.
- Assist the Municipal Highways Engineer, as needed, during the coordination process with municipalities.
- Assume responsibility to determine when the critical deficiency has been satisfactorily resolved.
- Keep the FHWA Division Bridge Engineer (DBE) apprised of critical findings throughout the process as they are discovered, managed, and resolved. CC’ing the DBE on all correspondence related to critical finding is acceptable notification.

The *Municipal Highways Engineer* shall:

- Send a letter to the bridge owner(s) along with supporting information, that informs them of the critical deficiency and any actions that must be taken to address the deficiency (e.g. reduced lost posting, bridge closure with barricades, traffic lane restriction, etc.).
- Follow-up with the bridge owner after 30, 60, and 90 days to confirm whether actions suggested by the Department have been completed.
- Inform the Existing Bridge Section via email or through Inter-Department Mail of corrective measures which have been implemented and seek concurrence from the Existing Bridge Section that the critical finding has been resolved in a satisfactory manner. A follow-up bridge inspection will usually be conducted during the following Red List inspection window or as an interim inspection for circumstances warranting greater concern, such as structural repairs.

**SPECIAL NOTE:** when a bridge closure is deemed necessary, **sufficient immovable barriers** shall be put in place to guarantee traffic will not be allowed on the bridge. Satisfactory immovable barriers include, but are not necessarily limited to, portable concrete barriers (i.e. jersey barriers), concrete waste blocks, locked gates and/or bars, appropriately sized earth or stone berms, etc.

**Critical deficiencies discovered outside of normal working hours, when the Bureau of Bridge Design is not staffed, shall be reported to the Transportation Management Center (TMC) in Concord at (603)-271-68627.**

### **3.8 Structure Number Assignment**

The Existing Bridge Section is responsible for assigning structure numbers for all bridges in New Hampshire. Bridge numbers are assigned using 11”x17” town maps created in 1961 and stored in a binder within the Existing Bridge Section. Each town map is scaled and rotated such that it fits within the page borders regardless of compass direction. Generally, the towns are scaled at a 1:62,500 ratio. The map “axes” are incremented uniformly and labeled 0 to 310 along the long edge and 0 to 210 along the short edge. The respective grid coordinates corresponding to the bridge location are combined into the bridge number (long edge ### / short edge ###). An official NH bridge ID consists of the town name separated from the bridge number by two (2) spaces (Town XXX/XXX).

Assignment of bridge numbers is a somewhat informal procedure and may be requested by any individual involved with a bridge project. Engineers with the Bureau of Bridge Design will generally request new bridge numbers for in-house and consultant based bridge projects on state-owned bridges. For municipal bridges, outside parties, most often consultant engineers, will make a request for a bridge number. This request may be made through a point of contact within the Bureau of Planning and Community Assistance or through direct contact with the Existing Bridge Section. It is also not uncommon for NHDOT bridge inspectors to stumbled upon new bridge structures unexpectedly, at which time a bridge number is assigned to allow the new bridge to be inventoried and added to the Bridge Management System.



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4.1 Purpose and Scope of a QC/QA Plan

NHDOT’s Quality Control and Quality Assurance Plan (QC/QA) for the bridge inspection program provides a systematic approach to maintain accuracy and consistency of bridge inspections and bridge inspection reporting and to evaluate program effectiveness, uniformity, and compliance with federal and state regulations relating to bridge inspections and load ratings. The goal of this QC/QA Plan is to continuously improve the quality of the bridge inspection process. These procedures will assist the State in implementing bridge asset management strategies to prioritize maintenance, preservation, repair, rehabilitation, and replacement strategies.

The Existing Bridge Section engineering staff and the Chief Bridge Inspector are collectively responsible for implementing the QC/QA Program, characterized by significant amount of overlap with regard to maintaining and monitoring staff qualifications, performing checks of the inspection data brought in from the field, and conducting field reviews of inspection activities in progress. Responsibility for the

QC/QA process as it pertains to bridge load ratings is assigned to the Load Rating Engineer. The QC/QA Program shall remain flexible and will be updated routinely per instruction provided by Chief of the Existing Bridge Section and guidance from FHWA

## 4.2 Quality Control (QC) Procedures

Quality Control (QC) is defined as procedures that are intended to maintain the quality of a bridge inspection and load rating at or above a specified level. Simply put, QC is a system of routine technical activities to measure and control the quality of the bridge inventory data and as it is being developed.

QC procedures utilized as part of the bridge inspection program include:

1. Maintaining an up-to-date record of bridge inspection staff qualifications and certifications, and training.
2. Ensuring bridge inspectors receive basic training in bridge inspection techniques (i.e. FHWA approved 2-week course) and providing additional opportunities for specialized training to enhance inspector competency (e.g. Fracture Critical Inspection Techniques, Scour Evaluation, Non-Destructive Evaluation (NDE) methods).
3. Provide bridge inspectors with access to latest applicable standards, training opportunities for proper use of specialized inspection equipment, and safety-related training.
4. Providing training opportunities for engineering staff to ensure competency in bridge inspection methods and techniques, NBIS reporting requirements, and expertise in bridge design and bridge load rating.
5. Overseeing QC of field inspection operations through periodic visits to observe bridge inspections actively in progress with subsequent follow-up with the inspectors to address any noted problems.
6. Ensuring QC procedures are being followed by office staff to check and validate the bridge inspection field data and to resolve detected issues prior to acceptance and sharing with parties outside of the Existing Bridge Section.
7. Implementing controls to limit who can access and modify data contained in the Bridge Management System.
8. Reviewing bridge files for completeness and accuracy.
9. Conducting an annual meeting with all eight (8) NHDOT bridge inspectors to provide an open forum for disseminating information regarding new Department initiatives, changes in policy, corrective actions to address persistent errors and mistakes, implementation of new software and software features.

10. Implement a repeatable and adaptable QA program to ensure consistency among bridge inspection activities and associated documentation statewide.
11. Ensure QC is performed on all load ratings to promote consistency and accuracy in the load rating process.

The NHDOT QC procedures for the bridge inspection program include the maintenance of staff training and certifications, field inspection review, checking inspection data and load ratings for accuracy, review of bridge inspection files, and conducting an annual meeting with the entire group bridge inspectors provide a forum in which information can be exchanged regarding new initiatives and processes, corrective action for persistent errors, updated inspection protocols or procedures, etc.

#### **4.2.1 Staff Qualifications and Training**

All personnel in the Existing Bridge Section are required to meet the minimum qualifications specific to the employee's assigned position. As previously discussed in Chapter 2, these qualifications are detailed in the Supplemental Job Description and Class Specifications for each position and are available from the NH Department of Administrative Services Human Resources Division upon request. Furthermore, the Program Manager, Load Rating Engineer, and Team Leaders shall all meet the minimum qualifications as set forth in the NBIS.

The Department requires that the Program Manager, Chief Bridge Inspector, all NHDOT in-house bridge inspectors, and consultant inspection Team Leaders shall periodically attend FHWA approved bridge inspection refresher training on a five (5) year maximum interval. The Department further *strives* for the Existing Bridge Section engineering staff to attend FHWA approved bridge inspection refresher training on the same five (5) year interval, subject to availability of funding and proximity of course offerings. Refresher training is only required for the bridge inspection Program Manager.

Consultants are required to submit comprehensive documentation of personnel qualifications with their proposal as part of the consultant selection process. This documentation shall consist of, but is not limited to, the following:

1. A listing of key personnel currently on staff that will conduct the bridge inspection.
2. Resumes of proposed key personnel.
3. Applicable documentation verifying compliance with required staff qualifications per the NBIS and any additional requirements detailed in the scope of work (e.g. NH P.E. license, specific inspection course certifications, etc.)

#### **4.2.2 Field Inspection QC Procedures**

The designated Team Leader is responsible for QC while conducting an inspection and include the following duties:

1. Ensuring the inspection vehicle includes all required inspection tools and equipment, and applicable manuals and references.
2. Adhering to proper safety procedures and implementing appropriate traffic control procedures in accordance with the requirements of this manual and other applicable references (e.g. MUTCD, BIRM)
3. Proper updating of the BMS installed on the inspection field laptops to record observed field conditions with clear, legible and complete notes and proper coding of NBI Items.
4. Taking photographs paired with appropriate captions or generating sketches with sufficient detail to convey the extent and severity of deficient areas in accordance with this manual.
5. Periodically transferring photos from the inspection camera into the appropriate folder location on the inspection field laptops and entering photo captions in the “pic list” Access database (applies to NHDOT inspectors only).
6. Cleaning of deteriorated steel sections and measurement of remaining section or losses for load rating updates. Discussion with one of the office engineers may be necessary to discern which areas of section loss are of concern.
7. Sounding of concrete structures to locate delaminations.
8. Proper reporting of structural and safety-related deficiencies (see Section 3.7 for Critical Finding Reporting Procedures).
9. Ensuring all fracture critical members shown on Fracture Critical Member ID sheets (as appropriate) receive an arm’s length visual inspection.
10. Inspection of fatigue-prone details identified on the structure for cracks.
11. Recording drop line channel measurements at all bridges designated Scour Critical.

12. Documentation of access methods used and/or required for inspection.
13. Contacting the Existing Bridge Section to report additions to and removals from the “Red List”(see Section 3.1.6.2)
14. Indicate in the “Critical Deficiency Note” when a an engineer should review the need for an updated load rating (e.g. when condition is reduced to “poor” (4 or less), new bridge installed, or significant repair measures are installed)

### **4.2.3 Field Review of Inspection Teams**

The inspection activities of each in-house Team Leader will be reviewed in the field by the Chief Bridge Inspector at least twice yearly. In some situations, more frequent review may be needed to appropriately address areas of special concern. Engineering staff of the Existing Bridge Section may also conduct these reviews as needed.

The field review shall be conducted in sufficient detail and duration to enable the Chief Bridge Inspector to determine whether the field inspections are being conducted and documented in full accordance with NHDOT policies and procedures and NBIS requirements. A *Team Leader Evaluation Form* (provided in Appendix C) shall be completed by the evaluator as part of each field review. Additionally, other aspects of the bridge inspection operation not specifically itemized on the form may also be evaluated.

Deviations from standard inspection policies or practices shall be clearly stated in the "General Comments and Findings" section of the evaluation form. Additionally, positive attributes observed during inspection should also be documented. At times it may be appropriate to develop an improvement plan, with the concurrence of the Bridge Inspection Engineer, to address deficiencies identified during the field review. The plan should clearly identify corrective measures to implemented, proposed timelines for each, and follow-up actions as appropriate. Improvement plans shall be kept on file with the Team Leader Evaluation. The findings of each evaluation shall be discussed with the inspection Team Leader listed in the report and with the Bridge Inspection Engineer.

### **4.2.4 Office Review of Inspection Data and Bridge Files**

#### *4.2.4.1 BMS Inspection Data and Inspection Reports*

Periodically the entire BMS database stored locally on each inspection team’s laptop computer is downloaded by the Chief Bridge Inspector and transferred into the “Active\_BL” database (i.e. Active Backlog) for review by Existing Bridge Section office personnel. The inspection photos and corresponding “pic list” from each laptop are also downloaded and transferred into the BIPR program. The new inspection events in the Active Backlog are checked for completeness and accuracy by the Existing Bridge Section engineers or by the Chief Bridge Inspector prior to being transferred into the “BrM\_Master” database, at which time the data is accessible to entities outside of the

Existing Bridge Section.

The office review of incoming inspection data includes cross referencing information entered by the inspectors in the “Structure Notes” and “Inspection Notes” fields, and verifying correct and consistent interpretation of NBI items and element level data in conformance with the FHWA Coding Guide, the BIRM, and the AASHTO *Manual for Bridge Element Inspection*. The Sufficiency Rating is recomputed for each record under review along with performing a Validation check on the data. These checks are particularly useful at identifying data changes since the previous inspection, and resolving finding and resolving data entries which are incompatible with one another or in the wrong format. Furthermore, an automated script is run on the incoming inspection data to correct common instances of data miscoding and to broadly apply rule-based criteria, commonly referred to as “conditioning” of the data. This oversight is crucial to ensuring the integrity of the bridge inventory data, since most data discrepancies can be detected by a reviewer and resolved prior to becoming incorporated into the Master bridge database (BrM\_Master).

Generally the inventory roadway data and bridge geometric data do not change between inspection events, unless the bridge was replaced or a rehabilitation project was carried out such as brush curb and rail replacement, bridge widening, sidewalk or median removal/addition, roadway repaving, or significant repairs were implemented. Given their inherent connection to public safety, the following BMS data fields should be scrutinized during *each and every* office review (NBI Items are defined in the Coding Guide):

- Within the **Condition** task:
  - 1) Major element condition ratings captured in NBI Items 58-62
  - 2) Defect flags assigned in the AASHTO Bridge Elements Table
- Within the **Appraisal** task:
  - 1) NBI Items 41 and 70 relative to open/posted/closed status
  - 2) NBI Items 53, 54a, and 54b for vertical clearance
  - 3) NBI Item 113 – Scour Critical Status
- Within the **Inventory** task:
  - 1) NBI Item 112 – Structure Classification
  - 2) NBI Item 103 - Temporary Structure designation
  - 3) NBI Items 10 and 47 - Vertical and Horizontal Clearances
- Within the **Schedule** task:
  - 1) Types of Inspections Performed
  - 2) NBI Items 92AA, 92BA, & 92CA - types of inspections required
  - 3) Corresponding inspection frequencies for required inspections
- Within the **NHDOT** task , “Inspections” page:
  - 1) Critical Deficiency Status and Remarks
  - 2) Red List Status
  - 3) Recommended Weight Limit Posting information

#### 4) Horizontal and Vertical Clearance recommendations

Some obvious discrepancies in the SI&A data are easily corrected by the reviewer without consulting the bridge inspectors; however, anytime there is uncertainty regarding the accuracy or intent of a data entry, the inspection team should be contacted using the DOT-issued cell phone assigned to that team (refer to Inspection Regions Map in Appendix B for contact info). In occasional instances, these questions can be resolved via E-mail, or a face-to-face meeting may also be necessary.

##### 4.2.4.2 *Inspection Photographs*

The person reviewing inspection data shall check that the photographs taken during field inspections are associated with the correct structure number. An automated routine exists in BIPR that is capable of correcting mistakes associated with photos that do not reference the correct structure number. Spell checking of photo descriptions is also conducted through the BIPR interface. A check is also done with each new inspection event to verify that photo numbers and associated captions are referred to in the “Inspection Notes” field of the BMS for the particular inspection event. A representative photo should be present for major elements coded a “4” or below, though updated photos are not necessarily required if there has been no discernible change in the member condition. Bridge lacking a recent photo of the approach and elevation should be identified and should have such photos captured at the time of the next inspection.

##### 4.2.4.3 *Existing Load Rating*

For bridge inspections identifying previously undocumented section losses or worsening of previously-identified deterioration of bridge members, the engineering staff of the Existing Bridge Section shall be consulted. The engineer(s) shall review any available load rating information and calculations on file to decide whether the level of deterioration considered in the calculations is representative of the actual field conditions. When it is determined that the present load rating does not adequately consider the observed section losses, the load rating shall be updated, and potential load posting shall be evaluated if necessary.

When an inspection reveals that a structure has been repaired or rehabilitated, the engineer(s) shall once again evaluate the load rating on file for that structure and update it appropriately. Investigation of load posting removal should be considered for major repairs and rehabilitations as appropriate.

##### 4.2.4.4 *Miscellaneous QC Protocols*

In addition to reviewing the inspection data brought in from the field, several other protocols and processes have been implemented to safeguard the integrity of data in the BMS. The use of assigned user roles within the BMS allows the editing and viewing permissions of all users to be restricted based on assigned user role. Existing Bridge Section Office personnel are granted unrestricted Admin privileges. Editing capabilities

assigned to the “NHDOT Inspector” role are less generous, with the inspectors “locked out” of fields deemed unnecessary for their responsibilities in the field. This feature enhances inspector productivity by targeting their focus on the BMS data fields for which they do bear responsibility to manage and update based on their observations in the field (i.e. condition ratings, geometrics). Other users are assigned security profiles with lesser degrees of editing capability. The primary goal is to reduce the incidence of erroneous modification of inventory data by restricting editing rights to those individuals who require it.

A second mechanism contributing to quality control of the bridge inventory data involves integration with the geographic information system (GIS) data managed by the NHDOT Bureau of Planning and Community Assistance. Roadway attributes such as functional class, National Base Network status, and NHS status (among others) are fed into the BMS from GIS approximately once a year to ensure our inventory data concurs with the master data set maintained by the experts in Planning.

The bridge inspection program QC efforts are further bolstered through availability of FCM ID sheets and Scour Critical Plans of Action (POA’s) in electronic format on all field-deployed inspector laptops. If a bridge is coded as either Scour Critical or Fracture Critical, the appropriate electronic documents are easily accessible within the BIPR software by clicking on the “Scour PDF” and “FC PDF” buttons. (see below)

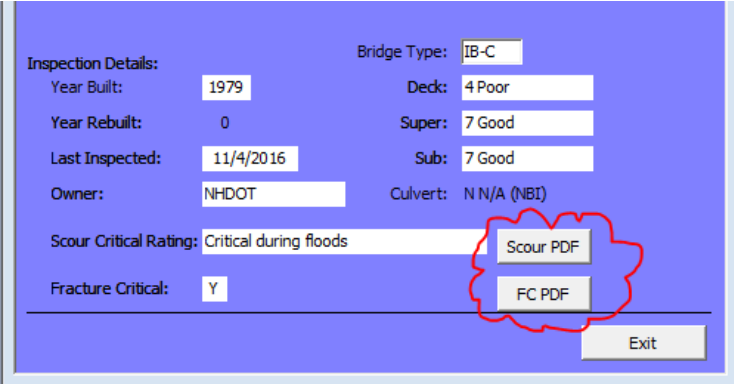


Figure 4.1: BIPR Selection Screen (Inspector Version shown)

**4.2.5 Annual Meeting with Bridge Inspectors**

Each year during the winter, while the inspectors are not conducting field inspections, an informational group meeting shall be held. The purpose of the meeting will be to brief the bridge inspectors on changes to the bridge inspection program procedures and policies, discuss any corrective measures necessary due to QC/QA findings, and provide an open forum for discussion between the inspectors and the engineering staff regarding procedural concerns, workplace safety, suggestions to improve efficiency, and other related bridge inspection topics.



#### **4.2.6 Quality Control of Bridge Load Ratings**

Bridge load ratings completed by the Existing Bridge Section are the responsibility of the Existing Bridge Section Engineers. These individuals routinely conduct load ratings upon completion of a rehabilitation or replacement project by the Bureau of Bridge Maintenance, for existing bridges in the inventory without available plans, and for structures requiring updated ratings from deterioration observed by the bridge inspectors during field inspections. Detailed checking of the calculations is handled by the individual who was not in charge of creating the calculations.

For design or rehabilitation projects handled by the Bureau of Bridge Design or by an outside consultant engineer, the design engineers involved with the project, whether done in-house or by a consultant, are responsible for performing the load rating analysis and detailed checking of the calculations.

The Load Rating Engineer (refer to Section 2.2.2) is responsible for verifying the accuracy of basic information (i.e. span length, material strengths), assessing the overall applicability of the analysis methods used, and ensuring that the load rating does not overlook important bridge elements, observed section losses, failure modes, or significant structural interactions. In general, the QC review shall address the following areas:

1. Review adequacy of inspection data, sketches, plans, and other information used as the basis for the rating calculations.
2. Review analysis procedures for conformance with NHDOT standards and appropriate design specifications. A detailed checking of calculations is not required, but key inputs such as material strength(s), member sizes, and load factors should be verified.
3. Review whether age, condition, and quality of materials have been accurately addressed in the determination of material strengths. Review the treatment of section losses or member deficiencies in the rating calculations. Assumptions should be clearly stated.
4. Determine that the controlling member(s) in the rating have been properly identified.
5. Determine that the method of analysis used produces a satisfactory result. Evaluate whether more sophisticated or more detailed analysis (e.g.: grillage model, finite element analysis) would improve the load rating.
6. Check the Form4 Bridge Capacity Summary sheet to ensure it is filled in appropriately and in conformance with NHDOT standards.
7. Evaluate whether additional measurements, materials testing, load testing, or other investigations are needed to refine the load rating.

The Load Rating Engineer shall confer with the engineer responsible for preparation of the calculations to resolve any comments regarding the load rating. Finally, the Load Rating Engineer is responsible for making sure that the BMS and BOPR reflect the updated load rating information. The Load Rating Engineer may delegate some or all of these tasks to various engineering staff within the Existing Bridge Section as he/she sees fit. Final acceptance of all load ratings is the responsibility of the Load Rating Engineer.

### 4.3 Quality Assurance (QA) Procedures

Quality Assurance (QA) is defined as the use of sampling and other measures to assure the adequacy of quality control procedures in order to verify or measure the quality level of the entire bridge inspection and load rating program. In the most basic sense, QA assures that the adequacy and effectiveness of the QC procedures are being realized. Quality Assurance is a review of the inspection data to provide the following:

1. An evaluation of how well the QC procedures are delivering consistent inspection data and;
2. Identification of where the data inconsistencies so the QC procedures can be corrected or modified

Responsibility for overseeing the Department's bridge inspection QA procedures is shared among the Existing Bridge Section office personnel, but primarily shouldered by the Chief Bridge Inspector, while QA procedures for load ratings are the exclusive responsibility of the engineers within the Existing Bridge Section.

#### 4.3.1 QA of Field Inspection Procedures and Documentation

NHDOT employs four bridge inspection teams to perform inspections complying with the NBIS. The Chief Bridge Inspector performs a formal quality assurance (QA) review of two of these inspection teams annually using the criteria described in the following sections.

##### 4.3.1.1 *Team Selection*

Two inspection teams are reviewed annually. The four teams are selected in the following 2-year cycle:

- Year 1 = Team A and Team D
- Year 2 = Team B and Team C

##### 4.3.1.2 *Bridge Selection*

Four bridges assigned to a team are selected for each review cycle, but bridges should not

be selected entirely at random. The age and overall bridge condition should be considered to avoid selecting bridges that are too new to exhibit notable deterioration. The bridges selected should include a mix of the following structures types:

1. Steel or prestressed concrete multi-beam bridge (e.g. IB-C, IB-W, PIB, NEBT)
2. Concrete slab-type bridge or culvert (e.g. CS, CTB, PVS, CRF, CB, CACUL)
3. Steel two girder bridge (e.g. TPG, DPG)
4. Corrugated metal structure (e.g. MP, MP-A, MP-B)

#### 4.3.1.3 Field Inspection Review

The bridges selected for review will be inspected independently without the knowledge of the team under review. The independent review shall be conducted within 60 calendar days following the inspection under review. The individual conducting the independent QA inspection should perform the following tasks as if he/she is performing a routine biennial NBI inspection:

- Review past inspection reports, photos, and available plans
- Verify inventory data
- Assign NBI major element condition ratings and appraisals
- Fill out element level data including defect flags and protective systems, and assign quantities to condition states
- Record section loss measurements and prepare sketches as necessary
- Verify presence or absence of required clearance signage
- Verify presence or absence of any required weight limit postings
- Take digital photographs and record relevant captions in a photo log

Following the QA inspection, the evaluator shall fill out and submit an “Independent QA Bridge Inspection Evaluation Form” to present his/her findings. Issues and concerns noted as part of the independent inspection shall be discussed, including any recommendations for corrective action as applicable. Corrective action recommendations could be targeted towards a specific inspector, inspection team, or the bridge inspection program as a whole.

Initially, the reviewer’s findings shall be discussed with either the Bridge Inspection Engineer or the Chief of the Existing Bridge Section as appropriate. Upon concurrence with one (or both) of these individuals, the results shall be discussed with the inspection team responsible for the most recent inspection of the subject bridge under consideration.

The Program Manager may make recommendations and/or changes to the above-specified procedures depending on the findings of the reviews. This may include special training on specific items, increased frequency of reviews, increased bridge sample size, issuance of clarifying memorandums or directives, or informal meetings with staff and/or

consultant inspection teams.

#### **4.3.2 Annual Bridge Tour with FHWA Division Bridge Engineer**

Each year the FHWA Division Bridge Engineer (DBE) assesses the NHDOT Bridge Inspection program for compliance with the *Metrics for the Oversight of the National Bridge Inspection Program*. A key component of this effort involves visiting a minimum of twenty (20) federal-definition bridges in the State's inventory to conduct independent field reviews, typically done in late summer or fall. This annual bridge tour is a component of Metric #12 – Quality Inspections. The finalized sample of bridges is derived from randomly-generated list of bridges (provided by the DBE) included in the most recent NBI submission. The pared down list of bridges to be field reviewed is assembled to provide overlap with other metrics being evaluated at either the Intermediate or In-Depth Assessment level for the current plan year. The list should also include bridges from each of the four bridge inspection regions and covering a variety of structure types. It is possible the Division Bridge Engineer may seek assistance from the Existing Bridge Section to narrow down the initial randomly-generated list to the final candidates.

The QA team for the annual tour generally consists of the FHWA Division Bridge Engineer, the Chief Bridge Inspector, and at least one engineer from the Existing Bridge Section to perform the following tasks:

- Verify the accuracy of NBI major element condition ratings (Items 58-60, 62)
- Verify accuracy of Channel and Channel Protection (NBI Item 61)
- Verify accuracy of coding for Approach Roadway Alignment (NBI Item 72)
- Confirm status of recommended signage and postings

The observations made at each bridge site are compared against SI&A sheets and inspection reports for consistency and accuracy. Following the annual tour of inspections, the Division Bridge Engineer incorporates his/her findings into “The National Bridge Inspection Standards Annual Program Review Summary Report” issued after the yearly review is completed.

#### **4.3.3 Load Rating QA Procedures**

The Quality Assurance Procedures for load ratings entail independent load rating calculations for a sample of bridges. For the sake of integrity, it is important that both sets of calculations not rely on the same software package when computer software is used for structural analysis.

Independent sets of load rating calculations are created by NHDOT design engineers for most in-house design projects. The two corresponding sets of results are reconciled to

arrive at an acceptable (and generally agreeable) result. Reconciliation may involve modifying assumptions, correcting errors (part of QC procedures), or adjusting analysis methodology.

Each year, the Existing Bridge Section will perform a minimum of three (3) independent load ratings, primarily targeted towards municipal bridges which have been recently constructed or reconstructed. Municipal bridge projects are designed and managed by outside parties with minimal, if any, direct oversight from NHDOT, and many of these entities lack intimate familiarity with NHDOT load rating guidelines, allowable assumptions, and procedures. Performing an independent load rating is intended to confirm the finalized load rating results following the resolution of any issues identified as part of this process. Other times consideration should also be given to performing a second independent load rating effort to verify load ratings done by consultants working on state projects, ratings by the in-house Bridge Design engineers (only when necessary), and occasionally by the Existing Bridge Section staff.

Consultants are responsible for implementing their own Quality Assurance procedures prior to submitting load ratings to the Department. Should the Load Rating Engineer decide to conduct an independent load rating to check the work of a consultant, it does not absolve the consultant of internal QA responsibilities.

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5.1 Overview

The general bridge inspection procedures outlined in the *AASHTO Manual for Bridge Evaluation (AASHTO MBE)*, the *Bridge Inspector’s Reference Manual (BIRM)*, and the *Manual for Bridge Element Inspection* are routinely utilized for bridge inspection in New Hampshire. Other publications relied upon during the bridge inspection process are presented in Section 1.5 of this manual.

The procedures outlined in this chapter are guidelines. There is a great deal of variability in structure types, construction methods, and site conditions encompassing all the bridges in the Department’s bridge inventory. Therefore, careful consideration is required in applying the guidance in this manual, since no two bridges are exactly the same. Defined procedures are useful to prevent overlooking the inspection of any particular item, but there is no substitute for good judgment and healthy curiosity.

5.2 Types of Inspection

The intensity of the inspection will vary depending on the extent of available access to the structural elements and the type of inspection required (in-depth, routine, underwater,

etc.). Some inspections will satisfy the requirements for more than one type, such as when a fracture critical inspection is conducted concurrently with an inventory inspection following a rehabilitation project. The intensity should be as described in the *AASHTO MBE* and as described in the following sections. The NBIS require a Team Leader be present at all times during each initial, routine, in-depth, fracture critical member and underwater inspection for Federal-definition bridges. The Department encourages, but does not require, the presence of a Team Leader during each initial and routine inspection of bridges not covered by the NBIS; State-definition bridges with clear span not exceeding twenty (20) feet. However, the Department does require the full-time presence of a Team Leader for all in-depth and Red List (interim) inspections. Refer to Section 2.2 and Section 2.3 for the description, qualifications, and responsibilities of a Team Leader and a Bridge Inspector, respectively.

### **5.2.1 Routine Inspection**

A routine inspection is a documented investigation of the bridge that serves to compare the current condition with the previously documented condition. This type of inspection is sometimes referred to as a *regular inspection* or an *NBIS inspection*. Routine inspections help to ensure that all present service requirements are satisfied. It is normal procedure to perform an in-depth inspection of critical areas. Refer to Section 5.1.3 for the description of in-depth inspections.

#### *5.2.1.1 Scope and Intensity*

The general scope of a routine inspection includes:

- Evaluation of the physical and functional condition of the bridge based on field observations and/or measurements (SI&A data);
- Inspection of the structure from the deck, walkways/structure platforms/access equipment (as applicable), and ground and/or water level;
- Inspection of the submerged substructure member(s) at low water levels from above the water surface through a wading inspection with probing methods to check for signs of scour (refer to Section 3.1.6.1 for more information);
- Identification of changes from previously recorded conditions;
- Verification of geometric clearances for grade separation structures (overpasses) and the presence of any required clearance signs as indicated in the BMS (e.g. "One Lane Bridge", "Narrow Bridge");
- Assessing the adequacy of the load rating on file for consistency with any deficiencies or structural modifications noted;
- Subsequent evaluation of the need to impose a weight restriction or modify an existing one;
- Assessment of urgent maintenance needs (critical findings);
- **At Scour Critical Bridges**, taking drop line readings in accordance with the Plan



- of Action for each bridge; and
- A fully documented inspection report complete with appropriate photographs and recommendations.

The routine inspection should be comprehensive, such that a load rating analysis (if required) can be performed using existing information from plans and information collected in the field. If the bridge condition worsens and the structural adequacy is compromised, deterioration should be documented during the inspection by taking sufficient measurements.

The following sequence is suggested for most routine inspections. Underwater inspections of substructure elements in excess of wading and probing around footings during low-flow conditions are treated separately from the other types of inspections and are discussed in Section 5.1.6.

Suggested Routine Inspection Sequence:

1. Inspect the bridge approaches and traffic safety features.
2. Inspect the deck top surface.
3. Inspect the underside of the deck.
4. Inspect the superstructure (e.g., slabs, beams, girders, trusses).
5. Inspect the bridge bearings.
6. Measure horizontal and vertical clearances for roadways passing under a bridge as appropriate.
7. Inspect the abutments and wingwalls.
8. Inspect the intermediate supports (if applicable).
9. Inspect the waterway/channel.
10. Take drop line readings for monitoring channel cross sections (**required at Scour Critical bridges**).
11. Verify correct placement of any signs pertaining to vertical clearance (see MUTCD for vertical clearance posting signage examples) and/or width constriction (e.g. “One Lane Bridge” or “Narrow Bridge”).
12. Verify correct placement of any signs required for weight restrictions (e.g. tonnage, “E-2”, “C-1”, etc.).

The level of effort for a routine inspection is dependent on the structure's type, size, design complexity, existing conditions, and location. Generally, a routine inspection will not require that every bridge element receive a hands-on inspection in order to provide an acceptable assessment of the bridge's condition. In some cases, a routine inspection may

also warrant in-depth inspection of problematic areas including critical or non-critical areas of the bridge that can pose safety or structural capacity issues.

Good judgment is required for all inspections, including routine inspections, in order to make the proper differentiation between critical and non-critical areas. Consultation with the Existing Bridge Section engineering staff may be advisable to identify these areas as appropriate. For more guidance regarding inspection procedures, inspection techniques, and common deficiencies associated with specific structure types, refer to appropriate sections of the *Bridge Inspector's Reference Manual* (i.e. the *BIRM*).

Although the information contained within the Structure Inventory and Appraisal (SI&A) data should be mostly up-to-date, minor changes and/or corrections to the SI&A data may be required based on current field observations and measurements. For bridges over roadways, vertical clearance measurements should be checked whenever it appears the opening may have changed (e.g. the suspected application of a pavement overlay). Vertical clearance measurements should be verified during every routine inspection for overpass bridges with a minimum vertical clearance of 14'-9" or less indicated in Item 54b of the BMS. This ensures all bridges with previously identified vertical clearances within 3 inches of the maximum legal height permissible on NH highways will be evaluated to determine if vertical clearance signs are necessary.

Inspectors shall also check to make sure that all required vertical clearance, roadway width constriction, and load posting signs are present at the bridge. Signs shall be provided along both roadway approaches to the bridge for traffic subject to the restriction indicated on the sign(s).

#### *5.2.1.2 Frequency*

Routine inspections are conducted at regular intervals not to exceed twenty-four (24) months in accordance with the NBIS, unless an increased inspection interval has been approved by FHWA.

### **5.2.2 Inventory Inspection**

An inventory inspection is the first inspection of the bridge following initial construction or rehabilitation, used to gather information that is included in the bridge records. The inventory inspection verifies that construction work has been completed and the bridge is open or waiting to be opened to highway traffic. An inventory inspection also serves to provide the required inventory information of the *As-Built* structure type, size, and location, and to document its structural and functional conditions. Additionally, an inventory inspection may also apply when the structure's configuration has changed (e.g., widening, lengthening, or addition of supplemental supports). FHWA recommends that initial inspections for new or rehabilitated bridges are to be complete prior to the bridge being opened to traffic. However, the Department does not require this considering bridge construction projects are usually overseen by competent Professional Engineers.

Furthermore, many municipal bridges are reconstructed and opened to traffic without the Department receiving any notification from the municipality. In these cases, the work is not discovered until the next inspection event which could be months or years away. The NBIS requires the presence of a Team Leader for inventory inspections of Federal-definition bridges.

Refer to Section 2.2 and Section 2.3 for the description, qualifications, and responsibilities of a Team Leader and a Bridge Inspector.

#### *5.2.2.1 Scope and Intensity*

An inventory inspection is the first routine inspection conducted on a bridge following initial construction or major rehabilitation. The intensity somewhat exceeds that required for a typical routine inspection, since the goal is to gather sufficient information to create or potentially modify an entire bridge record in the Bridge Management System (BMS). Close-up hands-on inspection is generally required to collect the pertinent information, although the exact level of effort required will depend on the structure's type, size, design complexity, and location. An inventory inspection provides all Structure Inventory and Appraisal (SI&A) data required by the NBIS, other pertinent data for non-NBI fields in the BMS, baseline structural conditions, and existing conditions or defects that may cause future problems. AASHTO Element quantities measured during an inventory inspection are verified by an Engineer in the Existing Bridge Section in comparison with the design plans (if available) as part of the inspection field data review (see Chapter 4 for more information regarding the Quality Control process). For inventory inspections where the structure is not newly constructed, some or all aspects of an in-depth inspection may apply. Refer to Section 5.1.3 for more information regarding in-depth inspections.

The scope of an inventory inspection includes:

- Identification of Structure Inventory and Appraisal (SI&A) data;
- Identification of fracture critical members (FCMs), including their problematic details.
- Identification of underwater members;
- Establishment or revision of weight restrictions on the structure;
- Documentation of baseline structural conditions;
- Documentation of existing problems or locations;
- A fully-documented inspection report complete with appropriate photographs; and
- A load rating analysis (may be performed by others).

Documentation for an inventory inspection includes photographs, any available engineering plans (as-built plans preferred), shop drawings, field sketches with measurements in the absence of plans, applicable scour analysis results, foundation information, and hydrologic data. Construction records (e.g., pile driving records, field changes) may contain valuable information in the future and should be included if

possible. It is noted the Bureau of Construction is responsible for storing and archiving construction records for NHDOT projects. Procedures and policies for storing engineering plans and shop drawings are presented in the NHDOT Bridge Design Manual. Most times it is preferable and sufficient to have the available plans scanned in by the NHDOT Print Shop and stored on the server in the following directory: V:\Bureaus\B14-FinanceContracts\Archive Bridge).

When inventory inspections are conducted following rehabilitation or a change in an existing structure's configuration, plans or other records should be sought from the Bureau of Bridge Maintenance or the Consulting Engineer responsible for the bridge work. Available plans for construction on municipality-owned bridges should be obtained through the Bureau of Planning and Community Assistance. The Municipal Highways Engineer serves as the primary liaison between municipalities and the Department. Often times, the Bureau of Planning is successful in securing shop drawings and miscellaneous plans for structures constructed without NHDOT involvement. In these cases there is no obligation for the plans to be provided, but they can prove very useful nonetheless.

#### *5.2.2.2 Frequency*

An inventory inspection is the first inspection following the construction of a new structure or major rehabilitation of an existing structure. Inventory inspections should be conducted within three weeks following the completion of major construction operations and/or reopening to traffic. The QC review of field inspection data and final transfer into the Bridge Management System should be completed within thirty (30) days of the field inspection, and preferably sooner for a brand new bridge considering BOPR (Overweight permitting) relies on the existence of a bridge record in the BMS.

### **5.2.3 In-Depth Inspections**

An in-depth inspection is a detailed inspection that determines the condition of the bridge and bridge elements above the water level, using close-up, hands-on inspection techniques. In-depth inspections may be limited to certain elements, span group(s), or structural units, but most often involve the entire superstructure and possibly the substructure. These inspections are typically utilized on larger significant structures to identify any deficiencies not readily detectable using routine inspection procedures; special access equipment is normally required to achieve an arms-length inspection (i.e. long spans, not accessible from below, significant traffic impacts, etc.). In-depth Inspections are intended to satisfy all requirements stipulated for a routine inspection in addition to other requirements presented herein. Per the NBIS, a Team Leader is required to be present at all times during in-depth inspections of Federal-definition bridges.

#### *5.2.3.1 Scope and Intensity*

In-depth inspections may include some or all of the following:

- Specialized inspection equipment (i.e. UBIV, staging, boats, rigging);

- Specialized inspection personnel (i.e. divers, riggers, climbers, certified technicians);
- Traffic control and/or lane closures
- Nondestructive testing or other material testing (i.e. ultrasonic, dye penetrant, magnetic particle, ground penetrating radar, ASR evaluation, etc.); and
- A load rating analysis (may be performed by others).

The level of effort required to perform an in-depth Inspection will vary according to the structure type, size, design complexity, existing conditions, and location. In-depth inspections require that every bridge element receive a hands-on inspection in order to assess the severity of any deficiencies detected on the structure. Measurements should be taken at locations exhibiting section loss. Deficiencies should be documented with photographs and noted in the inspection report. Additional guidance regarding inspection procedures, inspection techniques, and common deficiencies associated with specific structure types is provided in appropriate sections of the *BIRM*.

#### *5.2.3.1.1 In-Depth Inspections by NHDOT Inspectors*

In-depth inspections conducted by NHDOT personnel often rely on use of the UBIV (a.k.a. “snooper” or “lift”) operated and maintained by the Bureau of Mechanical Services and “spider staging” from the Bureau of Bridge Maintenance (BOBM), as appropriate. Each inspection team maintains lists of the bridges in their respective territory requiring the use of either the UBIV or spider staging for In-depth inspections. The bridge lists from each team are collected by the Chief Bridge Inspector and used to produce two combined lists of bridges, one referred to as the “Lift List” and the other being the “Spider Staging List”. These lists facilitate scheduling of the inspection equipment to maintain the required inspection intervals. As discussed in Section 3.1.2, the inspection teams are responsible for coordinating with other NHDOT bureaus to schedule use of inspection equipment, though the Chief Bridge Inspector provides assistance as needed, particularly to facilitate sharing of equipment among the inspection teams.

NHDOT bridge inspection personnel have access to calipers and ultrasonic thickness gauges for measuring components and documenting section losses. NHDOT inspectors are also trained in the use of dye penetrants for detecting cracks in steel members. Other more advanced inspection techniques are not typically performed by NHDOT bridge inspectors, but may be utilized by Consultants (see below).

In-depth Inspections by NHDOT inspectors result in the production of a typical inspection report based on information entered into the BMS, complete with photographs entered into BIPR. The information obtained during the inspection, including any measurements taken, should be sufficient to enable updating the load rating of the bridge if necessary.

#### 5.2.3.1.2 In-Depth Inspections by Consultants

Consultants are often used by the Department to conduct In-Depth Inspections on larger, more complex structures requiring a certain level of expertise in specialized methods or components. These Consultant inspection contracts tend to part of a larger overall rehabilitation or replacement project requiring a substantial level of effort including traffic management plans, specialized inspection equipment (i.e. snoopers, rigging, etc.) and testing methods, and uniquely qualified inspection/testing personnel (i.e. specialized training and/or areas of expertise). Components receiving an in-depth inspection by consultants often include pins, steel box beams, trusses and gusset plates, segmental concrete box beams, etc. Inspection reports by Consultants discuss the inspection methods and testing procedures utilized and provide detailed information regarding the condition of members, connections, and details. Additional discussion should interpret the impact of observed deficiencies on structure performance and present maintenance or repair recommendations to resolve the noted deficiencies. The inspection report submitted is unique to each structure and is retained in the bridge inspection folder.

A structural analysis and load rating is often conducted by the Consultant as part of their in-depth inspection. The intent is to fully capture the level of deterioration present, consider the detrimental effects on structure capacity, and conceivably, to guide decisions relative to repair, rehabilitation, or replacement.

#### 5.2.3.3 Frequency

The Department determines the necessity of in-depth inspections on a case-by-case basis. If a particular bridge is determined by the Department to require an in-depth inspection, the frequency of such will typically not exceed 72 months.

### 5.2.4 Fracture Critical Member Inspections

A Fracture Critical Member (FCM) inspection is a detailed inspection that evaluates the condition of FCMs (and associated fatigue sensitive details) on steel bridges using hands-on inspection methods and possibly other nondestructive evaluation techniques. A fracture critical member is a metallic (e.g. steel, aluminum, iron) member in tension or with a tension element, whose failure would probably cause complete or partial collapse of a bridge due to a lack of load path redundancy. Fatigue is one of the primary causes of failure for fracture critical members; therefore the presence of fatigue-sensitive details on FCMs warrants additional scrutiny.

Load path redundancy exists when there are three or more primary load paths present (e.g. a multiple girder bridge/IB-C). When only one or two primary load paths exist, load path redundancy does not exist and the primary structural members subject to tension are considered to be fracture critical. Other forms of redundancy (e.g. internal redundancy and structural redundancy) do not alleviate a lack of load path redundancy.

The Existing Bridge Section maintains a list of all bridges in the inventory with identified FCMs (i.e. the “Fracture Critical Bridge List”) and shares it with the inspection teams to aid with tracking inspection schedules and facilitate coordination of necessary special inspection equipment (e.g. UBIV/snooper, spider staging). A Team Leader is required to be present at all times during FCM inspections.

#### *5.2.4.1 Scope and Intensity*

The scope of a fracture critical inspection includes the following:

- Identification of fracture critical members (FCMs), including the location of the FCM and all history pertaining to the FCM. Fracture Critical Member Diagrams are included in the inspection folder for each applicable structure. FCM diagrams for new structures shall be added to the inspection folder when the bridge is added to the inventory;
- Identification of problematic details, including the location of the detail and all history relating to the detail;
- Development of a plan for inspecting FCMs and problematic details;
- Detection of cracks using very detailed, visual hands-on methods;
- Surface preparation (where necessary) prior to inspection and detection of deficiencies; and
- Documentation, including photographs and sketches, for both newly detected deficiencies and pre-existing deficiencies for comparison and monitoring.

A fracture critical inspection is a fully documented investigation of the fracture critical members (FCMs), including problematic details, that are located on the bridge. Given the inherent nature of FCMs and problematic details, the intensity of this type of inspection is significant.

All existing bridges in the inventory with FCMs have diagrams identifying the FCMs included in the inspection file. New bridges constructed with FCMs are required to indicate the location of these members and tension zones on the design plans. The engineers in the Existing Bridge Section are responsible for ensuring this information is added to the inspection folder and BIPR as part of the QC review process for an Initial Inspection (Refer to Section 4.2 for more information about the QC process). These FCM diagrams provide the inspectors with the information needed to properly identify members in need of hands-on inspection when conducting an FCM inspection. Each bridge identified as having FCMs shall have its FCM diagram stored in the BIPR database, allowing electronic access for all of the inspection teams and office personnel. Each inspection team shall maintain paper and/or electronic copies of the FCM diagrams for all fracture critical bridges in the inventory.

Identification of fatigue sensitive details is the responsibility of the inspection Team Leader; the engineers in the Existing Bridge Section are available to assist with this effort

when needed. Useful guidance for identifying and inspecting FCMs and fatigue-sensitive details, including the applicability and usefulness of various nondestructive testing procedures is provided in *Inspection of Fracture Critical Bridge Members* from FHWA and the *Bridge Inspector's Reference Manual*. Additionally, consultation with the training materials of the course, FHWA-NHI 130078 Fracture Critical Inspection Training, may aid the inspector in the identification of fatigue-sensitive details.

For the detection of cracks in steel members, surface preparation may be necessary and could require additional effort (e.g., removing rust scale prior to inspecting for cracks). During the inspection and detection process, lighting and magnification may also be required. Furthermore, fracture critical inspections may utilize nondestructive and/or other material evaluations.

The presence of floorbeams, or elements similar to floorbeams (e.g. steel straddle bent cap), is often an indicator that a structure lacks load path redundancy. Below are general areas and components to receive close-up hands on inspection during each FCM Inspection:

- All exposed surfaces of non-redundant load path metal superstructure elements. This includes areas subject to tension stress and stress reversal which will be clearly documented in the Fracture Critical Member diagram for each bridge requiring a FCM inspection. Fracture critical members may consist of riveted, bolted, or welded construction. Superstructures consisting of one or two girders (e.g. through plate girders, deck plate girders, steel box girders), steel arches, ties of tied arch structures, trusses, and suspension bridges are considered load path non-redundant. The steel rigid frame bridges in NHDOT's inventory are all load path redundant structures at present, though load path non-redundant versions have been constructed elsewhere;
- In unique cases, prefabricated panel truss bridges (e.g. Acrow/Bailey/Mabee) contain multiple adjacent trusses (double, triple, quadruple configurations) which may be deemed load path redundant, when each truss independently supports the bridge deck.
- The Department generally considers floorbeams spaced at 7'-0" or less to be load path redundant if they support either a continuous reinforced concrete deck or longitudinal stringers which are continuous over the top of the floorbeam. Floorbeams not meeting these criteria are considered by NHDOT to be load path non-redundant, and therefore, FCMs. This includes floorbeams at a spacing exceeding 7'-0", floorbeams supporting simple span stringers, and those supporting a structurally non-continuous deck.
- All exposed surfaces of steel pier caps, cross girders, and straddle bents subject to flexure from vehicular live loads. Specifically exempted by this definition are pile bents in which piles support the girders directly. The bent caps in these configurations serve as secondary members to tie all the piles together as a unit, rather than acting as primary members transferring loads from the girders to the



- piles.
- All fatigue-sensitive details (e.g. AASHTO fatigue categories D, E, or E') on FCMs. These may also require additional nondestructive testing as necessary for suspected and/or identified defects.
  - All exposed surfaces of pin and hanger details and all exposed primary member surfaces within 3 feet of pin and hanger details (applies only to pin and hanger connections on non-load path redundant members). All steel tension hanger members and their connections on arch bridges.

The following guidelines shall also apply:

- The inspectors shall utilize the Fracture Critical Member diagram developed for each fracture critical bridge during inspection to identify all members on the structure requiring arms-length inspection.
- Tension and stress reversal zones of members shall be examined for the presence of tack welds, remaining groove weld back-up bars, holes filled with plug welds (Category E details), and any other existing weld details, situations, or conditions not part of the original design.
- In general, all connections welded to a primary member shall be considered part of the primary member.
- When a FCM inspection is conducted, the date of the inspection shall be indicated in the “Structure Notes” section of the BMS and Inspection Report.
- Other details, situations, or conditions of special concern may be highlighted for special inspection emphasis even if the specific situation is not itemized in this list or on the Fracture Critical Member Diagram.

Findings of from a fracture critical inspection are presented in the “Inspection Notes” section of the inspection report. Additional information to be included in the inspection folder includes documentation of any measurements taken (as appropriate), photographs, sketches, and all results from any nondestructive or material evaluation performed. If the bridge condition deteriorates, it is imperative that sufficient investigation be undertaken to document the extent of deterioration observed to ensure an accurate load rating analysis can be performed.

#### *5.2.4.2 Frequency*

NHDOT conducts FCM Inspections at an interval not to exceed twenty-four (24) months in accordance with the NBIS. At the discretion of the Program Manager, the FCM inspection interval may be reduced when conditions warrant heightened concern.

#### **5.2.5 Interim (Special) Inspections**

Interim (special) inspections are used to evaluate load posted bridges, inspect bridges that

are out of service (closed and barricaded), monitor suspected or known deficiencies, or assess bridge or bridge members following a natural or manmade emergency. The Department maintains a “Red List” of bridges requiring a reduced inspection interval due to known deficiencies, poor condition, weight restrictions, or type of construction. Major element condition ratings of 4 or less, tonnage postings, and recently-repaired fatigue cracks requiring monitoring are several main reasons bridges are assigned to the Red List. Separate lists are maintained for bridges owned by the State and those owned by municipalities. Interim inspections for Red List bridges are commonly referred to as *Red List Inspections*.

Flood monitoring inspections are used to keep an eye on bridges of concern during identified high flow events. They are primarily used to monitor scour critical bridges in accordance with a Scour Plan of Action (POA), though bridges assessed to be scour-stable are monitored during flood events from time to time.

Bridges which have been closed to highway traffic due to poor conditions are also inspected on an interim basis as discussed below. These bridges remain on the Red List leading up to their eventual permanent closure.

#### *5.2.5.2 Red List Inspections*

The complexity of a Red List inspection will vary according to the number, magnitude, and importance of the deficiencies. Red List inspections pay special attention to previously identified areas of concern, often utilizing in-depth inspection techniques for critical components, members exhibiting advanced deterioration, and other known or suspected deficiencies such as impact damage or fatigue cracks.

The results of an interim inspection include a standard inspection report, photographs for new items of concern or to track advancing deterioration, and may require detailed measurements to capture the extent of any material losses that have occurred. The Existing Bridge Section Engineers and/or consultant engineers are responsible for assessing the measured section losses and incorporating their impact on structural capacity into a revised load rating for the structure.

State-owned Red List bridges are inspected twice yearly on an eight (8) month maximum interval, typically in March and November. Bridges on the Municipal Red List are inspected once per year at the end of the inspection season (November/December), at an interval not to exceed sixteen (16) months.

#### *5.2.5.3 Flood Monitoring Inspections*

Bridges are monitored during significant flood events to check for signs of instability and to identify conditions threatening the serviceability of a bridge. Scour critical bridges are the primary focus during flood events, since these bridges are known to possess an increased likelihood of becoming unstable during flood events as determined through a risk-based assessment of the entire bridge inventory, or there is a lack of available

information required to adequately assess the substructures for scour vulnerability. The Existing Bridge Section maintains a regularly-updated list of bridges from the inventory classified as scour critical. Bridges not on this list are inspected on a case-by-case basis when known concerns emerge (i.e. ice jams, debris clogging, etc.). More information specific to bridge scour in the State of New Hampshire is available in the Department's *Scour Evaluation and Plan of Action Manual (NHDOT Scour Manual)*.

Each scour critical bridge has a POA which addresses inspection strategies, monitoring requirements, communication responsibilities (emergency management), and scour alert criteria which could trigger certain actions up to and including bridge closure. Flood monitoring is required for scour critical bridges during flood events exceeding criteria established in the individual POAs. Visual observation of water elevations, monitoring installed countermeasures as appropriate, and checking for signs of structural distress are the primary techniques for monitoring a bridge during a flood event. Each inspection team is equipped with a binder containing all POAs currently in effect for New Hampshire bridges, and the NHDOT Bureau of Bridge Design maintains hard copies and electronic copies of the POAs.

Once the flood event has subsided, post-flood inspections are performed at each impacted scour critical bridge to check for signs of damage resulting from streambed scour. Drop line readings are taken from the bridge deck to ascertain the stream channel bed elevations at predetermined locations. These are compared with past drop line readings to check for changes over time that may indicate active scour conditions. The procedures to be used for taking drop line readings are presented in the *NHDOT Scour Manual*. Drop line readings for individual bridges are stored in their respective bridge files. Sometimes drop line readings are taken at other bridges of concern as designated by the Program Manager.

Each NHDOT inspection team is generally responsible for flood monitoring of the bridges in their respective territory, though teams should coordinate to assist each other when doing so would boost efficiency by relieving a significant burden imposed on a specific region; inspection teams may not have adequate availability to visit and monitor all bridges of concern for which they are responsible in a timely manner when flooding is isolated to a specific region of the state. The Chief Bridge Inspector and other engineers in the Bureau of Bridge Design are also available to assist with flood monitoring duties as the need arises, to be designated by the Chief of the Existing Bridge Section.

The Transportation Management Center (TMC) is responsible for notifying inspectors when flood warnings are issued by the National Weather Service out of Gray, Maine. This process alerts the inspectors to specific waterways and drainage predicted to reach certain stages of flooding, though the inspectors are responsible for identifying the scour critical bridges in their respective territory requiring attention. The POA for each scour critical bridge identified should be reviewed, since the POAs often do not require any specific action until floodwater elevations exceeding minor flood stage are reached.

Reviewing the up-to-date United States Geological Survey (USGS) stream gauge data available online at <http://www.weather.gov> or <http://waterwatch.usgs.gov> often serves as the best indicator for when action is required at a bridge in accordance with its POA. The Existing Bridge Section office personnel are available to assist the inspection teams with stream gauge monitoring and review of POAs during normal business hours, while the Chief of the Existing Bridge Section is responsible for providing assistance to the inspection teams outside of this window.

Flood monitoring inspections are to be indicated in the “Structure Notes” field of the inspection reports with observations as appropriate. Photographs should be taken to document the water level at the bridge for future reference.

Many scour critical bridges have been outfitted with scour monitoring placards which aid the inspector in determining whether the stream flow has met or exceeded the calculated scour critical flow. These standardized signs are mounted to abutments and/or piers, and the scour critical flow is represented by the margin of yellow and red on the sign.

#### *5.2.5.4 Closed Bridge Inspections*

Bridges located on public roadways which have been closed to traffic (no temporary structure in place) continue to be inspected according to the 8 or 16-month frequency established for Red List bridge inspections to verify that adequate non-movable barriers and warning signs remain in place to prevent vehicular travel across the structure. Once confident that the bridge will remain closed and appropriately barricaded, after approximately a period of two years, these bridges may be removed from the Red List, and placed on the “Black List”. At that point, the inspection interval would revert to a 24-month frequency unless otherwise directed by the Program Manager.

These bridges can remain on the Black List indefinitely, or the decision could be made to remove them from the bridge inventory entirely. The intentions of the bridge owner regarding eventual restoration of some level of functionality to the structure (e.g. rehabilitation, repurposing) is often the key factor in this decision. The Program Manager consults with other stakeholders at the Department to weigh the applicable competing variables and render a final decision regarding removal from the bridge inventory.

Continuing biennial inspections of structures after closure is intended to safeguard primarily against collapse and, secondarily, to note other apparent safety hazards that may develop and require attention.

#### **5.2.6 Underwater (Diving) Inspections**

An underwater inspection uses trained, certified divers to determine the condition of the underwater portions of the bridge substructure and the surrounding channel, which cannot be inspected visually at low water by wading or probing. Wading and probing inspections are conducted as part of each Initial, Routine, In-Depth, and Interim Inspection for

bridges over water. Applicable underwater inspection requirements are presented in the NBIS, *Code of Federal Regulations*, Title 23, Part 650, Subpart C, Section 650.313 (23 *CFR* 650.313). The Existing Bridge Section maintains a list of all bridges in the inventory requiring underwater dive inspections including the date of the most recent underwater inspection event, to facilitate planning and scheduling of these inspections per the frequency established for each bridge.

#### *5.2.6.1 Scope and Intensity*

An underwater diving inspection is a documented investigation of the bridge substructure elements that are located below the water surface. They are also used to inspect buried culvert-type structures (e.g. CMPs, box culverts) when water levels are deep enough to require the use of divers and/or inadequate freeboard exists to permit the safe entry of a bridge inspector. An underwater diving inspection provides a complete and detailed description of all activities, procedures, and findings from the inspection.

The Department does not keep trained inspection divers on staff, but rather utilizes statewide contractual agreements to procure underwater inspection services from outside firms. Under these agreements, consultants perform scheduled and emergency underwater inspections. The NHDOT Chief Bridge Inspector or another representative from the Bureau accompanies the contract divers for all underwater bridge inspections. The firm conducting underwater inspections for the Department is required to furnish at least one Team Leader who is present at all times for each underwater inspection and a qualified Underwater Bridge Inspection Diver as discussed previously in Section 2.2.4. Underwater inspections conducted by consultant engineering firms are required to satisfy all NBIS requirements.

The scope of an underwater diving inspection includes:

- An evaluation of the physical and functional condition of the underwater substructure member(s) based on field observations and/or measurements, which are conducted by specialized inspection personnel (e.g. divers);
- Specialized inspection tools (e.g., wetsuits, SCUBA equipment, surface-supplied air equipment);
- The identification of changes from previously recorded conditions;
- Determination of the need for establishing or revising a weight restriction;
- An assessment of maintenance needs regarding the bridge substructure units and waterway;
- Identification of any observed scour; and
- Documentation including an underwater inspection report complete with appropriate photographs, sketches, measurements, discussion of deficiencies, and NBI major element condition ratings for the substructure element(s) and/or culvert inspected.

Furthermore, an underwater diving inspection may include some or all of the following:

- Specialized inspection equipment (e.g., boats, barges, sounding equipment);
- Advanced inspection procedures (e.g., underwater imaging);
- Nondestructive or other material evaluation;
- Scour evaluation for scour critical bridges; and
- A load rating analysis.

Underwater inspections should utilize the procedures, recommendations and guidelines presented in the *BIRM* and the FHWA publication *Underwater Bridge Inspection*. Particular attention should be given to substructures on spread footings where scour or erosion can be much more critical than at bedrock-supported foundations or deep foundations on piles, drilled shafts, or caissons. However, scour or undercutting of a deep foundation can also be quite serious. The vertical support capacity of a foundation normally will not be greatly affected unless the scour is excessively severe, but the horizontal stability may be jeopardized by significant erosion along only one face created by an unbalanced loading condition. Earth, debris, and rock fills piled against or adjacent to substructure units may also impart unbalanced horizontal loads on a structure that were not part of the original design, so their presence should be noted.

The findings of an underwater inspection shall be summarized in an inspection report. The report shall document any deficiencies noted, including those related to structural capacity, observed scour conditions, presence of debris, hazardous safety conditions, other conditions of concern, and shall provide a major element condition rating for the substructure unit(s) or culvert inspected. In many cases, sketches of the substructures inspected should be provided to help convey findings discussed in the report, along with any pictures taken.

#### 5.2.6.2 Frequency

Underwater inspections are performed at regular intervals not to exceed 60-months in accordance with the NBIS. Other situations and deficiencies, as presented in the AASHTO MBE, may be cause to establish a shorter inspection interval for underwater components. Additionally, POAs for scour critical bridges may impose tighter inspection intervals or require underwater inspection following significant high flow events.

### 5.2.7 Damage Inspections

A damage inspection is an unscheduled inspection that evaluates structural damage to the bridge caused by environmental effects and/or human actions (e.g. ship/traffic/debris impacts). Damage inspections are meant to determine if the bridge is safe to remain open to vehicular traffic and/or pedestrians, verify whether the bridge can still perform its required level of service, and identify any needed repairs resulting from the damaging incident. The inspection reports for damage inspections shall be submitted no later than 5 days after inspection.

Although the NBIS does not specify minimum qualifications of inspection personnel for

a damage inspection, the State requires that a Team Leader be present for each field inspection team. It may also be advisable in many cases for a Professional Engineer to be present to assist in the damage assessment. In the event a critical finding is discovered, refer to Section 3.7 for the reporting procedures for critical findings.

#### *5.2.7.1 Scope and Intensity*

The complexity of field observations and measurements made during a damage inspection can vary greatly depending on the intensity of the damage and the magnitude of the area impacted. Note that in some cases, damage may render the structure incapable of supporting the loadings imposed by standard inspection access equipment and require utilizing alternative means of access.

The scope of a damage inspection includes the following:

- Assessment of the damage to the bridge and surrounding environment;
- Determination of the need for immediate closing or emergency load restrictions for vehicles or pedestrians utilizing the bridge;
- Evaluation of the effort required to repair the bridge; and
- Documentation of measurements, calculations/analyses, photographs, and all other findings.

The results of a damage inspection include measurements, sketches, photographs, and indications of all findings which should be referred to in a standard inspection report. The results of the inspection may also be presented in a detailed technical inspection report, particularly when the inspection is handled by a consultant. In addition, on-site calculations and analysis may be required to evaluate the load-carrying capacity of the bridge in its damaged state, possibly warranting implementation of emergency load restrictions, partial bridge closure (i.e. reduced lanes), temporary closure of the structure until the necessary repairs have been completed, or even permanent closure.

In some cases, a damage inspection may be followed by a separate in-depth inspection to provide:

- Further evaluation of damaged conditions;
- Verification of field measurements and calculations performed during the initial damage inspection;
- Adjustment or establishment of load restrictions through a detailed analysis; or
- Advancement of the follow-up procedures as mandated by the bridge owner.

#### *5.2.7.2 Frequency*

The Department assigns damage inspections as situations require. Follow-up inspections are dictated by the severity of the damage, resulting condition of the structure, and may also include inspections to verify postings or closure, and/or following the completion of

repairs.

### **5.2.8 Complex Bridge Inspections**

Per the NBIS complex bridges are defined as movable, suspension, cable stayed, and other bridges possessing unusual characteristics or of unique construction. A complex bridge inspection is a type of in-depth inspection which also encompasses the unique features and specialized systems of complex bridges. Generally, inspection of electrical and mechanical components of movable bridges is beyond the scope general bridge inspections. The same is true regarding the in-depth inspection techniques used to inspect the specialized components of suspension and cable stayed bridges. Structural components of complex bridges must still be inspected with the same intensity and frequency required for conventional bridges, therefore, complex bridges shall receive routine and diving inspections at the same frequency as required for conventional bridges.

Special inspection procedures and inspection team qualification requirements are required to be documented for each complex bridge per the NBIS (23 *CFR* 650.313 (f)). These inspection procedures are to be followed during each complex bridge inspection in accordance with the documented procedures, but this will not necessarily coincide with every single inspection event. Ideally this information should be provided in the Operation, Inspection, and Maintenance (OIM) manuals specific to each structure.

Currently the Department has the following four (4) complex bridges in its inventory, comprised of two bascule and two vertical lift bridges:

1. **Hampton 235/025**
  - “Hampton Harbor Bridge” or “Neil R. Underwood Memorial Bridge”
  - Carries NH 1A over Hampton River
  - Moveable Span: Single-Leaf Bascule
  
2. **New Castle 066/071**
  - “Little Harbor Bridge”
  - Carries NH 1B over Little Harbor
  - Moveable Span: Single-Leaf Bascule
  
3. **Portsmouth 247/084**
  - “Memorial Bridge”
  - Carries US 1 over Piscataqua River
  - Moveable Span: Vertical Lift
  
4. **Portsmouth 251/108**
  - “Sarah Mildred Long Bridge”
  - Carries US 1 Bypass over Piscataqua River, Railroad, Market Street



- Moveable Span: Vertical Lift

The Department utilizes a combination of in-house inspectors and consultants to perform periodic complex bridge inspections given the inherent scale of the operation and expertise required to accomplish this task.

Complex bridge inspection procedures for each of NH's four complex bridges are available in the inspection files. Systems and sub-systems identified in the reports include the machinery, electrical and mechanical equipment present, linkages, movement guides, and special connections between and components, in addition to the primary structural load path components. In the absence of OIM manuals, sound judgment should be used where specific conditions are encountered that are not covered by this manual or in the complex bridge inspection procedure for the particular bridge.

#### *5.2.8.1 Scope and Intensity*

The scope and intensity of complex bridge inspections shall rely on the directions provided in the individual bridge's complex bridge inspection procedure and also rely upon the findings from previous inspection events and their associated reports.

Inspection of the various components of the complex portions of the bridge shall be conducted at an in-depth level of effort. A detailed inspection report shall accompany each complex bridge inspection. The report shall document the inspection procedures and testing methods utilized for the inspections. Detailed information regarding the condition of all structural members, connections, electrical and mechanical systems, and special features shall also be provided in addition to interpretation of how observed deficiencies impact performance of the structure. Maintenance and/or repair suggestions should be provided as appropriate to aid in monitoring or correcting deficiencies, preserving functionality, and ensuring safety. Each inspection report is kept on file, either as a hard copy in the inspection folder, or electronically. It is suggested that electronic reports be stored on the server and written to a CD or DVD and placed in the inspection folder, so it remains available to all interested parties.

Complex bridge inspections may entail a structural analysis and subsequent load rating to gauge the effects of any deterioration observed.

#### *5.2.8.2 Frequency*

Complex bridge inspections of movable bridges shall be conducted at intervals not to exceed 72-months unless deterioration or other conditions warrant more frequent inspections, subject to the discretion of the Program Manager. All other complex bridge inspections shall be conducted at intervals established by the Program Manager, taking into consideration the need for specialized inspection training, availability of resources, and the proven reliability of the structural system employed for each individual structure.

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**6.1 Introduction and Background**

The National Bridge Inspection Standards (NBIS) require a load rating be calculated and kept on file for each bridge in the National Bridge Inventory. The load rating calculations are a required component of the bridge file and are to be updated when the condition of the bridge changes to reflect the “As-Inspected” structure condition. Therefore, load ratings will be updated for those

structures where available live load capacity has been reduced because of deterioration, applied dead load increase, or structural modifications. Updating the load rating for a structure which experiences an increase in capacity is optional, subject to approval by the Chief of the Existing Bridge Section. Load rating of bridges shall be completed per Chapter 13 of the NHDOT *Bridge Design Manual* and the AASHTO *Manual for Bridge Evaluation (MBE)*. See the appropriate appendices in the MBE for examples of load rating different types of structures in accordance with the accepted load rating methods and AASHTO specifications (e.g. Allowable Stress Rating/ASR, Load Factor Rating/LFR, Load and Resistance Factor Rating/LRFR) or based on other appropriate rational criteria.

Rating calculations shall be performed by engineers who are familiar with the principles of structural analysis and load rating methods relative to the structure type under consideration. The engineering knowledge and skill necessary to properly evaluate bridges varies with the complexity of the bridge. A Professional Engineer (P.E.) licensed to practice in the State of New Hampshire is required to be in responsible charge of all bridge load ratings submitted to the Department. Specialized knowledge of other engineers or experts may be required in certain instances.

Interpretation of load rating results and load posting requirements requires the judgment of an experienced engineer. Accordingly, the results of each analysis shall be reviewed by a qualified engineer. Good judgment on the part of the rating engineer is prudent for recognizing special situations where routine, simplified analysis procedures are inadequate and more sophisticated methods are required. In addition, the reviewing engineer shall evaluate the decisions in the load rating regarding material strengths, effects of deterioration and defects, stability, etc. The reviewing engineer may also recommend additional inspection and/or testing.

## 6.2 General Load Rating and Re-Rating Guidelines

- The Load rating of new bridges shall be completed within 90 days of opening the structure to the traveling public in the anticipated final configuration.
- The ratings of existing bridges shall be re-examined when the “Revise Rating Flag” is turned on. The condition of identified bridge elements shall be reviewed and the load ratings shall be updated if needed.
- In cases where the capacity of a member is reduced significantly, such as impact damage to a girder with loss of reinforcing or damage to steel members, ratings shall be updated within 30 days. In other cases such as increase in dead load, a preliminary assessment can be made based on the increase in dead load, condition of the structure and existing ratings. If in the engineer’s judgment, the ratings will not be affected significantly, and will not require a need to post or lower the load restriction on the bridge, ratings should be updated within 12 months.

### 6.3 Load Rating Revision Criteria

Revisions to bridge load ratings should be considered when one or more of the following items apply:

- The deck exhibits signs of significant distress including cracking, efflorescence, underside delaminations, potholes, alligator cracking of the asphalt wearing surface, etc.
- The overlay thickness has increased.
- The bridge railing has been replaced with a heavier traffic barrier, or additional barriers and/or medians have been added.
- New utilities such as a water main or sewer line have been installed on the structure leading to the addition of potentially considerable dead loads for some of the bridge members.
- The number of striped lanes has increased on superstructures with only two or three primary load paths such as trusses, 2-girder bridges, steel arch bridges, steel box girder bridges, and post-tensioned concrete box girder bridges.
- The NBI element condition rating for the deck or superstructure is reduced to a '4' or less.

When a deficiency is observed in the field, such as rot pockets in timber or section loss in a steel member, the inspector should provide sufficient information to adequately describe the location of the deterioration, extensiveness of the observed losses, length, remaining competent section, indication of how isolated or widespread the deterioration is. Provide a sketch of the deficient member, show deterioration as described above and take photographs. For steel sections, remaining thickness measurements shall be taken to the extent practical using calipers and/or ultrasonic thickness meters to accurately assess the true remaining section. Documenting accurate information rather than estimating section losses is of great importance, since posting or restricting a bridge depends greatly on this information in many instances.

### 6.4 Selection of Members for Analysis

Conceivably, all primary structural bridge elements should be analyzed as part of a load rating. At a minimum, the Form 4 should capture the most conservative rating for each type of component present on the structure. In some cases it may be necessary to load rate every component individually, say for stringers, hanger connections, or gusset plates, if member geometry and/or the pattern of deterioration dictates increased effort in number of sections analyzed and rated. Member/component selection and presentation of the load rating results should reflect the complexity of the bridge structural system and the severity and variability of the deterioration encountered throughout the structure (or lack thereof), since these all produce additional layers of complexity. In essence, increased difficulty ascertaining the critical locations and/or controlling components warrants increased analytical effort and presentation detail.

### 6.4.1 Decks

The following lists common deck components to be analyzed. Typically a structure will utilize one type of deck, and sometimes two or three for longer bridges with carrying superstructure configurations throughout the spans.

- Reinforced concrete decks (cast-in-place and post-tensioned)
- Pretensioned partial depth deck panels
- Concrete-filled (partial or full) and open steel grid decks
- Corrugated metal bridge plank (Deck Pans, not SIP forms)
- Timber Decks
- Orthotropic steel decks
- Proprietary deck systems not listed herein (e.g exodermic)

### 6.4.2 Superstructures

- Girders and Stringers (Interior and Exterior)
- Floor Beams
- Cross frames and diaphragms for curved girder bridges
- Truss members, gusset plates, connections and splices, and truss bearing details
- Steel and concrete arches, floor beam hangers, columns, connections, and arch bearing details
- Steel rigid frames (entire frame element)
- Prestressed concrete beams including box beams, deck beams, NEXT beams, NEBT's, AASHTO I-girders, etc.
- Reinforced concrete slabs and tee-beams
- Concrete rigid frames and arches
- Concrete box culverts

#### 6.4.2.1 *Bearings*

Stringer and girder bearings do not usually require analysis for structural capacity unless so directed by the Chief of the Existing Bridge Section. However, the ability of bearings to provide a satisfactory load path between connected superstructure and substructure components should always be assessed.

### 6.4.3 Steel and Timber Substructures

- Pier caps,
- Columns
- Braced frames and moment frames
- Straddle bents
- Pile bents

Load rating analysis is not required for typical concrete substructures including abutment stems, piers, footings, and piles unless directed by the Chief of the Existing Bridge Section.

## 6.5 Load Rating Method

The following guidelines, per FHWA policy, shall apply when selecting a bridge load rating method for Federal and State-definition bridges:

- For new bridges and complete replacement bridges designed according to the LRFD specifications using HL-93 loading, LRFR methods shall be used.
- For bridges designed or reconstructed according to ASD or LFD specifications, the load rating method may be ASR, LFR, or LRFR.
- For bridges reconstructed or partially reconstructed using a combination of specifications (e.g. superstructure replacement designed LRFD with LFD substructure), the selected load rating method may be LFR or LRFR.
- Bridges carrying a facility that is part of the National Highway System (NHS) are required to be load rated using LFR or LRFR (ASR not allowed).
- Once LRFR methods are used to load rate a bridge, it is required to be load rated using LRFR methods thereafter.
- Once LFR methods are used to load rate a bridge, it is required to be load rated using LRFR or LFR methods thereafter.
- The use of ASR methods is allowed for timber and masonry bridges and/or components, contrary to the guidelines presented above.
- A bridge proof loading is a viable alternative to calculating a load rating using one of the AASHTO methods.

## 6.6 Computer Software

In most cases, the use of computer software is necessary for load rating bridges to promote efficiency, expediency, and accuracy of results. Some software, such as Microsoft Excel or MathCAD, is helpful for automating repeated computations and producing presentable sets of calculations. The use of other software may streamline the structural analysis, computation of member capacities, and determination of load ratings for the wide array of bridge structures in

the inventory. It is the responsibility of the engineer in charge of the load rating to verify the applicability of computer software used to load rate a particular structure. This includes verifying that results make sense, verification of a representative sample of software output, ensuring appropriate design code changes have been implemented, and that the analysis methods utilized are appropriate for the structure under consideration. Some commonly recognized structural analysis software packages the Department considers to be useful for load rating bridges (current versions of each program should be used) include:

- BOXCAR
- STAAD
- CSi Bridge
- GT Strudl
- BRASS-GIRDER
- AASHTOWare Bridge Design and Rating (formerly Opis and Virtis)
- PENNDOT BAR7
- DESCUS and Merlin DASH
- MDX
- PS Beam
- LEAP CONSPAN
- Midas Civil
- LARSA

This list is not intended to be all-inclusive and does not preclude the use of other engineering software packages and methods, nor is it intended to endorse the use of these analysis programs. As mentioned previously, the engineer in charge of the load rating is responsible for assessing the overall suitability of computer software, accuracy, and applicability of the results produced.

## 6.7 Bridges with Unknown Structural Components

For bridges where necessary details, such as reinforcement in a concrete bridge, are unknown and cannot be measured, approximate load capacity ratings may be determined by a qualified engineer using rational criteria based on the results of a physical field inspection. Nondestructive load tests may prove helpful in establishing the safe load capacity for such structures. Such a bridge does not need to be posted for load restrictions if it has been carrying normal traffic for an appreciable period of time and shows no apparent signs of distress. Refer to the Manual for Bridge Evaluation (MBE) second edition, Sections 6.1.4 and 6A.8.1. General rating guidelines for these structures are:

- For bridges in which the original design load is known, the Inventory rating shall be equal to the design truck. Operating rating shall be set using a ratio of the Inventory Rating consistent with the design/rating method. For LFR, the ratio between Operating and Inventory is typically 1.67.



- Bridges for which no design load information is available, that have been carrying traffic for an appreciable length of time and show no signs of distress should be assigned Operating Ratings equal to NH Ordinary Legal Loads (not certified legal loads) for the longitudinal effective length and load influence type (shear or moment) applicable to the various members entered on the Form 4 - Bridge Capacity Summary Sheet. The bridge should also be posted 'E-2' to exclude certified legal loads (refer to NH RSA 266:18-b and -c) from using the bridge.
- Posting or restricting of a bridge shall be assessed when NBI condition rating of the major structural elements is 4 or less, or when obvious signs of structural distress exist.

Load rating determinations using field evaluation and engineering judgment, shall be discussed with and approved by the Chief of the Existing Bridge Section.

It should be the practice of the inspection team to determine the dimensions and details of the necessary components if possible (i.e.: reinforcement steel size and spacing can be determined by measurement in spalled areas, depths of steel beams may be determined by measuring up from the bottom of encasement and down from the top of deck, etc.). If these dimensions and properties are not measurable, sufficient sketches and photographs should be taken to adequately document the conditions for the purpose of providing an evaluation of load capacity.

In some instances it will be possible to gain further insight into the makeup of the structural elements of the bridge by using non-destructive testing methods. An ultrasonic thickness meter is useful for determining thicknesses of exposed steel elements. Pachometers can be utilized to determine spacing of reinforcement steel as well as some indication of concrete cover if the bar size is known or bar size if the cover is known.

## 6.8 Posting Requirements

Posting of a structure shall occur when the available capacity listed in either the Posting or Operating Level columns of the Bridge Capacity Summary Sheet are less than the required capacities for legal loads listed for any member. The enveloped load effects for NH Legal Loads, Certified Single Unit Legal Loads, and Certified Multi-Unit Legal Loads are tabulated on the "NH legal Load Equivalents" sheet available on the NHDOT webpage in the Bridge Design Document library. This sheet presents the maximum bending moment and shear effects for the various types of NH legal loads, expressed as equivalent HS load effects (truck and lane loads included). The HS equivalents vary with span length for the different types of NH legal loads, therefore the load effects are presented for spans ranging from 1ft to 300ft. The legal load equivalents are the "Required Capacities" to be entered on the Form4-Bridge Capacity Summary.

For typical redundant structures such as multi-beam and concrete slab bridges, posting

recommendations are generally made considering the full Operating capacity. For structures exhibiting lower levels of redundancy, it may be prudent to make posting determinations based on the Posting capacity, defined as three quarters of the way between the Inventory and Operating levels, to provide some reserve capacity in the structural system. Furthermore, structures load rated using LRFR methodology incorporate redundancy factors within the individual load rating equations to reduce available component capacity for structural systems exhibiting less redundancy. Therefore posting recommendations based on the Operating Capacity may make sense for structures load rated using LRFR, since redundancy has been considered in the computation of rating factors.

The minimum permissible load posting which can be used for a highway bridge is three tons. Any highway bridge that is not capable of carrying a minimum gross live load of three tons shall be closed. Standard tonnage postings utilized by the Department include 20, 15, 10, 6, and 3 tons. Selecting an appropriate tonnage posting can be a bit of a creative exercise, since interpreting the available bridge capacities listed on the Form 4 requires consideration of the vehicles using the bridge, striped lane configuration, traffic volume, safe allowable load limits, and consequences of the various failure modes. The Program Manager should be consulted for more guidance when questions arise regarding suggested criteria for determination of a load posting.

The Chief of the Existing Bridge Section initiates the internal bridge posting process by submitting a completed *Bridge Weight Limit Posting* form to the Administrator of the Bureau of Bridge Design. This form requires concurrence of the Bureau Administrator, the NHDOT Director of Operations, and the NHDOT Commissioner to implement a proposed load posting in accordance with RSA 266:18. This process will usually require meetings of all the parties involved. Once all parties approve of changing the weight limit posting at a bridge, a written request is sent to the Bureau of Traffic for installation of the appropriate corresponding signs at the subject bridge. In general, posting of a structure, when warranted, shall occur within 30 days of all necessary individuals signing off on the *Bridge Weight Limit Posting* form.

For a municipality-owned bridge, reduced load postings are implemented by following the Critical Deficiency Procedures outlined in Section 3.7.3.

## 6.9 Format of Load Rating Package

Each load rating package shall contain the following, as applicable:

- All supporting calculations for the applied dead loads, live loads, live load distribution factors, and rating factors. Calculations shall be clear, legible, organized, and indicate the units of measurement.
- A list or discussion of all assumptions used to conduct the load rating.
- Sketches and diagrams for areas with observed section losses or concrete deterioration to indicate locations on the structure, extent of deterioration, and

remaining section measured. These may include member cross sections, elevation views, and framing plans.

- Calculation of section properties and member capacities for the original as-constructed condition and the as-inspected condition incorporating section losses. Provide copies of reference material used to ascertain section properties for rolled structural shapes (i.e. W-, S-, WT-, etc.).
- Printouts of the input and output files for any software utilized in the load rating, as applicable. Results for girders and stringers should preferably be shown at tenth (1/10th) points at a minimum, potentially twentieth (1/20<sup>th</sup>) points on long structures.
- A completed Bridge Capacity Summary sheet (Form 4) bearing the P.E. seal and signature of the engineer responsible for the load rating. The P.E. shall be licensed to practice in New Hampshire. A blank version of this sheet is available for download via the “Document Library” link on the NHDOT Bureau of Bridge Design webpage at the following web address: <http://www.nh.gov/dot/org/projectdevelopment/bridgedesign/documents.htm>. Refer to the *NHDOT Bridge Design Manual*, Chapter 13 for instructions regarding how to fill out a *Bridge Capacity Summary Sheet*.
- If applicable, calculation of longitudinal effective span lengths applicable to truss members.
- Engineering plans for the structure as appropriate. These may already have been submitted during the design process as Final Design Plans or Record Drawings.

For structures load rated using LRFR methods, rating factors must be converted to equivalent HS load effects. A spreadsheet titled *HS Equivalents of HL-93* developed by the Existing Bridge Section shall be used for converting LRFR rating factors into equivalent HS loadings for moment and shear based on the longitudinal effective span length for the member or component under consideration. For clarity and simplicity in checking and verifying load ratings, it is imperative that calculations showing the conversion from rating factors to HS equivalents be provided, *or* the rating factors and HS equivalents be provided on two separate lines on the Form 4 for each unique entry consisting of the combination of member and longitudinal effective length. Both pieces of information may also be provided with the load rating package.

Some of the more complicated load ratings may be accompanied by a load rating report to elaborate on the modeling techniques utilized, assumptions made, and interpretation of the results. Requirements for a load rating report will generally be addressed in the contract agreement and the scope of work for a consultant-led project. Load rating reports are not a typical part of load ratings conducted in-house.

Newer load rating calculations are stored in the bridge inspection folder for each bridge behind the inspection reports and correspondence. For larger sets of calculations, a representative sample should be placed in the inspection folder rather than the entire set. Extremely large sets of

calculations are not worth separating, so the hard copies consisting of three-ring binders or spiral bound reports will be stored in the Existing Bridge Section and made available upon request. It is also useful to store these calculation sets electronically on the server for easy access and distribution.

In all cases, a signed and stamped Form 4 shall be placed in the inspection folder, on top with the most recent inspection report for easy reference.

## 6.10 Oversize/Overweight (OS/OW) Permits

The Permits Section of the Bureau of Highway Maintenance is responsible for overseeing the issuance of the various specialized permits required for travel on State highways. The Existing Bridge Section assists the Permits Section by conducting bridge reviews for overweight vehicles seeking to cross bridges. The specific axle weight criteria used to identify vehicles requiring a bridge review are identified in the table below.

Bridge reviews conducted as part of an overweight permit application are handled using the Bridge Overweight Permit Review (BOPR) software created in-house based in Microsoft Access. The Bridge Database Engineer bears primary responsibility for processing bridge reviews. Oversight and assistance are provided by the Bridge Database Engineer and Chief of the Existing Bridge Section as needed; these two individuals are trained in the bridge review process too.

Using BOPR and a bridge map in Google Earth, a list of bridges to be crossed on an applicant's proposed route of travel is assembled. The BOPR software identifies bridges in the list for which the applied load effects of the permit vehicle exceed the safe live load capacity of the structure. The software is able to accomplish this task by computing the load effects produced by the permit vehicle on each span length and comparing this information with a database of Bridge Capacity Summary sheets (Form 4's) kept on file for all bridges in the inventory. Final determination for approving or denying permits and stipulating required crossing conditions for specific bridges is made by the engineer processing the bridge review.

More information regarding the permit process and BOPR may be found here (<http://www.nh.gov/dot/org/operations/highwaymaintenance/overhaul/index.htm>), on the Overhaul (NHDOT Permits Section) website.

September 17, 2009

**OS/OW Permit shall be submitted to Bridge Design for bridge review if:**

Description of bridge review "trigger":
Any bridge on the proposed route has a load posting or weight restriction
Any axle spacing less than 4'-0"
Any single axle exceeds 27,500 pounds. (10'-0" or more to any adjacent axle)
Any axle of a tandem group exceeds 25,000 pounds. (see note 2)
Any axle of a tridem group exceeds 22,500 pounds. (see note 2)
Any axle of a quad group exceeds 20,000 pounds. (see note 2)
Any group of five axles. (see note 2)
Any 2-Axle Single Unit exceeds 55,000 pounds.
Any 3-Axle Single Unit exceeds 72,500 pounds.
Any 4-Axle Single Unit exceeds 90,000 pounds.
Any 5-Axle Single Unit exceeds 100,000 pounds.
Any Single Unit, with 6 or more axles, exceeds 110,000 pounds.
Any 3-Axle combination Unit exceeds 82,500 pounds.
Any 4-Axle combination Unit exceeds 95,000 pounds.
Any 5-Axle Combination Vehicle exceeds 108,000 pounds.
Any 6-Axle Combination Vehicle exceeds 120,000 pounds.
Any 7-Axle Combination Vehicle exceeds 130,000 pounds.
Any Combination Vehicle, with 8 or more axles, exceeds 149,999 pounds.

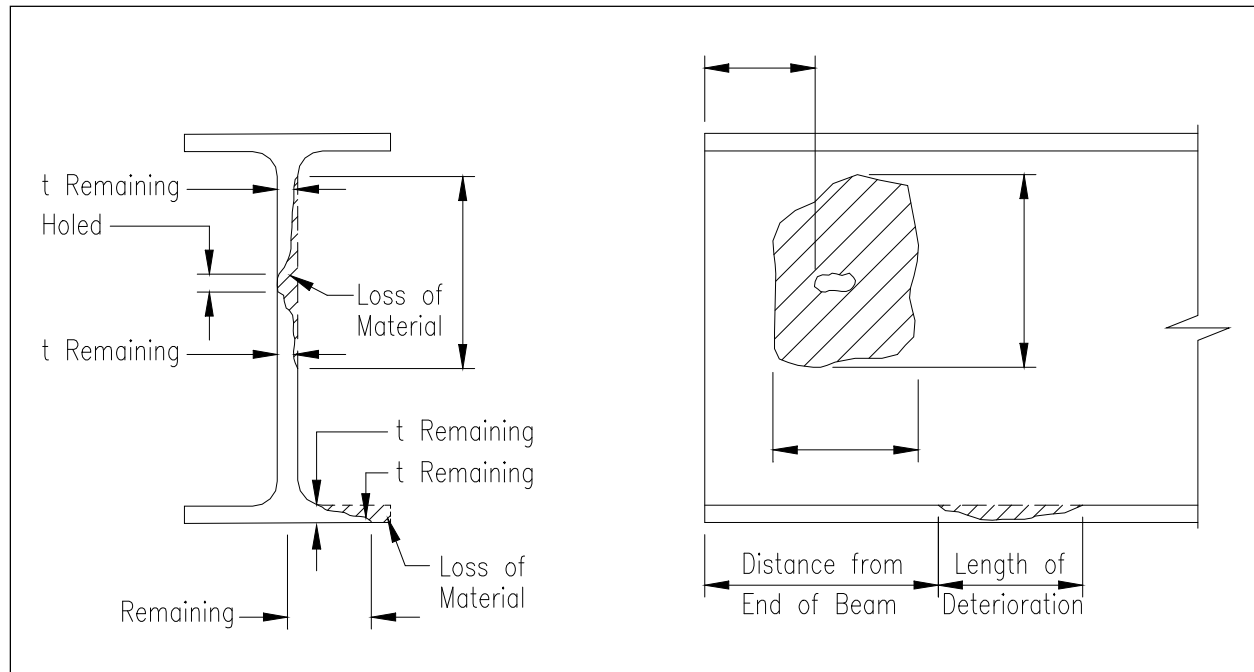
Note 1) RSA 266:18-c states that a vehicle or combination of vehicles shall not be driven or moved over any bridge or other structure on any way if the weight of such vehicle, or combination of vehicles and load, is greater than the capacity of the structure as shown by a sign on the right side of or overhead on the structure. It is assumed that the weight of the OS/OW permit vehicle will be in excess of the provisions of RSA 266:18-b, and therefore will exceed the posted capacity of the bridge.

Note 2) For purposes of this table, axles together are considered a group of axles (tandem, tridem, quad, etc.) when each individual axle space in the group is less than 10'-0".

Note 3) Speed of permit vehicle shall not exceed 20 miles per hour while crossing bridges (except for bridges on the interstate and turnpike system, or corridors designed to meet interstate standards...including NH101 from Manchester to Hampton, etc.).

## 6.11 Documentation of Losses

The amount of material remaining and the location and extent of losses on steel members must be recorded for use in the analysis.



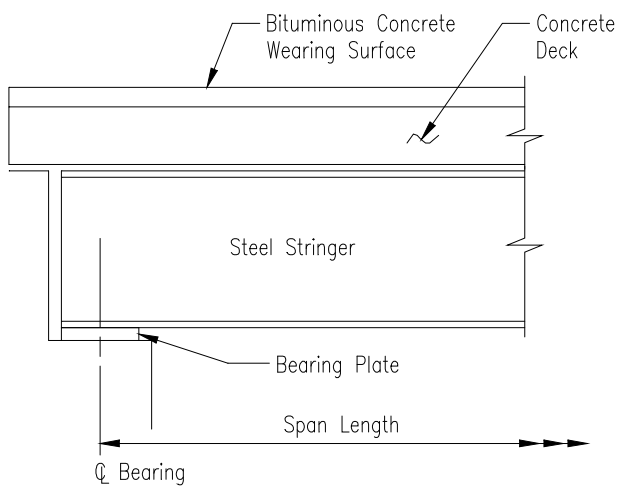
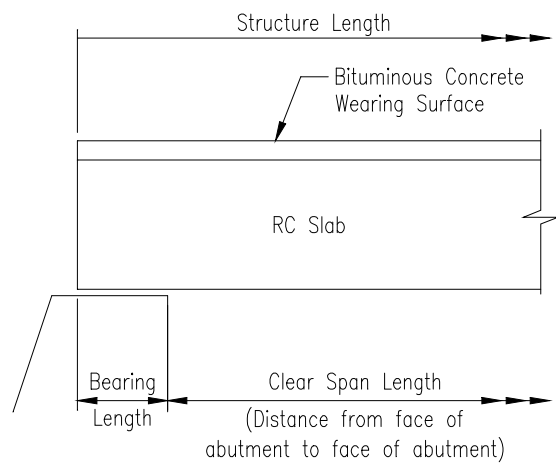
Additionally, the size, number and relative location of bolts or rivets that affect the "net area" in tension members should be accounted for in the analyses. For compression members, misalignments, bends and kinks that may result in eccentric loading or possible buckling should be carefully located and measured since these defects may have a great effect on the load carrying capacity of the member. **Section losses preferably should be expressed in terms of remaining thickness, or depth of pitting, and not estimated as a percentage.** Calipers and ultrasonic thickness gauges, not tape measures, shall be used whenever possible to accurately determine steel element thicknesses.

## 6.12 Field Investigation Forms for Load Rating Evaluations

The field forms on the following pages may be useful for documenting structure dimensions to facilitate load rating evaluations and document deterioration of steel members.

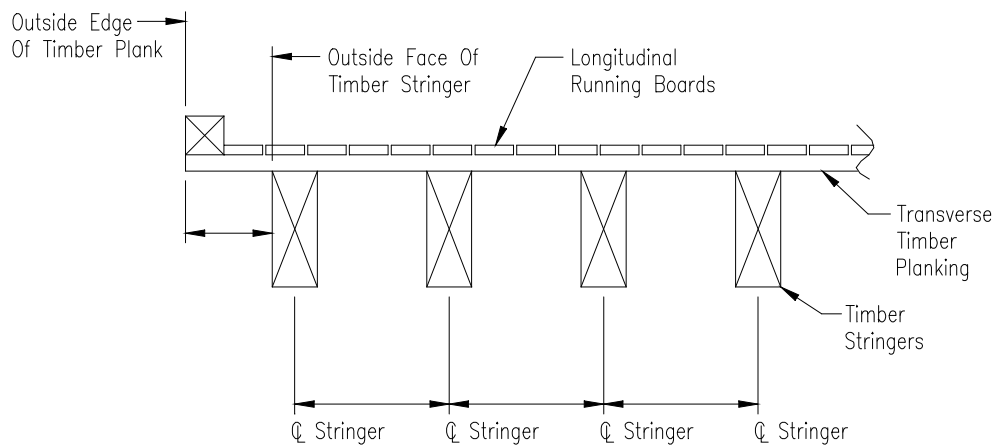
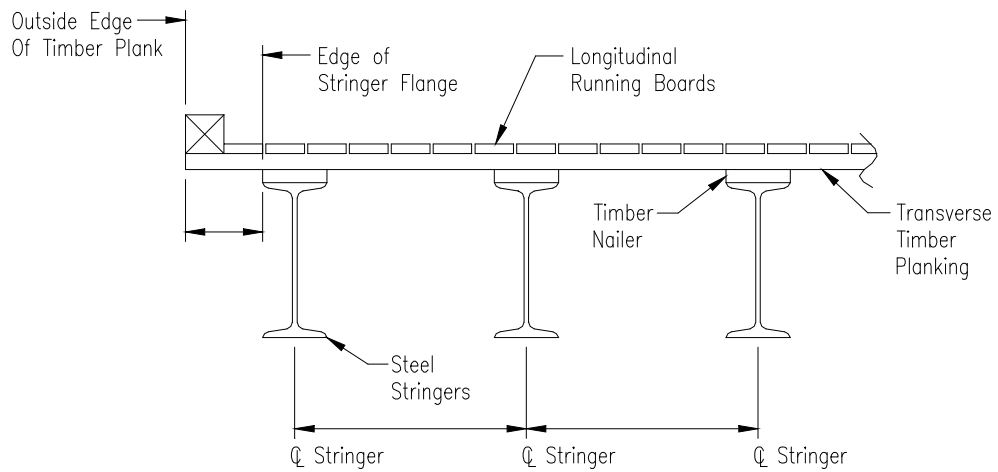
<i>FIELD NOTES</i>	BRIDGE NO.	DATE:
	CREW:	SHEET

SPAN AND STRUCTURE LENGTH



<i>FIELD NOTES</i>	BRIDGE NO.	DATE:
	CREW:	SHEET

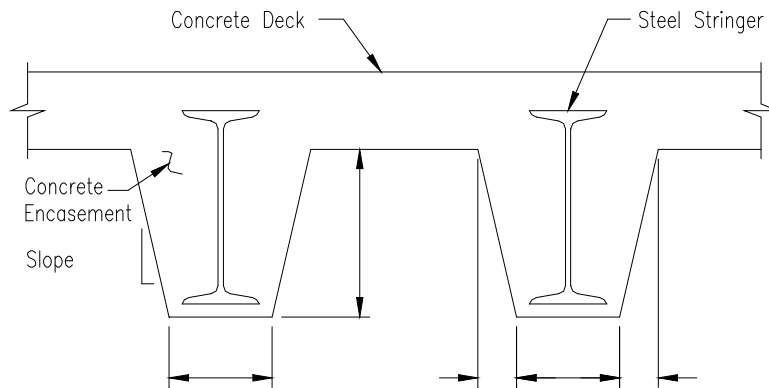
STRINGER SPACING





<i>FIELD NOTES</i>	BRIDGE NO.	DATE:
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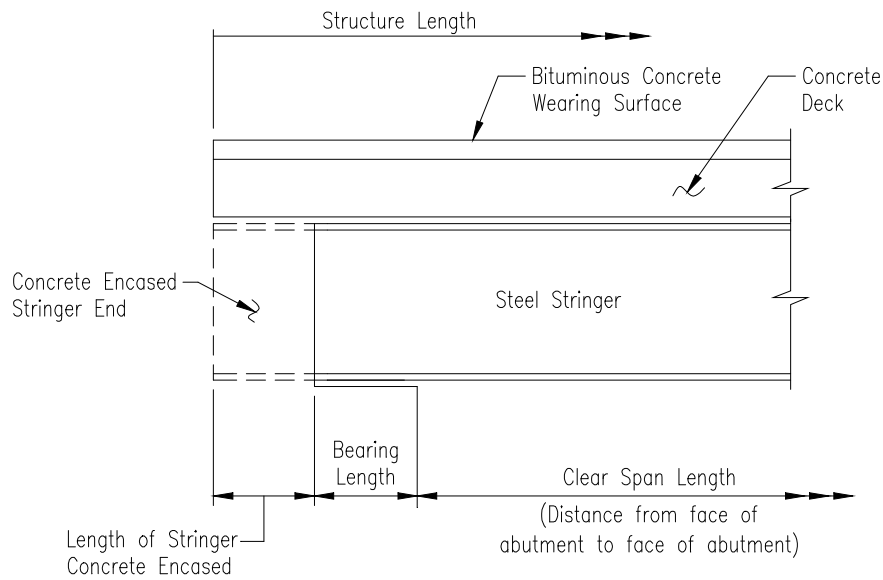
CONCRETE ENCASED STRINGER



- \* Measure size of concrete encasement.
- Width at lower flange.
- Width adjacent to concrete deck.
- Height of concrete encasement, measured from underside of deck to bottom flange of stringer.

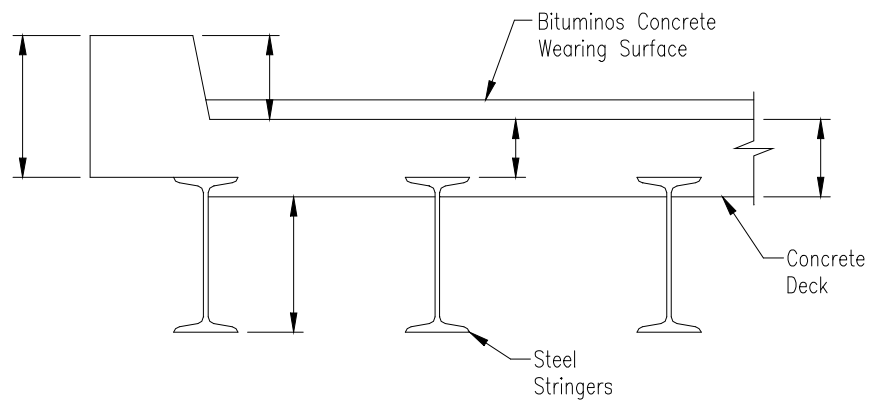
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SPAN AND STRUCTURE LENGTH



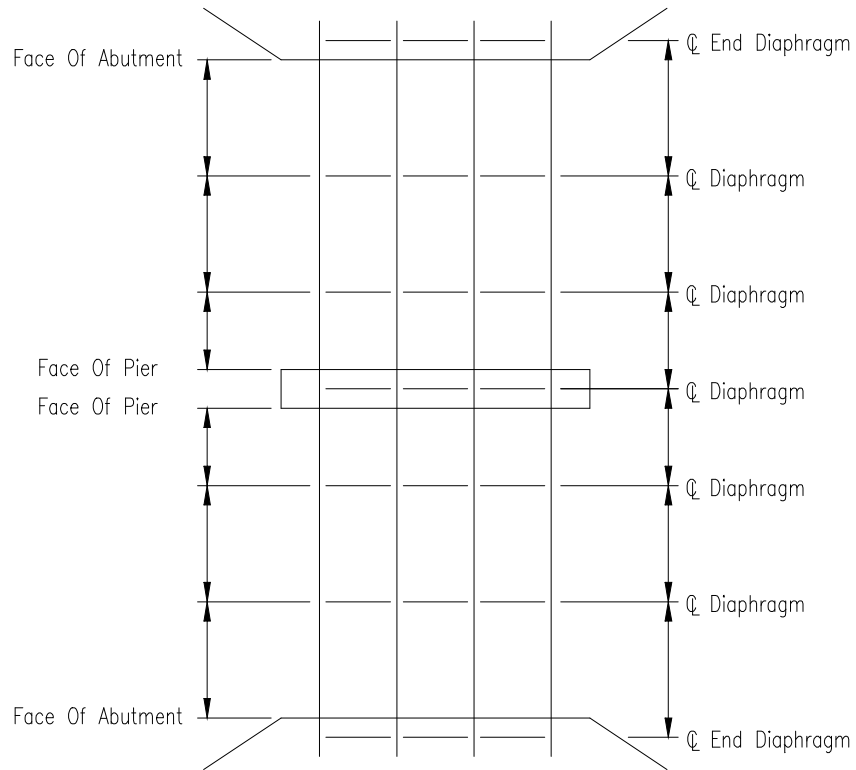
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THICKNESS OF CONCRETE DECK



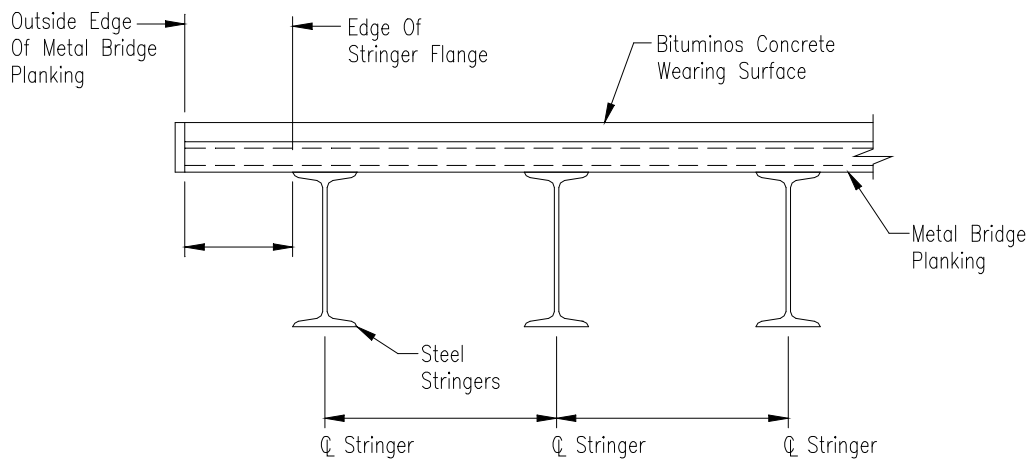
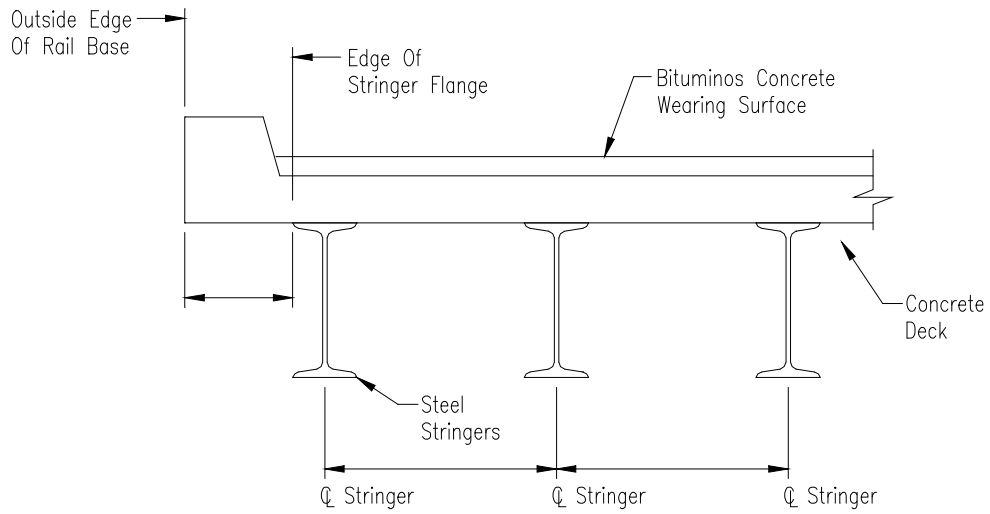
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DIAPHRAGM SPACING



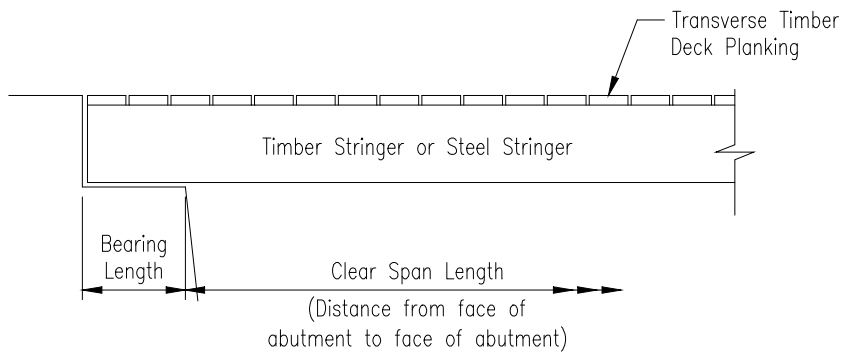
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	CREW:	SHEET

STRINGER SPACINGS

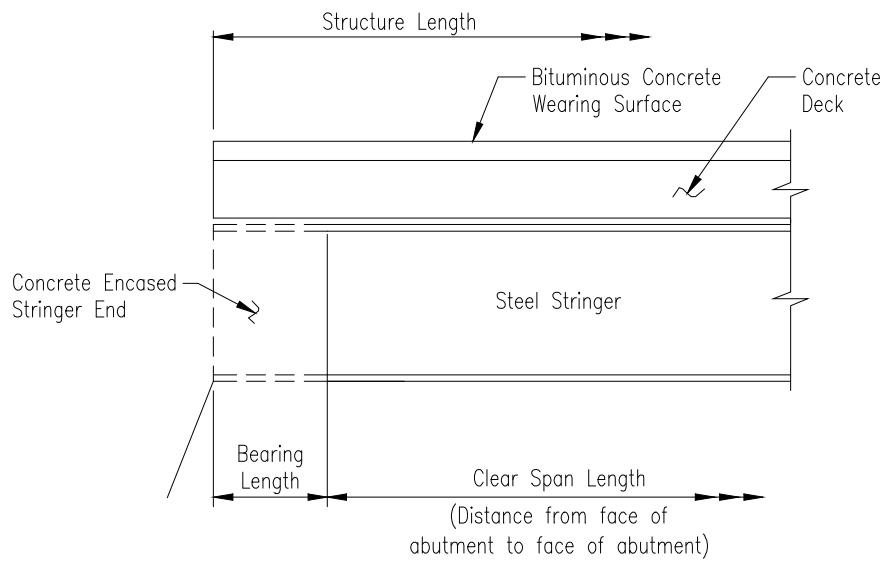


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	CREW:	SHEET

SPAN AND STRUCTURE LENGTH

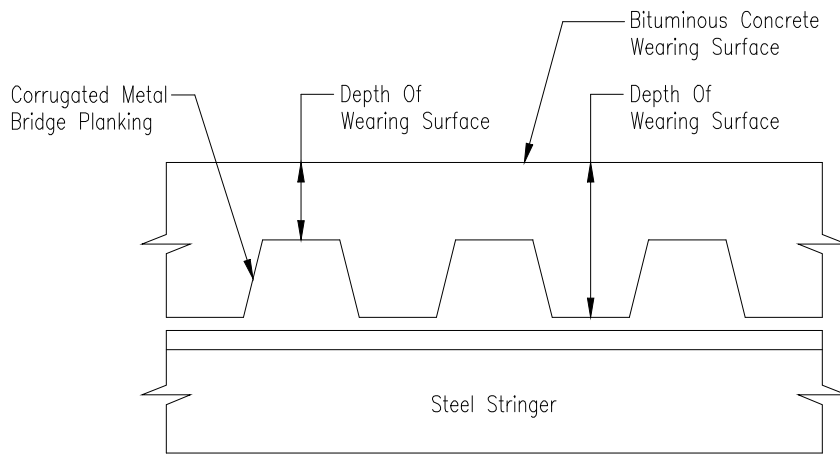
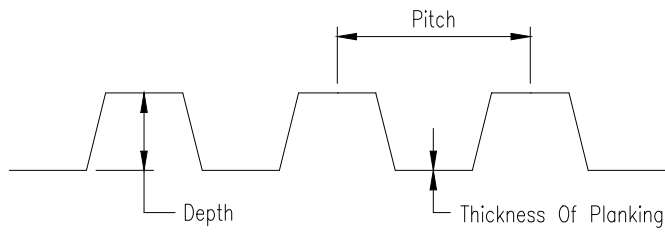


No Bearing Plates.  
The Timber Or Steel Stringer Seating  
On The Abutment Or Pier Seat.



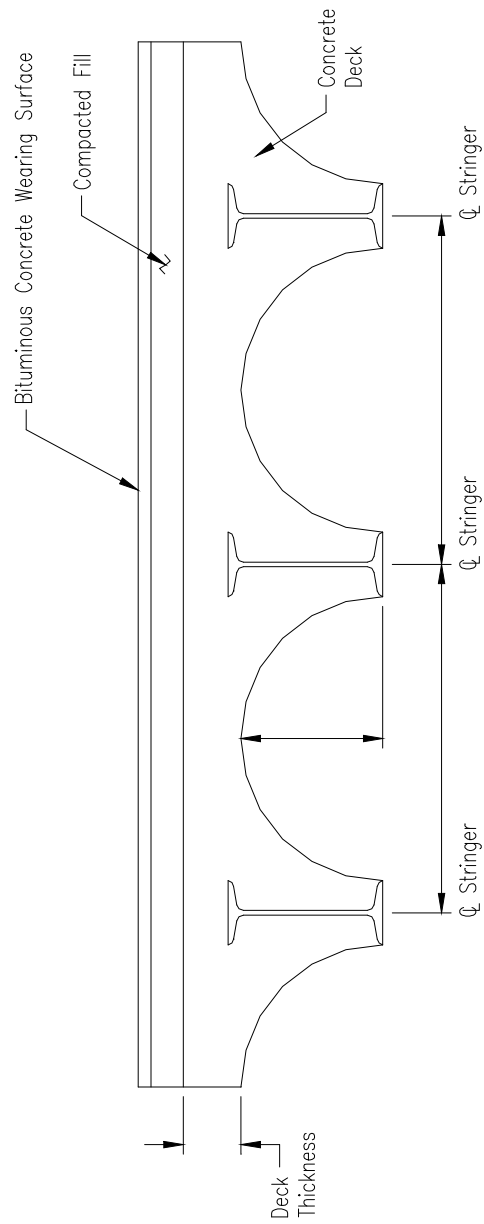
<i>FIELD NOTES</i>	BRIDGE NO.	DATE:
	CREW:	SHEET

CORRUGATED METAL BRIDGE PLANKING



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	CREW:	SHEET

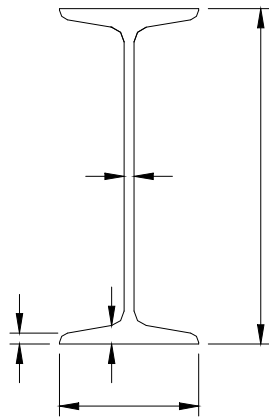
STRINGER SPACING



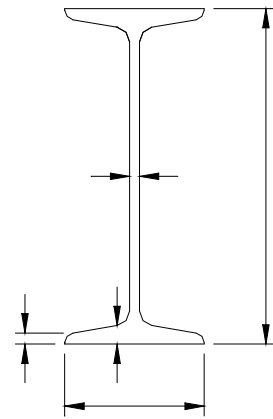


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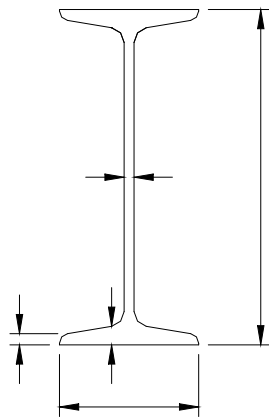
S-SHAPE BEAM



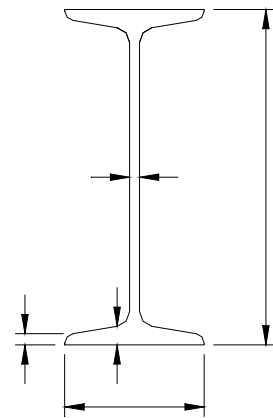
Beam No. \_\_\_\_\_



Beam No. \_\_\_\_\_



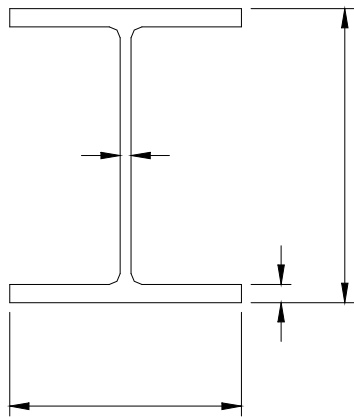
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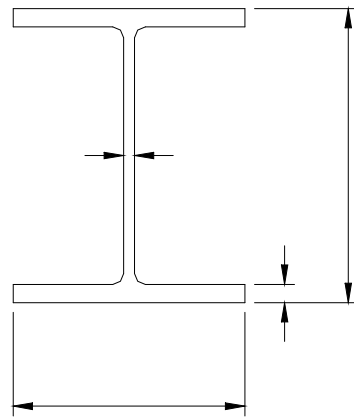
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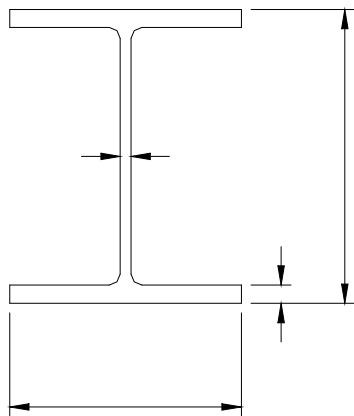
W-SHAPE BEAM



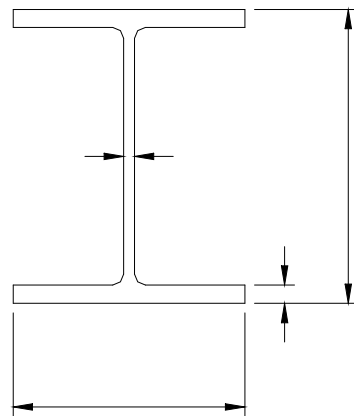
Beam No. \_\_\_\_\_



Beam No. \_\_\_\_\_



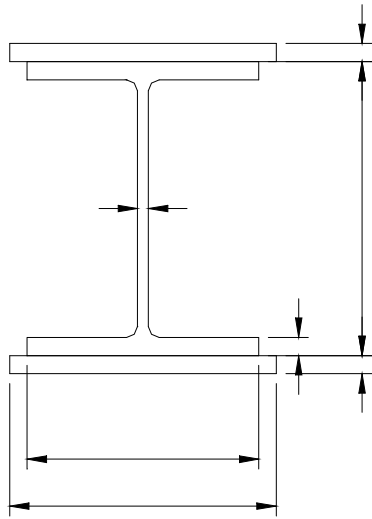
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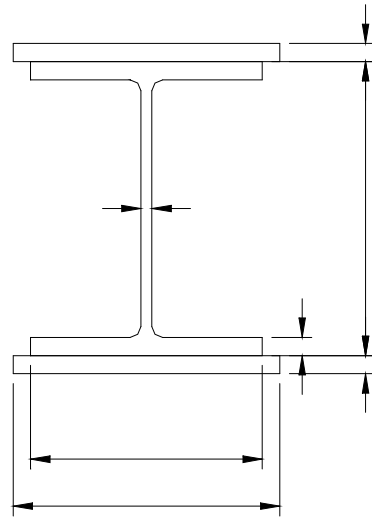
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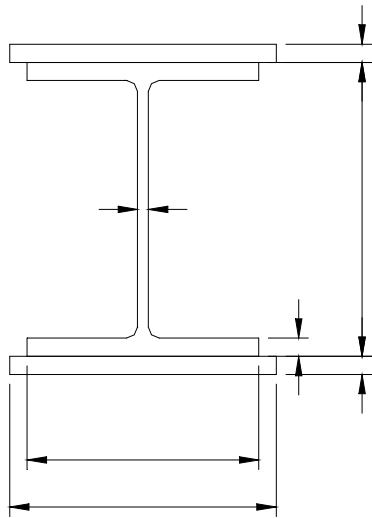
W-SHAPE BEAM WITH COVER PLATE



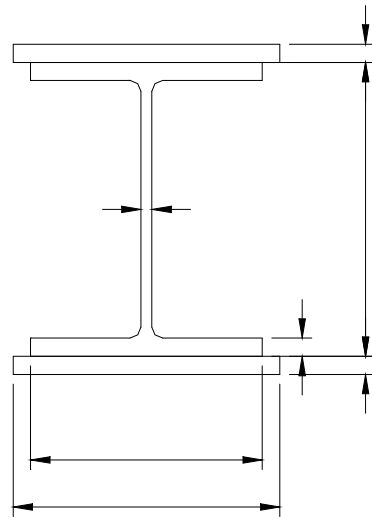
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Beam No. \_\_\_\_\_



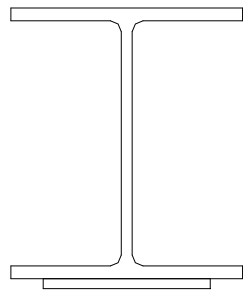
Beam No. \_\_\_\_\_



Beam No. \_\_\_\_\_

<i>FIELD NOTES</i>	BRIDGE NO.	DATE:
	CREW:	SHEET

SECTION LOSS NOTES



W-Shape Beam  
With Cover Plate

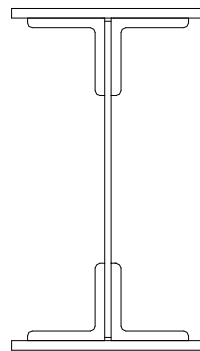
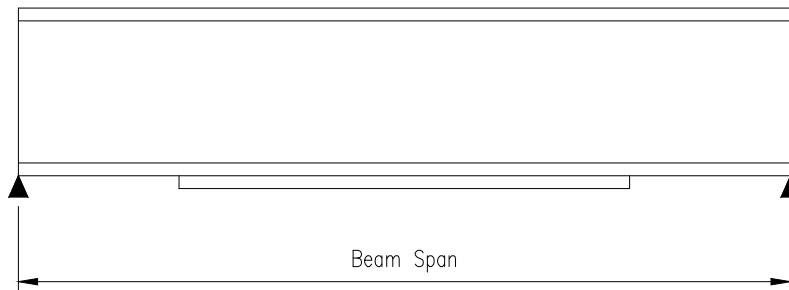


Plate Girder

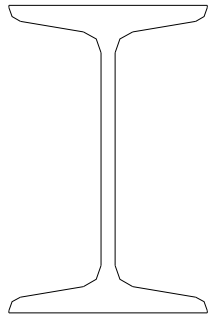


Elevation View

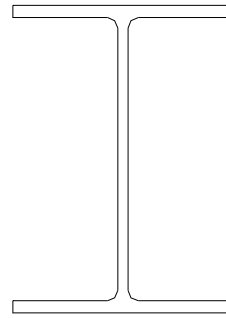
Beam No. \_\_\_\_\_ Span No. \_\_\_\_\_

<i>FIELD NOTES</i>	BRIDGE NO.	DATE:
	CREW:	SHEET

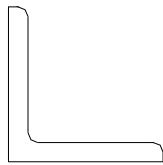
SECTION LOSS NOTES



S-Shape Beam



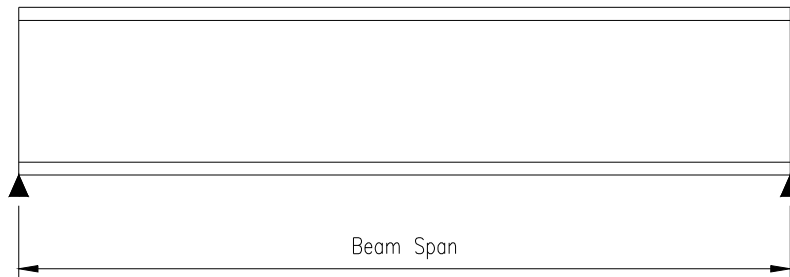
W-Shape Beam



Angle



Channel



Elevation View

Beam No. \_\_\_\_\_ Span No. \_\_\_\_\_

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# Appendix A

imposes on the States. These requirements include the development of procedures for follow-up on critical findings.

In the NPRM published on September 9, 2003, the FHWA proposed a burden increase of 67,000 hours for the information collection, OMB control number 2125-0501, and invited interested parties to send comments regarding any aspect of these information collection requirements. Such comments could include, but were not limited to: (1) Whether the collection of information will be necessary for the performance of the functions of the FHWA, including whether the information will have practical utility; (2) the accuracy of the estimated burden; (3) ways to enhance the quality, utility, and clarity of the collection of information; and (4) ways to minimize the collection burden without reducing the quality of the information collected. The FHWA did not receive any comments in response to the proposed burden hour increase of 67,000 hours. The revision to the information collection, OMB control number 2125-0501, based on this final rule will increase the burden hours by only 2,080 hours, a much smaller amount than that originally proposed in the NPRM.

#### *National Environmental Policy Act*

The agency has analyzed this action for the purpose of the National Environmental Policy Act of 1969 (42 U.S.C. 4321) and has determined that this action will not have any effect on the quality of the environment.

#### *Executive Order 13211 (Energy Effects)*

We have analyzed this rule under Executive Order 13211, Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use. We have determined that it is not a significant energy action under that order, because although it is a significant regulatory action under Executive Order 12866 it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

#### *Regulation Identification Number*

A regulation identification number (RIN) is assigned to each regulatory action listed in the Unified Agenda of Federal Regulations. The Regulatory Information Service Center publishes the Unified Agenda in April and October of each year. The RIN contained in the heading of this document can be used to cross-reference this action with the Unified Agenda.

#### **List of Subjects in 23 CFR Part 650**

Bridges, Grant Programs—transportation, Highways and roads, Incorporation by reference, Reporting and record keeping requirements.

Issued on: December 9, 2004.

**Mary E. Peters,**

*Federal Highway Administrator.*

■ In consideration of the foregoing, the FHWA is amending title 23, Code of Federal Regulations, part 650, subpart C, as follows:

#### **PART 650—BRIDGES, STRUCTURES, AND HYDRAULICS**

■ 1. The authority citation for part 650 continues to read as follows:

**Authority:** 23 U.S.C. 109 (a) and (h), 144, 151, 315, and 319; 33 U.S.C. 401, 491 *et seq.*, 511 *et seq.*; 23 CFR 1.32; 49 CFR 1.48(b), E.O. 11988 (3 CFR, 1977 Comp. p. 117); Department of Transportation Order 5650.2 dated April 23, 1979 (44 FR 24678); sec. 161 of Public Law 97-424, 96 Stat. 2097, 3135; sec. 4(b) of Public Law 97-134, 95 Stat. 1699; and sec. 1057 of Public Law 102-240, 105 Stat. 2002; and sec. 1311 of Pub. L. 105-178, as added by Pub. L. 105-206, 112 Stat. 842 (1998).

■ 2. Revise subpart C to read as follows:

#### **Subpart C—National Bridge Inspection Standards**

Sec.

- 650.301 Purpose.
- 650.303 Applicability.
- 650.305 Definitions.
- 650.307 Bridge inspection organization.
- 650.309 Qualifications of personnel.
- 650.311 Inspection frequency.
- 650.313 Inspection procedures.
- 650.315 Inventory.
- 650.317 Reference manuals.

#### **Subpart C—National Bridge Inspection Standards**

##### **§ 650.301 Purpose.**

This subpart sets the national standards for the proper safety inspection and evaluation of all highway bridges in accordance with 23 U.S.C. 151.

##### **§ 650.303 Applicability.**

The National Bridge Inspection Standards (NBIS) in this subpart apply to all structures defined as highway bridges located on all public roads.

##### **§ 650.305 Definitions.**

Terms used in this subpart are defined as follows:

*American Association of State Highway and Transportation Officials (AASHTO) Manual.* “Manual for Condition Evaluation of Bridges,” second edition, published by the American Association of State Highway and Transportation Officials

(incorporated by reference, *see* § 650.317).

*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 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.

*Bridge inspection experience.* Active participation in bridge inspections in accordance with the NBIS, in either a field inspection, supervisory, or management role. A combination of bridge design, bridge maintenance, bridge construction and bridge inspection experience, with the predominant amount in bridge inspection, is acceptable.

*Bridge inspection refresher training.* The National Highway Institute “Bridge Inspection Refresher Training Course”<sup>1</sup> or other State, local, or federally developed instruction aimed to improve quality of inspections, introduce new techniques, and maintain the consistency of the inspection program.

*Bridge Inspector’s Reference Manual (BIRM).* A comprehensive FHWA manual on programs, procedures and techniques for inspecting and evaluating a variety of in-service highway bridges. This manual may be purchased from the U.S. Government Printing Office, Washington, DC 20402 and from National Technical Information Service, Springfield, Virginia 22161, and is available at the following URL: <http://www.fhwa.dot.gov/bridge/bripub.htm>.

*Complex bridge.* Movable, suspension, cable stayed, and other bridges with unusual characteristics.

*Comprehensive bridge inspection training.* Training that covers all aspects of bridge inspection and enables inspectors to relate conditions observed on a bridge to established criteria (see the Bridge Inspector’s Reference Manual for the recommended material to be covered in a comprehensive training course).

*Critical finding.* A structural or safety related deficiency that requires immediate follow-up inspection or action.

*Damage inspection.* This is an unscheduled inspection to assess structural damage resulting from environmental factors or human actions.

<sup>1</sup> The National Highway Institute training may be found at the following URL: <http://www.nhi.fhwa.dot.gov/>



*Fracture critical member (FCM).* A steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse.

*Fracture critical member inspection.* A hands-on inspection of a fracture critical member or member components that may include visual and other nondestructive evaluation.

*Hands-on.* Inspection within arms length of the component. Inspection uses visual techniques that may be supplemented by nondestructive testing.

*Highway.* The term "highway" is defined in 23 U.S.C. 101(a)(11).

*In-depth inspection.* A close-up, inspection of one or more members above or below the water level to identify any deficiencies not readily detectable using routine inspection procedures; hands-on inspection may be necessary at some locations.

*Initial inspection.* The first inspection of a bridge as it becomes a part of the bridge file to provide all Structure Inventory and Appraisal (SI&A) data and other relevant data and to determine baseline structural conditions.

*Legal load.* The maximum legal load for each vehicle configuration permitted by law for the State in which the bridge is located.

*Load rating.* The determination of the live load carrying capacity of a bridge using bridge plans and supplemented by information gathered from a field inspection.

*National Institute for Certification in Engineering Technologies (NICET).* The NICET provides nationally applicable voluntary certification programs covering several broad engineering technology fields and a number of specialized subfields. For information on the NICET program certification contact: National Institute for Certification in Engineering Technologies, 1420 King Street, Alexandria, VA 22314-2794.

*Operating rating.* The maximum permissible live load to which the structure may be subjected for the load configuration used in the rating.

*Professional engineer (PE).* An individual, who has fulfilled education and experience requirements and passed rigorous exams that, under State licensure laws, permits them to offer engineering services directly to the public. Engineering licensure laws vary from State to State, but, in general, to become a PE an individual must be a graduate of an engineering program accredited by the Accreditation Board for Engineering and Technology, pass the Fundamentals of Engineering exam,

gain four years of experience working under a PE, and pass the Principles of Practice of Engineering exam.

*Program Manager.* The individual in charge of the program, that has been assigned or delegated the duties and responsibilities for bridge inspection, reporting, and inventory. The program manager provides overall leadership and is available to inspection team leaders to provide guidance.

*Public road.* The term "public road" is defined in 23 U.S.C. 101(a)(27).

*Quality assurance (QA).* The use of sampling and other measures to assure the adequacy of quality control procedures in order to verify or measure the quality level of the entire bridge inspection and load rating program.

*Quality control (QC).* Procedures that are intended to maintain the quality of a bridge inspection and load rating at or above a specified level.

*Routine inspection.* Regularly scheduled inspection consisting of observations and/or measurements needed to determine the physical and functional condition of the bridge, to identify any changes from initial or previously recorded conditions, and to ensure that the structure continues to satisfy present service requirements.

*Routine permit load.* A live load, which has a gross weight, axle weight or distance between axles not conforming with State statutes for legally configured vehicles, authorized for unlimited trips over an extended period of time to move alongside other heavy vehicles on a regular basis.

*Scour.* Erosion of streambed or bank material due to flowing water; often considered as being localized around piers and abutments of bridges.

*Scour critical bridge.* A bridge with a foundation element that has been determined to be unstable for the observed or evaluated scour condition.

*Special inspection.* An inspection scheduled at the discretion of the bridge owner, used to monitor a particular known or suspected deficiency.

*State transportation department.* The term "State transportation department" is defined in 23 U.S.C. 101(a)(34).

*Team leader.* Individual in charge of an inspection team responsible for planning, preparing, and performing field inspection of the bridge.

*Underwater diver bridge inspection training.* Training that covers all aspects of underwater bridge inspection and enables inspectors to relate the conditions of underwater bridge elements to established criteria (see the Bridge Inspector's Reference Manual section on underwater inspection for the recommended material to be covered in

an underwater diver bridge inspection training course).

*Underwater inspection.* Inspection of the underwater portion of a bridge substructure and the surrounding channel, which cannot be inspected visually at low water by wading or probing, generally requiring diving or other appropriate techniques.

#### **§ 650.307 Bridge inspection organization.**

(a) 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 that are owned by Federal agencies.

(b) Federal agencies must inspect, or cause to be inspected, all highway bridges located on public roads that are fully or partially located within the respective agency responsibility or jurisdiction.

(c) Each State transportation department or Federal agency must include a bridge inspection organization that is responsible for the following:

(1) Statewide or Federal agencywide bridge inspection policies and procedures, quality assurance and quality control, and preparation and maintenance of a bridge inventory.

(2) Bridge inspections, reports, load ratings and other requirements of these standards.

(d) Functions identified in paragraphs (c)(1) and (2) of this section may be delegated, but such delegation does not relieve the State transportation department or Federal agency of any of its responsibilities under this subpart.

(e) The State transportation department or Federal agency bridge inspection organization must have a program manager with the qualifications defined in § 650.309(a), who has been delegated responsibility for paragraphs (c)(1) and (2) of this section.

#### **§ 650.309 Qualifications of personnel.**

(a) A program manager must, at a minimum:

(1) Be a registered professional engineer, or have ten years bridge inspection experience; and

(2) Successfully complete a Federal Highway Administration (FHWA) approved comprehensive bridge inspection training course.

(b) There are five ways to qualify as a team leader. A team leader must, at a minimum:

(1) Have the qualifications specified in paragraph (a) of this section; or

(2) Have five years bridge inspection experience and have successfully completed an FHWA approved comprehensive bridge inspection training course; or

(3) Be certified as a Level III or IV Bridge Safety Inspector under the National Society of Professional Engineer's program for National Certification in Engineering Technologies (NICET) and have successfully completed an FHWA approved comprehensive bridge inspection training course, or

(4) Have all of the following:

(i) A bachelor's degree in engineering from a college or university accredited by or determined as substantially equivalent by the Accreditation Board for Engineering and Technology;

(ii) Successfully passed the National Council of Examiners for Engineering and Surveying Fundamentals of Engineering examination;

(iii) Two years of bridge inspection experience; and

(iv) Successfully completed an FHWA approved comprehensive bridge inspection training course, or

(5) Have all of the following:

(i) An associate's degree in engineering or engineering technology from a college or university accredited by or determined as substantially equivalent by the Accreditation Board for Engineering and Technology;

(ii) Four years of bridge inspection experience; and

(iii) Successfully completed an FHWA approved comprehensive bridge inspection training course.

(c) The individual charged with the overall responsibility for load rating bridges must be a registered professional engineer.

(d) An underwater bridge inspection diver must complete an FHWA approved comprehensive bridge inspection training course or other FHWA approved underwater diver bridge inspection training course.

#### § 650.311 Inspection frequency.

(a) *Routine inspections.* (1) Inspect each bridge at regular intervals not to exceed twenty-four months.

(2) Certain bridges require inspection at less than twenty-four-month intervals. Establish criteria to determine the level and frequency to which these bridges are inspected considering such factors as age, traffic characteristics, and known deficiencies.

(3) Certain bridges may be inspected at greater than twenty-four month intervals, not to exceed forty-eight-months, with written FHWA approval. This may be appropriate when past inspection findings and analysis justifies the increased inspection interval.

(b) *Underwater inspections.* (1) Inspect underwater structural elements at regular intervals not to exceed sixty months.

(2) Certain underwater structural elements require inspection at less than sixty-month intervals. Establish criteria to determine the level and frequency to which these members are inspected considering such factors as construction material, environment, age, scour characteristics, condition rating from past inspections and known deficiencies.

(3) Certain underwater structural elements may be inspected at greater than sixty-month intervals, not to exceed seventy-two months, with written FHWA approval. This may be appropriate when past inspection findings and analysis justifies the increased inspection interval.

(c) *Fracture critical member (FCM) inspections.* (1) Inspect FCMs at intervals not to exceed twenty-four months.

(2) Certain FCMs require inspection at less than twenty-four-month intervals. Establish criteria to determine the level and frequency to which these members are inspected considering such factors as age, traffic characteristics, and known deficiencies.

(d) Damage, in-depth, and special inspections. Establish criteria to determine the level and frequency of these inspections.

#### § 650.313 Inspection procedures.

(a) Inspect each bridge in accordance with the inspection procedures in the AASHTO Manual (incorporated by reference, *see* § 650.317).

(b) Provide at least one team leader, who meets the minimum qualifications stated in § 650.309, at the bridge at all times during each initial, routine, in-depth, fracture critical member and underwater inspection.

(c) Rate each bridge as to its safe load-carrying capacity in accordance with the AASHTO Manual (incorporated by reference, *see* § 650.317). Post or restrict the bridge in accordance with the AASHTO Manual or in accordance with State law, when the maximum unrestricted legal loads or State routine permit loads exceed that allowed under the operating rating or equivalent rating factor.

(d) Prepare bridge files as described in the AASHTO Manual (incorporated by reference, *see* § 650.317). Maintain reports on the results of bridge inspections together with notations of any action taken to address the findings of such inspections. Maintain relevant maintenance and inspection data to allow assessment of current bridge condition. Record the findings and results of bridge inspections on standard State or Federal agency forms.

(e) Identify bridges with FCMs, bridges requiring underwater inspection, and bridges that are scour critical.

(1) Bridges with fracture critical members. In the inspection records, identify the location of FCMs and describe the FCM inspection frequency and procedures. Inspect FCMs according to these procedures.

(2) Bridges requiring underwater inspections. Identify the location of underwater elements and include a description of the underwater elements, the inspection frequency and the procedures in the inspection records for each bridge requiring underwater inspection. Inspect those elements requiring underwater inspections according to these procedures.

(3) Bridges that are scour critical. Prepare a plan of action to monitor known and potential deficiencies and to address critical findings. Monitor bridges that are scour critical in accordance with the plan.

(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.

(g) *Quality control and quality assurance.* Assure systematic quality control (QC) and quality assurance (QA) procedures are used to maintain a high degree of accuracy and consistency in the inspection program. Include periodic field review of inspection teams, periodic bridge inspection refresher training for program managers and team leaders, and independent review of inspection reports and computations.

(h) *Follow-up on critical findings.* Establish a statewide or Federal agency wide procedure to assure that critical findings are addressed in a timely manner. Periodically notify the FHWA of the actions taken to resolve or monitor critical findings.

#### § 650.315 Inventory.

(a) Each State or Federal agency must prepare and maintain an inventory of all bridges subject to the NBIS. Certain Structure Inventory and Appraisal (SI&A) data must be collected and retained by the State or Federal agency for collection by the FHWA as requested. A tabulation of this data is contained in the SI&A sheet distributed by the FHWA as part of the "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges," (December 1995) together with subsequent interim changes or the most recent version. Report the data using FHWA established procedures as

outlined in the "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges."

(b) For routine, in-depth, fracture critical member, underwater, damage and special inspections enter the SI&A data into the State or Federal agency inventory within 90 days of the date of inspection for State or Federal agency bridges and within 180 days of the date of inspection for all other bridges.

(c) For existing bridge modifications that alter previously recorded data and for new bridges, enter the SI&A data into the State or Federal agency inventory within 90 days after the completion of the work for State or Federal agency bridges and within 180 days after the completion of the work for all other bridges.

(d) For changes in load restriction or closure status, enter the SI&A data into the State or Federal agency inventory within 90 days after the change in status of the structure for State or Federal agency bridges and within 180 days after the change in status of the structure for all other bridges.

#### **§ 650.317 Reference manuals.**

(a) The materials listed in this subpart are incorporated by reference in the corresponding sections noted. These incorporations by reference were approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. These materials are incorporated as they exist on the date of the approval, and notice of any change in these documents will be published in the **Federal Register**. The materials are available for purchase at the address listed below, and are available for inspection at the National Archives and Records Administration (NARA). These materials may also be reviewed at the Department of Transportation Library, 400 Seventh Street, SW., Washington, DC, in Room 2200. For information on the availability of these materials at NARA call (202) 741-6030, or go to the following URL: [http://www.archives.gov/federal\\_register/](http://www.archives.gov/federal_register/)

[code\\_of\\_federal\\_regulations/ibr\\_locations.html](http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html). In the event there is a conflict between the standards in this subpart and any of these materials, the standards in this subpart will apply.

(b) The following materials are available for purchase from the American Association of State Highway and Transportation Officials, Suite 249, 444 N. Capitol Street, NW., Washington, DC 20001. The materials may also be ordered via the AASHTO bookstore located at the following URL: <http://www.aashto.org/aashto/home.nsf/FrontPage>.

(1) The Manual for Condition Evaluation of Bridges, 1994, second edition, as amended by the 1995, 1996, 1998, and 2000 interim revisions, AASHTO, incorporation by reference approved for §§ 650.305 and 650.313.

(2) 2001 Interim Revision to the Manual for Condition Evaluation of Bridges, AASHTO, incorporation by reference approved for §§ 650.305 and 650.313.

(3) 2003 Interim Revision to the Manual for Condition Evaluation of Bridges, AASHTO, incorporation by reference approved for §§ 650.305 and 650.313.

[FR Doc. 04-27355 Filed 12-13-04; 8:45 am]

**BILLING CODE 4910-22-P**

## **DEPARTMENT OF THE TREASURY**

### **31 CFR Part 103**

#### **Financial Crimes Enforcement Network; Interpretive Release 2004-1—Anti-Money Laundering Program Requirements for Money Services Businesses With Respect to Foreign Agents or Foreign Counterparties**

**AGENCY:** Financial Crimes Enforcement Network (FinCEN), Treasury.

**ACTION:** Final rule; interpretive release.

**SUMMARY:** This Interpretive Release sets forth an interpretation of the regulation requiring Money Services Businesses that are required to register with FinCEN to establish and maintain anti-money laundering programs. Specifically, this Interpretive Release clarifies that the anti-money laundering program regulation requires such Money Services Businesses to establish adequate and appropriate policies, procedures and controls commensurate with the risk of money laundering and the financing of terrorism posed by their relationship with foreign agents or foreign counterparties of the Money Services Business.

**DATES:** Effective June 13, 2005.

**FOR FURTHER INFORMATION CONTACT:**

Office of Regulatory Policy and Programs Division, 1-800-800-2877, Office of Chief Counsel (703) 905-3590 (not a toll free number).

**SUPPLEMENTARY INFORMATION:** Section 5318(h) of the Bank Secrecy Act, which is codified in subchapter II of chapter 53 of title 31, United States Code, requires every financial institution to establish an anti-money laundering program. The Bank Secrecy Act regulations define financial institution to include money service businesses. On April 29, 2002, FinCEN issued interim final rules-31

CFR 103.125-concerning the application of the anti-money laundering program requirement to money services businesses. 67 FR 21114.

#### **List of Subjects in 31 CFR Part 103**

Authority delegations (government agencies), bank, banking, currency, investigations, reporting and recordkeeping requirements.

#### **Department of the Treasury**

##### *31 CFR Chapter I*

#### **Authority and Issuance**

■ For the reasons set forth in the preamble, part 103 of title 31 of the Code of Federal Regulations is amended as follows:

#### **PART 103—FINANCIAL RECORDKEEPING AND REPORTING OF CURRENCY AND FOREIGN TRANSACTIONS**

■ 1. The authority citation for part 103 continues to read as follows:

**Authority:** 12 U.S.C. 1829b and 1951-1959; 31 U.S.C. 5311-5314 and 5316-5332; title III, secs. 312, 313, 314, 319, 326, 352, Pub. L. 107-56, 115 Stat. 307, 12 U.S.C. 1786(q).

■ 2. Part 103 is amended by adding a new appendix C to read as follows:

#### **APPENDIX C TO PART 103—INTERPRETIVE RULES**

##### **Release No. 2004-01**

This Interpretive Guidance sets forth our interpretation of the regulation requiring Money Services Businesses that are required to register with FinCEN to establish and maintain anti-money laundering programs. See 31 CFR 103.125. Specifically, this Interpretive Guidance clarifies that the anti-money laundering program regulation requires Money Services Businesses to establish adequate and appropriate policies, procedures, and controls commensurate with the risks of money laundering and the financing of terrorism posed by their relationship with foreign agents or foreign counterparties of the Money Services Business.<sup>1</sup>

Under existing Bank Secrecy Act regulations, we have defined Money Services Businesses to include five distinct types of financial services providers and the U.S. Postal Service: (1) Currency dealers or exchangers; (2) check cashers; (3) issuers of traveler's checks, money orders, or stored

<sup>1</sup> This Interpretive Guidance focuses on the need to control risks arising out of the relationship between a Money Service Business and its foreign counterparty or agent. Under existing FinCEN regulations, only Money Service Business principals are required to register with FinCEN, and only Money Service Business principals establish the counterparty or agency relationships. 31 CFR 103.41. Accordingly, this Interpretive Guidance only applies to those Money Service Businesses required to register with FinCEN, that is, only those Money Service Businesses that may have a relationship with a foreign agent or counterparty.

# TITLE XX

## TRANSPORTATION

### CHAPTER 229

#### HIGHWAY SYSTEM IN THE STATE

##### Section 229:5

**229:5 Classification.** – Highways of the state shall be divided into 7 classes as follows:

I. Class I highways shall consist of all existing or proposed highways on the primary state highway system, excepting all portions of such highways within the compact sections of the cities and towns listed in RSA 229:5, V, provided that the portions of the turnpikes and the national system of interstate and defense highways within the compact sections of these cities and towns shall be class I highways.

II. Class II highways shall consist of all existing or proposed highways on the secondary state highway system, excepting all portions of such highways within the compact sections of the cities and towns listed in RSA 229:5, V.

III. Class III highways shall consist of all recreational roads leading to, and within, state reservations designated by the legislature.

III-a. Class III-a highways shall consist of new boating access highways from any existing highway to any public water in this state. All class III-a highways shall be limited access facilities as defined in RSA 230:44. Class III-a highways shall be subject to the layout, design, construction, and maintenance provisions of RSA 230:45-47 and all other provisions relative to limited access facilities, except that the executive director of the fish and game department shall have the same authority for class III-a highways that is delegated to the commissioner of the department of transportation for limited access facilities. A class III-a highway may be laid out subject to the condition that it shall not be maintained during the winter months. A class III-a highway may be laid out subject to gates and bars or restricted to the accommodation of persons on foot, or certain vehicles, or both, if federal funds are not used. The executive director of fish and game may petition the governor and council to discontinue any class III-a highway.

IV. Class IV highways shall consist of all highways within the compact sections of cities and towns listed in RSA 229:5, V. The compact section of any such city or town shall be the territory within such city or town where the frontage on any highway, in the opinion of the commissioner of transportation, is mainly occupied by dwellings or buildings in which people live or business is conducted, throughout the year and not for a season only. Whenever the commissioner reclassifies a section of a class I or class II

highway as a class IV highway, the commissioner shall prepare a statement of rehabilitation work which shall be performed by the state in connection with the turnback. No highway reclassification from class I or II to class IV shall take effect until all rehabilitation needed to return the highway surface to reputable condition has been completed by the state. Rehabilitation shall be completed during the calendar year preceding the effective date of the reclassification. A copy of the commissioner's statement of work to be performed by the state shall be attached to the notification of reclassification to class IV, and receipt of said statement shall be acknowledged, in writing, by the selectmen of the town, or the mayor of the city, affected by the reclassification.

V. The commissioner of transportation may establish compact sections in the following cities and towns:

Amherst Keene  
Bedford Laconia  
Berlin Lebanon  
Claremont Londonderry  
Concord Manchester  
Derry Merrimack  
Dover Milford  
Durham Nashua  
Exeter Pelham  
Franklin Portsmouth  
Goffstown Rochester  
Hampton Salem  
Hanover Somersworth  
Hudson

VI. Class V highways shall consist of all other traveled highways which the town has the duty to maintain regularly and shall be known as town roads. Any public highway which at one time lapsed to Class VI status due to 5-years' nonmaintenance, as set forth in RSA 229:5, VII, but which subsequently has been regularly maintained and repaired by the town on more than a seasonal basis and in suitable condition for year-round travel thereon for at least 5 successive years without being declared an emergency lane pursuant to RSA 231:59-a, shall be deemed a Class V highway.

VII. Class VI highways shall consist of all other existing public ways, and shall include all highways discontinued as open highways and made subject to gates and bars, except as provided in paragraph III-a, and all highways which have not been maintained and repaired by the town in suitable condition for travel thereon for 5 successive years or more except as restricted by RSA 231:3, II.

**Source.** 1925, 110:1. PL 83:22. RL 99:24. 1943, 123:1. 1945, 188:1, part 1:4. 1951, 30:1. RSA 230:4. 1955, 333:2. 1957, 181:1, 2, 3. 1961, 4:2. 1973, 418:1-3. 1975,

249:1-3. 1979, 216:1. 1981, 87:1; 443:1. 1983, 131:1. 1985, 235:1-4; 402:6, I(b)(1).  
1992, 265:8-10. 1995, 77:1. 1999, 109:1. 2000, 24:1, eff. May 28, 2000.

## *Appendix B*

# Bridge Inspection Regions



## Chief Bridge Inspector

(KLM) Ken Morrison  
 Work Cell: 419-9539  
 Vehicle: H-130

### A-Team

(MAH) Mark Huntoon  
 (TDC) Tom Clement  
 Work Cell: 419-9548  
 Van: H-1528

### B-Team

(MTC) Todd Courser  
 (MHC) Mike Courser  
 Work Cell: 419-9549  
 Van: H-1670

### C-Team

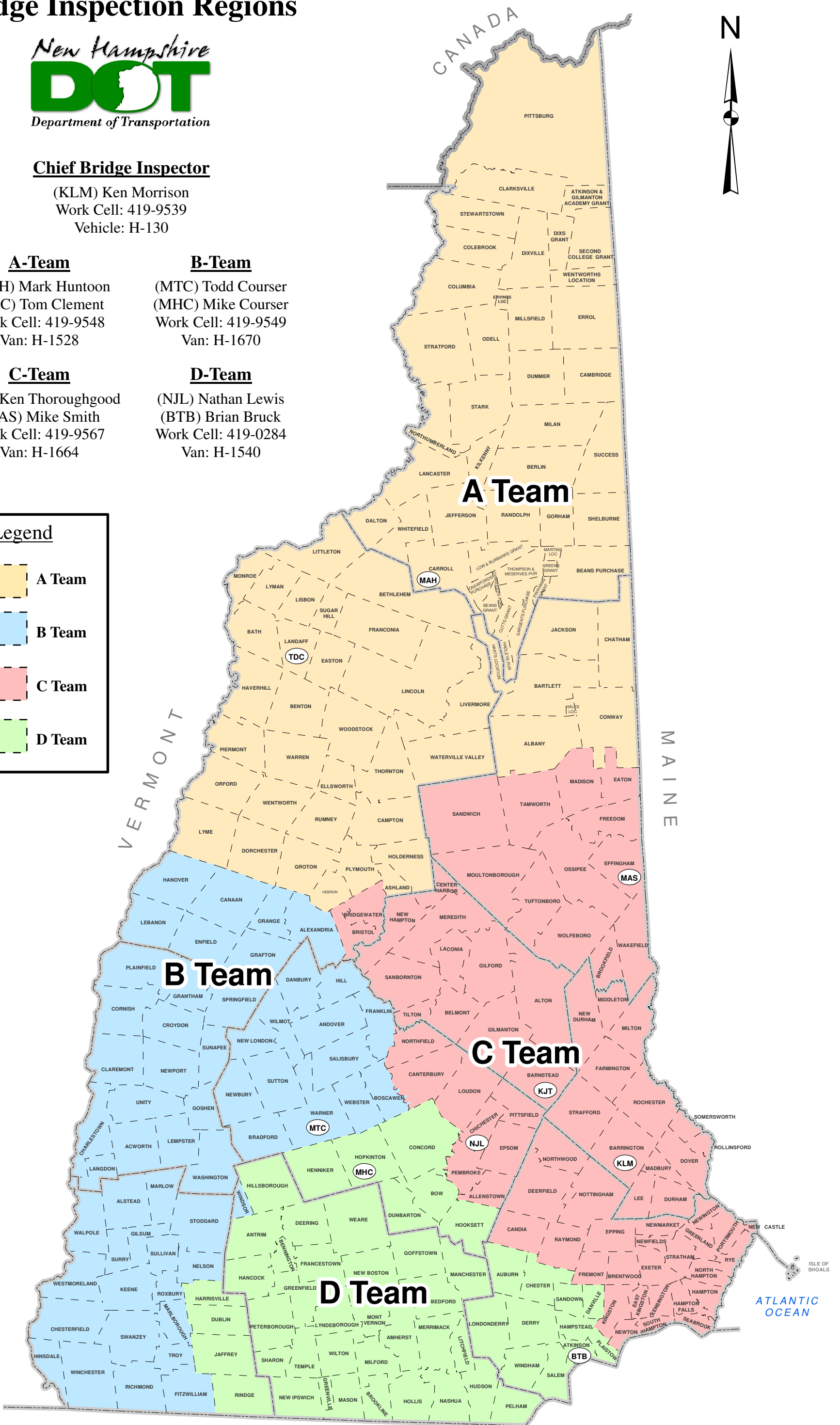
(KJT) Ken Thoroughgood  
 (MAS) Mike Smith  
 Work Cell: 419-9567  
 Van: H-1664

### D-Team

(NJL) Nathan Lewis  
 (BTB) Brian Bruck  
 Work Cell: 419-0284  
 Van: H-1540

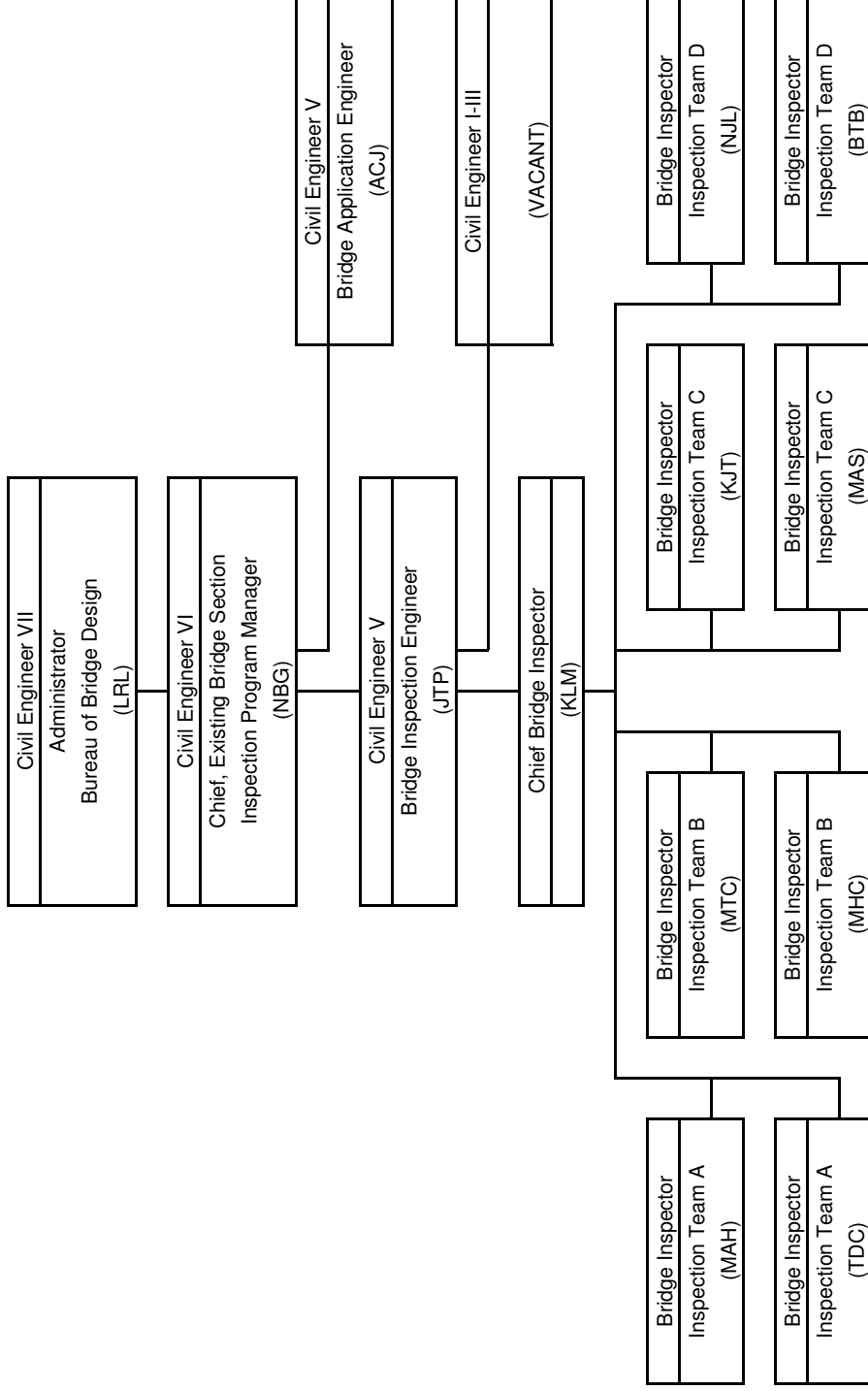
### Legend

	<b>A Team</b>
	<b>B Team</b>
	<b>C Team</b>
	<b>D Team</b>





# Organizational Chart - NHDOT Existing Bridge Section



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## *Appendix C*

# INDEPENDENT QA BRIDGE INSPECTION EVALUATION FORM

DATE OF QA REVIEW \_\_\_\_\_ EVALUATION BY \_\_\_\_\_

WEATHER CONDITIONS \_\_\_\_\_

## MOST RECENT INSPECTION INFORMATION

TEAM LEADER NAME \_\_\_\_\_ TEAM \_\_\_\_\_ INSPECTION DATE \_\_\_\_\_

NH BRIDGE ID \_\_\_\_\_ BRIDGE TYPE \_\_\_\_\_ FED DEF Y / N

INSPECTOR RATINGS \_\_\_\_\_ CHANNEL PROTECTION \_\_\_\_\_ APPROACH ROADWAY ALIGNMENT \_\_\_\_\_

EVALUATOR RATINGS \_\_\_\_\_ CHANNEL PROTECTION \_\_\_\_\_ APPROACH ROADWAY ALIGNMENT \_\_\_\_\_

CONDITION RATINGS/APPRaisal COMMENTS \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RECOMMENDED WEIGHT POSTING \_\_\_\_\_ SIGNS PRESENT? Y / N

WEIGHT POSTING COMMENTS \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

RECOMMENDED VERTICAL CLEARANCE \_\_\_\_\_ SIGNS PRESENT? Y / N

VERTICAL CLEARANCE POSTING COMMENTS \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

RECOMMENDED WIDTH SIGNS \_\_\_\_\_ SIGNS PRESENT? Y / N

HORIZONTAL CLEARANCE/WIDTH POSTING COMMENTS \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

GENERAL COMMENTS AND FINDINGS \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REPORT REVIEWED BY \_\_\_\_\_ DATE \_\_\_\_\_

# TEAM LEADER EVALUATION

DATE \_\_\_\_\_

NAME \_\_\_\_\_ TEAM \_\_\_\_\_ EVALUATION BY \_\_\_\_\_

TOWN \_\_\_\_\_ BRIDGE NUMBER \_\_\_\_\_ BRIDGE TYPE \_\_\_\_\_ FED DEF Y / N

INSPECTORS RATINGS \_\_\_\_\_ CHANNEL PROTECTION \_\_\_\_\_ APPROACH ROADWAY ALIGNMENT \_\_\_\_\_

EVALUATOR RATINGS \_\_\_\_\_ CHANNEL PROTECTION \_\_\_\_\_ APPROACH ROADWAY ALIGNMENT \_\_\_\_\_

COMMENTS ON RATINGS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

FOLLOWED PROPER INSPECTION PROCEDURE Y / N

COMMENTS ON PROCEDURE \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

ARE REFERENCE MATERIALS AND MANUALS AVAILABLE TO THEM Y / N \_\_\_\_\_

EQUIPMENT USED \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PROPER PPE Y / N COMMENTS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

FOLLOWED PROPER SAFETY PROCEDURE Y / N COMMENTS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

GENERAL COMMENTS AND FINDINGS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REPORT REVIEWED BY \_\_\_\_\_ DATE \_\_\_\_\_

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