CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

The collapse of the "Silver Bridge" at Point Pleasant, West Virginia in 1967, and the subsequent investigation of the reasons for the failure of the structure, led to a congressional mandate to the US Department of Transportation/Federal Highway Administration (**USDOT/FHWA**) to develop a nationwide program of bridge inspections and suitable standards for these inspections. This led to the development of federal regulations known as the National Bridge Inspection Standards (NBIS).

The Massachusetts Department of Transportation, hence forth referred to as MassDOT, (formerly MassDPW) in 1970 began to formalize the inspection of MassDOT owned bridges in the Commonwealth by instituting a Bridge Inspection Program.

MassDOT's original program did not address bridges owned by other agencies or by cities and towns. This was the subject of subsequent findings from FHWA that also made federal funds available for the inspection of city and town owned bridges and "off-system" bridges. Presently, MassDOT inspects all city and town owned bridges that meet the federal definition of a bridge. MassDOT performs these inspections in recognition that various cities and towns do not have the ability to maintain and finance their own inspection programs that meet the NBIS and under the authority of Massachusetts General Laws (M.G.L.) Chapter 85 Section 35, which gives MassDOT the responsibility to determine the safe load carrying capacity of municipally owned bridges, something that cannot be accurately done without a bridge inspection.

In addition, MassDOT acts as "Lead Agency" in interaction with USDOT/FHWA. MassDOT is responsible for maintaining the inventory of all bridges within the Commonwealth. Other state agencies owning bridges in the Commonwealth maintain their own inspection programs, using the same NBIS criteria and report the results of inspections to MassDOT periodically for inclusion into the MassDOT submission to USDOT/FHWA.

1.2 PURPOSES OF BRIDGE INSPECTION

There are several warrants that justify the Bridge Inspection Program:

- Assure the safety of the traveling public on bridges
- Achieve and maintain compliance with the National Bridge Inspection Standards (NBIS) assuring eligibility for Federal-Aid Highway Bridge Replacement and Rehabilitation Program Funds
- Identify deficiencies to incorporate into the Asset Management Program that would initiate maintenance activities on and/or rehabilitation/replacement of structures

1.3 FUNCTIONS

The functions of a Bridge Inspection Unit include:

- Conducting bridge inspections
- Reporting the results of the inspections
- Evaluating the inspection results
- Maintaining a Bridge History File documenting the condition of all bridges in the State
- Maintaining an electronic bridge management and inventory database

To fulfill these functions, it is necessary to:

- Supervise and coordinate the work of the inspection force
- Provide training to the inspectors
- Review their performance
- Maintain records of inventories, inspections and bridge ratings
- Report the deficiencies found during inspection to appropriate authorities
- Report the safe load carrying capacity for bridges to the appropriate authorities
- Initiate recommendation to the State Bridge Engineer to reduce load limits or close bridges where necessary

1.4 NATIONAL BRIDGE INSPECTION STANDARDS (NBIS)

The National Bridge Inspection Standards (NBIS) were first established in 1971 to set national policy regarding bridge inspection frequency, inspector qualifications, report formats, and inspection and rating procedures. The NBIS can be found in 23 CFR 650 Subpart C.

In addition, MassDOT has established its own standards as stated in Policy Directive Number P-13-002 dated 3/15/13; see Attachment 1-1.

1.4.1 MassDOT Qualification's and Training Requirements

All bridges in the NBIS Bridge Inventory shall be inspected by Teams lead by Team Leaders that meet the qualifications outlined in 23 CFR 650 Subpart C. MassDOT requires any Inspection Personnel participating in the inspection program to receive bridge inspection refresher training at a minimum of five year intervals. All requirements mentioned above also apply to consultant personnel that are performing inspections on behalf of the Department.

1.4.1.1 Team Leader Qualifications

All Team Leaders shall meet the requirements set forth and outlined in 23 CFR 650 Subpart C.

1.4.1.2 Team Member Qualifications

A Team Member must be physically able to participate and assist the Team Leader in performing the necessary functions of an inspection, which may require the individual to pick up and move a ladder, wade thru water in chest waders, lift and place a boat in waterways, and participate in inspections that require entering confined spaces.

It is desirable that all potential new Team Members meet **one** of the three prerequisite requirements for participation in a NHI course entitled *Safety Inspection of In-Service Bridges* (Course Number FHWA-NHI-130055), which they will have to participate in and successfully

pass. The three prerequisite requirements are 1) NHI course entitled *Engineering Concepts for Bridge Inspectors* (Course Number FHWA-NHI-130054), 2) NHI course entitled *Introduction to Safety Inspection of In-Service Bridges* (Course Number FHWA-NHI-130101), and/or 3) NHI course entitled a *Prerequisite Assessment for Safety Inspection of In-Service Bridges* (Course Number FHWA-NHI-130101A). The Team Member will be given an initial period of three months to fulfill the prerequisite requirements and upon successful completion, shall be enrolled in the next available session for the NHI course entitled *Safety Inspection of In-Service Bridges.*

1.4.2 Applicable Reference Materials for Bridge Inspectors

The proper reference material to be used by the bridge inspection personnel is to be the latest editions of the following:

- FHWA NHI Bridge Inspector's Reference Manual (BIRM)
- FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges
- AASHTO Manual for Bridge Evaluation (MBE)
- AASHTO Movable Bridge Inspection, Evaluation and Maintenance Manual
- Manual on Uniform Traffic Control Devices (MUTCD)
- AASHTO Element Level Inspection Manual
- 23 CFR 650 Subpart C (NBIS)
- MassHighway Work Zone Safety Manual

In order to carry out inspection function in accordance with the NBIS, the Bridge Inspectors shall follow all of the rules, regulations and technical data that pertain to Bridge Inspection contained in the latest editions of the above reference manuals.

1.5 BRIDGE INVENTORY DATABASE

As the "Lead Agency" in interactions with USDOT/FHWA, it is MassDOT's responsibility to maintain an inventory of all bridges within the Commonwealth. The inventory database that MassDOT uses for this purpose is called the *Bridge Inspection Management System*, which MassDOT developed for this purpose by customizing the commercially available 4D database software.

Each bridge in this database is inventoried by a unique Bridge Number (BDEPT) and Bridge Identification Number (BIN) combination, which are issued only by MassDOT. The Bridge Number and BIN also make up part of the Item 8 Structure Number that the USDOT/FHWA uses to identify Massachusetts bridge inventory data in its National Bridge Inventory.

Other state agencies, who own bridges in the Commonwealth, maintain their own inspection programs, using the same NBIS criteria as does MassDOT and they report the results of their inspections to MassDOT periodically for inclusion into the annual MassDOT submission of the bridge inventory to USDOT/FHWA. However, even if these agencies have their own inventory numbers for these structures, these bridges still require a unique MassDOT assigned Bridge Number and BIN combination for inclusion into the MassDOT bridge inventory.

Furthermore, the *Bridge Inspection Management System* is not limited to the inventory of NBIS length bridge structures. Massachusetts General Laws define a structure carrying a public highway with a span of over 10 feet as a bridge that comes under MassDOT purview. The MassDOT bridge inventory also includes other Non-NBIS structures such as: railroad structures, primarily owned by the MBTA, currently carrying live or abandoned rail lines over water and roadways; pedestrian or bikeway structures; culvert structures with a clear span of 4 feet or greater; structures carrying utilities over roadways and waterways; tunnels for vehicular access; and buildings constructed over roadways. These Non-NBIS structures are also issued a Bridge Number and BIN combination so that they can be included in the bridge inventory.

As a result, such structures regardless of owner must be issued a Bridge Number and BIN. There are usually two situations that will warrant a request for a BDEPT and/or BIN. The situations are:

1. An existing structure not previously in the inventory
2. A structure that is under design as a new structure or a replacement of an existing structure

Agencies requiring a BDEPT and/or BIN can submit a request to the State Bridge Engineer along with the necessary documentation. Other MassDOT responsible parties and municipalities that are involved in the design, rehabilitation or replacement of existing structures, including culverts, should submit a BDEPT/BIN request to make sure that the inventory numbers they are using are correct or if new numbers should be issued, based on the type of project.

All requests are to be submitted to the State Bridge Engineer in accordance with the procedures outlined in Section 9.3. The State Bridge Engineer will decide if a new BDEPT and/or BIN should be issued or not. When requesting a Bridge Number/BIN, the Bridge Number/BIN Request Form, shown in Attachment 1-2, shall be used. The request shall have back-up documentation that includes: for bridges under design, plan and elevation sheet from the Sketch Plans; for existing bridges being inventoried for the first time, plans (if available), the physical location of the structure (google map, latitude and longitude coordinates), and photos (elevation, underside and approaches).

1.6 ABOUT THE HANDBOOK

It is the policy of MassDOT to comply with or exceed NBIS Standards. MassDOT policies of a general and specific nature that apply to the Bridge Inspection Unit are included in each of the chapters of this Handbook.

The purpose of the Bridge Inspection Handbook is to provide direction for the Bridge Inspection Unit (BIU) in complying with the National Bridge Inspection Standards (NBIS). The Bridge Inspection Handbook provides guidance to the members of the Bridge Inspection Unit needed to perform assigned tasks.

This Handbook is divided into chapters, with each chapter divided into various sections. Any corresponding attachments associated with each chapter will be located at the end of the particular chapter and will be number “X-Y”, where “X” will refer to the chapter number and “Y” will refer to the attachment number.

Attachments at the end of the chapters that are sample cover letters that are signed by the District Highway Director are shown with the intent to have the minimum language required. Each District reserves the right to add additional language as needed.

1.6.1 Summarization of Abbreviations and Acronyms Used Throughout the Handbook

Contained in Attachment 1-3 is a list of commonly used abbreviations and acronyms contained throughout this Handbook.

1.6.2 Revisions to the Handbook

Any revisions to the Handbook, further explanation or clarification, or additional information that may require insertion into the Handbook will be incorporated and reflected as a new section with the date of the revision stated in the section heading. Furthermore, the Table of Contents shall be revised to reflect the revised section and date of revision.

1.6.3 Supplemental Information

Chapter 10 will contain information/directions distributed from the Bridge Inspection Engineer for clarification on issues or policies that may arise through the duration of this Handbook. Some of the information/directions provided may lead to revised sections being issued in the future for inclusion in the Handbook.

1.7 PERMANENT HOLDING LOCATION

The most current copy of this Bridge Inspection Handbook will be contained on the MassDOT website. Revisions to any sections of this Handbook shall be listed on the website with a corresponding revision date and shall supersede all sections prior to the revision date.

1.8 CHAPTER 1 ATTACHMENTS

Number: P-13-002
Date: 3/15/2013

POLICY DIRECTIVE

Frank DePaola P.E. (signature on original)

ADMINISTRATOR

Bridge and Tunnel Inspection Standards and Procedures

The purpose of this Policy Directive is to identify the bridge and tunnel inspection standards and procedures of the Massachusetts Department of Transportation, Highway Division.

All bridges and tunnels to be inspected by the Massachusetts Department of Transportation, Highway Division, shall be inspected in accordance with the standards and procedures identified in this Policy Directive.

This policy recognizes that Chapter 25 of the Acts of 2009 formally abolished the Massachusetts Highway Department ("MassHighway") and the Massachusetts Turnpike Authority ("MTA"), established the Massachusetts Department of Transportation ("MassDOT") and enabled MassDOT with all powers and responsibilities necessary to manage the assets and programs formerly managed by MassHighway and MTA. Thus, all references to MassHighway and MTA within the standards and procedures identified in this Policy Directive apply fully to MassDOT.

1. All highway bridges shall be inspected in accordance with:

   - National Bridge Inspection Standards, 23 CFR Part 650 Subpart C
   - AASHTO Manual for Bridge Evaluation
   - MassHighway Bridge Inspection Handbook
   - MassHighway Bridge Manual

2. In addition to the standards and procedures listed in Part 1 above, the following highway bridges shall also be inspected in accordance with the relevant volumes of the Central Artery/Tunnel Inspection and Maintenance Manual dated May 2003, with addenda dated February 2005:

   - Leonard P. Zakim Bunker Hill Bridge (Volume 1)
   - North of Charles River Bridges (Volume 2)
   - South Bay Interchange Bridges (Volume 4)
   - I-90/Route 1A Interchange (Volume 7)

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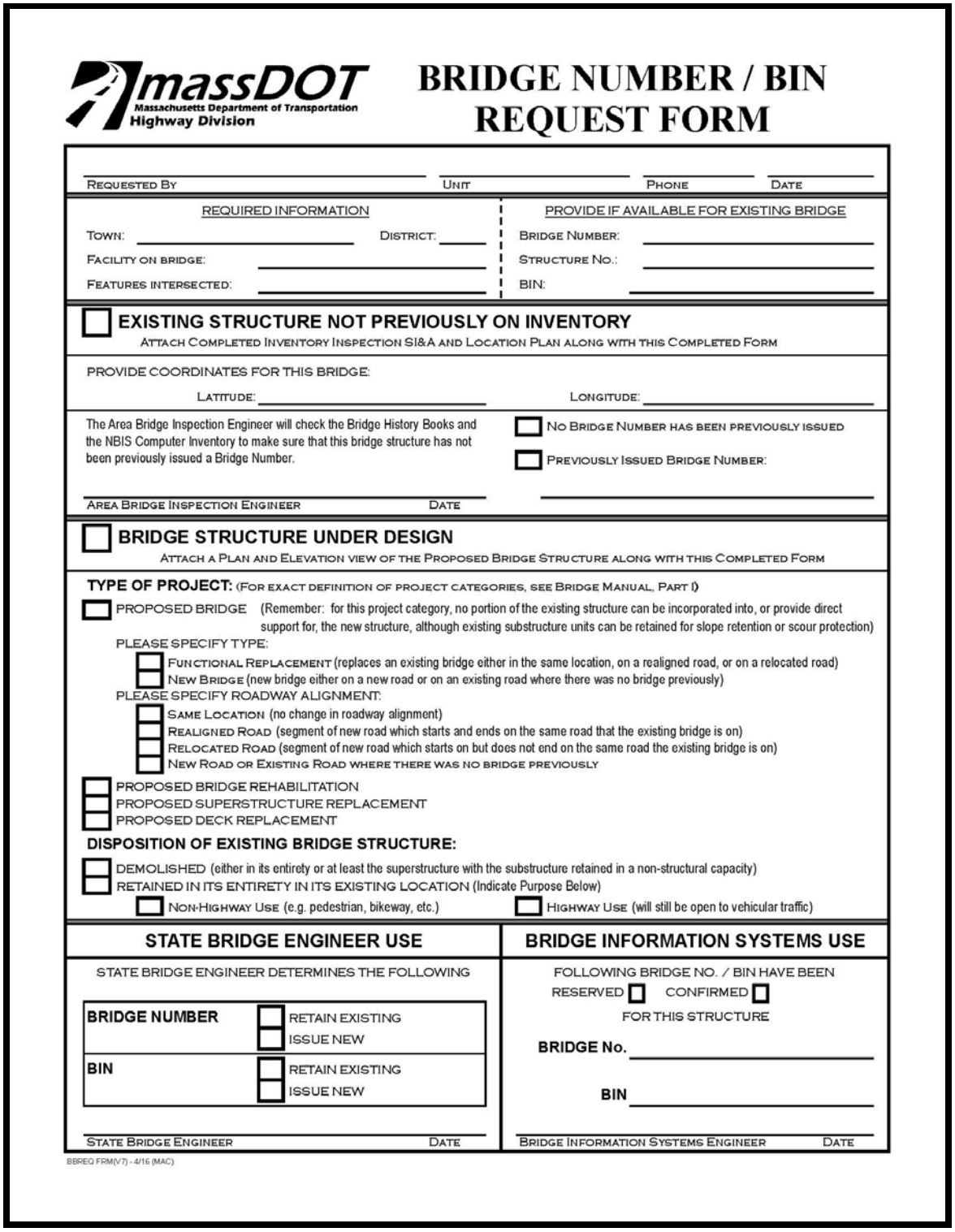
3. All rail bridges shall be inspected in accordance with:

   - Federal Highway Administration Railway and Transit Inspection Manual

4. All highway tunnels shall be inspected in accordance with:

   - MassDOT Highway Division Policy Directive P-13-003 "Tunnel Inspection and Testing Program" dated March 15, 2013
   - MassDOT Highway Division Policy Directive P-13-004 "Tunnel Inspection and Testing Protocol for Roadways Covered by Air Rights Developments" dated March 15, 2013

Attachment 1-1: Policy Directive P-13-002, Page 2 of 2



MassDOT Massachusetts Department of Transportation Highway Division

BRIDGE NUMBER / BIN REQUEST FORM

REQUESTED BY _____ UNIT _____ PHONE _____ DATE _____

REQUIRED INFORMATION

TOWN: _____ DISTRICT: _____

FACILITY ON BRIDGE: _____

FEATURES INTERSECTED: _____

PROVIDE IF AVAILABLE FOR EXISTING BRIDGE

BRIDGE NUMBER: _____

STRUCTURE NO.: _____

BIN: _____

☐ **EXISTING STRUCTURE NOT PREVIOUSLY ON INVENTORY**

ATTACH COMPLETED INVENTORY INSPECTION SI&A AND LOCATION PLAN ALONG WITH THIS COMPLETED FORM

PROVIDE COORDINATES FOR THIS BRIDGE:

LATITUDE: _____ LONGITUDE: _____

The Area Bridge Inspection Engineer will check the Bridge History Books and the NBIS Computer Inventory to make sure that this bridge structure has not been previously issued a Bridge Number.

☐ NO BRIDGE NUMBER HAS BEEN PREVIOUSLY ISSUED

☐ PREVIOUSLY ISSUED BRIDGE NUMBER: _____

AREA BRIDGE INSPECTION ENGINEER _____ DATE _____

☐ **BRIDGE STRUCTURE UNDER DESIGN**

ATTACH A PLAN AND ELEVATION VIEW OF THE PROPOSED BRIDGE STRUCTURE ALONG WITH THIS COMPLETED FORM

TYPE OF PROJECT: (FOR EXACT DEFINITION OF PROJECT CATEGORIES, SEE BRIDGE MANUAL, PART I)

☐ PROPOSED BRIDGE (Remember: for this project category, no portion of the existing structure can be incorporated into, or provide direct support for, the new structure, although existing substructure units can be retained for slope retention or scour protection)

PLEASE SPECIFY TYPE:

☐ FUNCTIONAL REPLACEMENT (replaces an existing bridge either in the same location, on a realigned road, or on a relocated road)
☐ NEW BRIDGE (new bridge either on a new road or on an existing road where there was no bridge previously)

PLEASE SPECIFY ROADWAY ALIGNMENT:

☐ SAME LOCATION (no change in roadway alignment)
☐ REALIGNED ROAD (segment of new road which starts and ends on the same road that the existing bridge is on)
☐ RELOCATED ROAD (segment of new road which starts on but does not end on the same road the existing bridge is on)
☐ NEW ROAD OR EXISTING ROAD WHERE THERE WAS NO BRIDGE PREVIOUSLY

☐ PROPOSED BRIDGE REHABILITATION
☐ PROPOSED SUPERSTRUCTURE REPLACEMENT
☐ PROPOSED DECK REPLACEMENT

DISPOSITION OF EXISTING BRIDGE STRUCTURE:

☐ DEMOLISHED (either in its entirety or at least the superstructure with the substructure retained in a non-structural capacity)
☐ RETAINED IN ITS ENTIRETY IN ITS EXISTING LOCATION (Indicate Purpose Below)

☐ NON-HIGHWAY USE (e.g. pedestrian, bikeway, etc.) ☐ HIGHWAY USE (will still be open to vehicular traffic)

STATE BRIDGE ENGINEER USE

STATE BRIDGE ENGINEER DETERMINES THE FOLLOWING

BRIDGE NUMBER	☐ RETAIN EXISTING ☐ ISSUE NEW
BIN	☐ RETAIN EXISTING ☐ ISSUE NEW

STATE BRIDGE ENGINEER _____ DATE _____

BRIDGE INFORMATION SYSTEMS USE

FOLLOWING BRIDGE NO. / BIN HAVE BEEN
RESERVED ☐ CONFIRMED ☐
FOR THIS STRUCTURE

BRIDGE No. _____

BIN _____

BRIDGE INFORMATION SYSTEMS ENGINEER _____ DATE _____

BBREQ FRM(V7) - 4/16 (MAC)

Attachment 1-2: Bridge Number/BIN Request Form

List of Abbreviations and Acronyms

ABIE	Area Bridge Inspection Engineer	HOC	Highway Operations Center
ADBIE	Assistant District Bridge Inspection Engineer	IOM	Interoffice Memorandum
ADTT	Average Daily Truck Traffic	MassDOT	Massachusetts Department of Transportation
BIE	Bridge Inspection Engineer	MBE	Manual for Bridge Evaluation
BIMS	Bridge Inspection Management System	MEMA	Massachusetts Emergency Management Agency
BIN	Bridge Identification Number	MGL	Massachusetts General Laws
BIRM	Bridge Inspectors Reference Manual	MUTCD	Manual on Uniform Traffic Control Devices
BIU	Bridge Inspection Unit	NBI	National Bridge Inspection
CH/I	Critical Hazard Deficiency/Immediate Urgency	NBIS	National Bridge Inspections Standards
Chapter 634	Massachusetts General Laws – Chapter 634	NHI	National Highway Institute
CS	Condition State	NOAA	National Oceanographic & Atmospheric Administration
CS/I	Critical Structural Deficiency/Immediate Urgency	OOF	Out of Frequency
DAN	Divers Alert Network	PM	Project Manager
DBE	District Bridge Engineer	PPE	Personnel Protective Equipment
DBIE	District Bridge Inspection Engineer	QA/QC	Quality Control / Quality Assurance
DEF	Deficiencies	R&O	Ratings & Overload Unit
DHD	District Highway Director	SCUBA	Self-Contained Underwater Breathing Apparatus
ELBID	Element Level Bridge Inspection Data	SIA	Structure Inventory and Appraisal Sheet
ELCS	Element Level Condition State	TL	Team Leader
ERS	Event Reporting System	TM	Team Member
F/T	Freeze/Thaw	U/W	Underwater
FC	Fracture Critical	UOT	Underwater Operations Team
FCM	Fracture Critical Member	USDOT	United States Department of Transportation
FHWA	Federal Highway Administration	USGS	United States Geological Survey

Attachment 1-3: List of Abbreviations and Acronyms