CHAPTER 7
UNDERWATER OPERATIONS TEAM

7.1 INTRODUCTION

This chapter introduces MassDOT's Underwater Operations Team (UOT). The primary function of the Underwater Operations Team is to conduct underwater inspections of all state, city and town bridges where required in accordance with the National Bridge Inspection Standards (NBIS). The Team conducts underwater inspections on a year round basis for structures throughout the Commonwealth of Massachusetts. Additional duties of the Underwater Operations Team includes assistance to state and municipal departments in repairing bridge substructure elements and installing scour countermeasures, assisting in search and recovery efforts, debris removal and other related underwater work associated with bridges.

Underwater inspections and other underwater tasks will be conducted by the Underwater Operations Team for all divisions of the Department of Transportation. Upon written request and when approved by the Chief Engineer, these activities will be conducted for other government agencies. Also, in times of flooding or other emergencies and with the approval of the Chief Engineer, part-time members of the Underwater Operations Team may be temporarily activated to assist in situations on a full time basis.

7.2 ORGANIZATIONAL STRUCTURE

The Underwater Operations Team (UOT) is a self-contained unit within MassDOT's Bridge Inspection Section and the Team reports to the Bridge Inspection Engineer. The UOT is headed by the Underwater Operations Engineer who is responsible in overseeing the operation of the unit on a statewide basis.

The Underwater Operations Engineer oversees two Area Dive Coordinators, an Eastern and a Western Area Dive Coordinator. The Area Dive Coordinators are responsible to schedule and coordinate diving activities in their respective areas.

The UOT also consists of full time divers and part time divers. Full Time Dive Team Members dedicate 100% of their time to the Underwater Operations Team. MassDOT also maintains a roster of part-time divers that are able to participate in a minimum of 20 dives per calendar year. The part time divers are DOT engineers from other departments statewide. They collectively supplement the full time divers on a daily basis. Dive teams shall operate on a statewide basis that shall not be restricted by District Boundaries.

7.3 DIVER CLASSIFICATIONS

MassDOT's Underwater Operations Personnel shall be assigned a diver classification and must maintain certain individual diver requirements. A dive is defined as participation by an individual in one day's diving operation, including participation as a safety diver. The divers shall be classified in one of three groupings. The classifications are as follows:

- Class I Diver - Full time diver

- Class II Diver – 20 dives/year (minimum)
- Class III Diver – Inactive/Reserve

A Class III diver must make a check-out dive with the Underwater Operations Engineer or his designee in order to be upgraded from inactive/reserve status. The check-out dive may be held at a bridge site.

7.4 UNDERWATER INSPECTION DIVER QUALIFICATIONS

All members of the Underwater Operations Team receive various training. Such training includes initial scuba training, NBIS bridge inspection training and various training that is conducted annually. This section outlines these requirements.

7.4.1 Initial Eligibility Requirements for Divers

In order to be initially eligible to participate in the Underwater Operation Team, an individual must meet the following requirements:

1. Candidates must receive approval from their current supervisor to participate in the dive program (minimum 20 dives/year)
2. Be employed by the Department in an engineering title
3. Pass a physical examination
4. Pass the following swim test:
   A. Complete 1 mile non-stop swim in a pool
   B. Swim 20 yards underwater
   C. Survival swim, 10 minutes
   D. Recover weight from 10 feet of water
   E. Swim a short distance with a blacked out mask
5. Complete and pass the MassDOT sponsored Scuba Diver Training program. The program is approximately 100 hours in duration and includes classroom, pool and a minimum of 20 open water dives. It is designed to be very physical and expose the candidate to the wide range of diving environments.
6. Complete an FHWA approved comprehensive bridge inspection training course such as the NHI Safety Inspection of In-Service bridges training

7.4.2 Annual Requirements for Divers

All members of the Underwater Operations Team are also required to receive various training/certification/examinations on a yearly basis as follows:

1. Participate and pass an annual Skill Review Session. The session will include reviewing of basic scuba skills, stressful diving situations and other related training
2. Complete an annual 440 yard non-stop swim (pool)
3. Pass and have a current certification for First Aid, CPR, AED, and Oxygen Management
4. Pass an annual physical examination

7.4.3 Additional NBIS Requirements for Divers

As outlined in Section 7.4.1 above, all underwater bridge inspectors must complete an FHWA approved comprehensive bridge inspection training course. MassDOT also requires that all inspectors receive bridge inspection refresher training at a minimum of five year intervals.

7.5 DIVER SAFETY PRACTICES

Divers may be exposed to hazards that include circulatory risk, respiratory risk, low visibility, hypothermia, and possible injury from falls or submerged debris. Safety of all Dive Team members is paramount in daily activities. As such, Dive Team members must adhere to the following diver safety practices:

1. If a diver does not feel well, has sinus congestion, or ear problems, he or she shall refrain from diving. Under no circumstances should a diver forcibly clear his ears in order to participate in a diving operation.

2. A diver shall terminate the dive if he or she becomes ill, experiences equipment malfunction, or for any reason becomes uncomfortable with the surroundings.

3. Dive flags shall be used on all diving operations where boat traffic is possible.

4. Water entries should be made carefully to avoid being impaled on any object protruding from the bottom.

5. Divers should visually scan each other prior to entering the water.

6. Surface personnel should be aware of the position of the divers in the water at all times.

7. When using a boat, do not operate the motor unless the precise location of all divers is known, and then only when the divers are well clear of the boat.

8. Dives requiring decompression stops are not authorized.

9. Dives in excess of 100 feet **are not** authorized.

10. Ascent rates should be slow and never exceed 30’/minute, unless the diver is making an emergency ascent.

11. All scuba dives will be terminated to allow 500 PSI in the tank when the diver surfaces.

12. The “Buddy System” will be used on all scuba diving operations. However, there are times, when working in heavy current, or with limited visibility, that two divers in the water are more of a hazard to each other than a safety factor. Under these conditions it is acceptable for one diver to work at a time, but extreme vigilance should be exercised by surface personnel. The Buddy must be suited with equipment at the ready and be prepared to assist without delay. A specific dive plan should be prepared and carried out so that the safety diver can monitor diver progress.

13. Divers will wash their scuba equipment after each dive and maintain it in good repair.

14. Divers are responsible to deliver their regulator to the Underwater Operations Engineer for yearly maintenance. Visual and hydro scuba tank inspections will be kept current.

15. Divers are responsible to deliver any faulty scuba equipment to the Underwater Operations Engineer for repair or replacement.

16. A qualified diver will remain on the surface during all diving operations.

17. In the event of a thunder and lightning storm, diving operations shall be halted until the storm passes.

18. All dives into submerged structures when a direct ascent to the surface is not possible shall be made with surface supply diving equipment.

19. During surface supply operations, the dive may be terminated when requested by the diver, or the diver fails to correctly respond to communication or signals from a surface team member, or the diver begins to use the reserve air supply.

7.5.1 Compressed Air Injuries

Due to the nature of the work that the Underwater Operation Team performs, an accident involving the compressed air that the divers must breathe involves a different set of emergency procedures that must be followed.

A. If an accident occurs while a diver is breathing compressed air and an air embolism or decompression sickness is suspected, the diver must be taken to a hyperbaric chamber for treatment as soon as possible.

B. The primary source of information for diving accidents and the national coordinating agency for hyperbaric chamber treatment is the National Divers Alert Network (DAN), located at the Duke University Medical Center in Durham, North Carolina. Their emergency number is 919-684-9111, 24 hours/day (office number for non-emergencies is 1-866-446-2641, 8:30AM to 6:30PM, M-F).

C. The procedure for contacting DAN is:
    1. Out at sea, call the Coast Guard not DAN
    2. If inland, transport diver to the nearest hospital or contact rescue personnel first, then call DAN.
    3. The DAN emergency telephone number is the switchboard for Duke University Medical Center. The operators are not trained in diving medicine. Tell the operator:
        - You are calling DAN
        - You have an emergency, or an urgent problem related to a dive
        - That you must talk to the DAN physician on call
        - Coordinating chamber treatment may take 5-15 minutes or longer

- Give your area code and telephone number and stay on the line
- Do not transport a patient to a hyperbaric chamber unless the staff has been alerted and they are willing and able to accept a patient for treatment

D. Transportation to a hyperbaric chamber or hospital
   - Local ambulance service/fire department
   - United States Coast Guard – Search and Rescue
     427 Commercial St.
     Boston, MA
     617-223-5757 (24 hours)

E. Communication
   1. Call 911 for emergency operator assistance
   2. Call Mass. Dept. of Transportation (HOC) (if unable to reach 911)
      1-800-227-0608, 617-310-4700 or 617-946-3150
   3. Local medical facilities may not be familiar with diving related accidents
      - One diver from the Dive Team should accompany the patient
      - If the emergency room doctor does not voluntarily call DAN, insist that it be done. If necessary, make the call yourself
      - A diver with a compressed air injury would be stabilized with oxygen and intravenous drugs in an emergency room before transport to a hyperbaric chamber. The DAN physician must be informed of the patient's dive profile so he can select the proper treatment and drug regimen

7.6 UNDERWATER BRIDGE INSPECTION

There are three methods used to evaluate underwater elements during bridge inspections:

- Wading inspections
- Self-contained diving (SCUBA)
- Surface supplied air diving

Wading inspections can generally be used when waterways are less than 3 feet in depth and have low velocity water flow. The substructure units and stream bed is typically evaluated using waders and a sounding rod or probe. Above water inspection teams generally perform wading inspections as part of the regular inspections.

The Underwater Operations Team is responsible for all SCUBA and Surface Supply inspections. When underwater inspections are required Item 92 (B) on the SI&A sheet is coded "Y".

7.6.1 Waterway Characteristics That Warrant Dive Inspections

As outlined above, a bridge will be assigned to the Underwater Operations Team for an underwater inspection if the water depth is three feet or greater, or at a lesser depth if site conditions require that a diver be used for a complete inspection of all underwater elements.

Those bridges requiring underwater inspection will be inspected on a regular basis in accordance with National Bridge Inspection Standards.

7.6.2 Inspection Frequency

The National Bridge Inspection Standards require that underwater structural elements be inspected at intervals not to exceed 5 years. That maximum frequency is appropriate for bridges with underwater elements that are in excellent conditions in waterways that are passive. In general there are not many structures that will qualify for this maximum frequency. Situations that would cause one to consider reducing the inspection frequency are structural deterioration, stream bed scour and erosion due to water flow, unknown foundations, susceptible stream bed materials, damage to structural components, etc.

Suggested underwater inspection frequencies are offered below. These are some typical situations that may dictate the frequency. The dive frequency is always at the discretion of the Underwater Operations Engineer.

- **60 Months** - New bridges with substructure elements in excellent conditions and known deep foundations in a benign waterway.
- **48 months** – Bridges with substructure element and stream bed in very good condition.
- **36 Months** – Bridges and stream bed in average condition. The majority of MassDOT's bridges have this U/W inspection frequency.
- **24 Months** - Bridges that have substructure elements that are exhibiting minor deterioration or stream beginning to exhibit scour.
- **12 Months** - Bridges that have substructure elements that are exhibiting advanced deterioration or stream beds that have advanced scour. Such bridges may receive a condition rating for Item 60 of 4 (Poor).
- **6 Months** – Bridges that have substructure elements that are exhibiting serious deterioration or stream beds with advanced scour that may impact substructure stability. Such bridges may receive a condition rating for Item 60 of 3 (Serious).
- **3 Months or less** - Bridges that have substructure elements that are exhibiting critical deterioration or stream beds with advanced scour that impacts substructure stability. Such bridges may receive a condition rating for Item 60 of 2 (Critical) or less.

The underwater inspection frequency is entered on the SI&A sheet under Item 92 (B) as a two digit number.

Special member inspections are usually interim inspections with a reduced frequency. Special member inspections may only include elements that require additional inspection. If an inspection identifies element conditions that may deteriorate prior to the next scheduled routine inspection, a special member inspection will be scheduled for those elements.

See Attachments 7-1 thru 7-3 for examples of routine underwater inspection reports and Attachment 7-4 for an example of an underwater special member inspection.

7.7 CLASSIFICATION OF UNDERWATER BRIDGE INSPECTIONS

Underwater bridge inspections are defined under four different levels of inspection. The levels are defined as follows:

Level I:	A general, visual or tactile inspection of the structure, with minimal cleaning, to determine overall condition and identify any problems (See Attachment 7-1)
Level II:	A detailed inspection with sufficient cleaning and measurements to fully document deficiencies (See Attachment 7-2)
Level III:	A very detailed inspection with extensive cleaning and measurements. Non-destructive test will be performed if necessary
Level IV:	A channel grid sounding is obtained. Level IV inspections are normally utilized for a new bridge to establish a river bed benchmark. Every scour critical bridge should have this level of inspection completed with an update as channel features change over time. (See Attachment 7-3)

7.8 UNDERWATER INSPECTION PROCEDURES

It is the diver's responsibility to provide a complete underwater inspection of the structure they have been assigned to inspect. The inspection may be visual if the water clarity permits, or tactile if the visibility is poor. For most dives, a Level II inspection is completed. A Level II inspection is essentially a site reconnaissance to determine if any problems exist and to estimate their size and scope. This will also give the diver an opportunity to acclimate to the site and learn the location of hazardous debris. If significant problems are found, the level of inspection should be upgraded.

7.8.1 Bridge Data Review and Dive Planning

The divers will review all previous underwater inspection reports and all substructure plans available on the bridge to be inspected. The divers will develop a dive plan for each underwater inspection that will determine the number of divers needed, assign duties to each of the divers participating in the dive, state the access means (boat or shore entry) to accomplish the inspection, review dive procedures and determine entry and exit points for the inspection. If conditions do not allow an inspection at the primary bridge, the dive team will proceed to the secondary preplanned inspection.

A dive plan should include the following:

1. Review previous underwater inspection reports and check for:
   - Dive conditions
   - Traffic setup/police detail required
   - Penetration/low clearance requiring surface supply or other specific equipment
   - Boat or inflatable
   - Tidal conditions requiring an inspection at low tide, high tide, or slack tide
   - Notify State Police Marine Unit or local police, if necessary
   - The Underwater Operations Engineer will notify the BIE prior to an inspection, by any team, at a critical or high profile structure

2. Review the bridge plans, if available, and look for:
   - Footing type, depth, dimensions, etc.
   - Sheeting type and location
   - Scour countermeasures

3. Make visual above water inspection of piers and abutments, before beginning diving operations to:
   - Note any misalignment, settlement, cracks, displacement, etc.
   - Note best location for diver entrance and exit
   - Note boat traffic requiring dive flag(s)
   - Coordinate with bridge operator for bridge openings

7.8.2 Dive Equipment

MassDOT possesses and maintains an extensive amount of general and personal use dive equipment to allow for safe and thorough underwater inspections. Safety of employees and the traveling public is MassDOT's primary concern. Divers are required to ensure that all equipment is maintained in good working order. A partial list of equipment typically used by the Dive Team is as follows:

Unit Equipment:

- Dive Vans
- 19' Boston Whaler
- 24' Privateer
- Surface supply gear
- Communication gear
- Underwater camera
- Underwater video
- Probing rods
- Hammers
- Scrapers
- Rulers & measuring tapes
- Clipboards
- Rope
- Ladder (s)
- Dive flags

Personal Equipment:

- Wet suit
- Dry suit
- Face mask
- Swim fins
- Air tank
- Regulator

- Buoyancy compensator
- Weight belt
- Depth gauge
- Pressure gauge
- Knife

Upon completion of dives and return to the office, all divers must clean and store personal equipment and work together to clean unit equipment. If any equipment should show wear or require replacement, notify the Underwater Operations Engineer.

7.8.3 Dive Inspection Process

7.8.3.1 Dive Master

As mentioned previously, multiple divers are always used. The number of divers will depend on the size and type of inspection required. One diver serves as the Dive Master. The Dive Master directs other team members during the inspection, assigning specific duties. The Dive Master is responsible for the report preparation.

7.8.3.2 References

The typical underwater inspection process is well documented in industry reference materials as noted below. As such it will not be detailed in this manual. For a step by step description of the suggested method of inspecting underwater elements and features please refer to the following documents. Copies are available at the Underwater Operations Office (Dive Shack) and at Bridge Inspection Headquarters.

- FHWA Bridge Inspector's Reference Manual (BIRM) Publication No.FHWA-NHI-03-002
- NHI Couse No 130091 Underwater Bridge Inspection class reference manual. Publication No.FHWA-NHI-10-027

7.8.3.3 Established Water Elevation

During an inspection, divers will establish a location for a "water control shot". A water shot is a measurement from a fixed location on the structure to the top of water at the time of the inspection. Sounding depths can then be converted to stream bed elevations relative to the water shot. This allows relevant comparison of soundings from different inspection cycles. Divers should always utilize the water shot location that has been used for previous dives.

a) Height of water level to a constant and fixed location on the bridge (use judgment) (i.e. bottom of beam, bottom of deck, arch intrados, bottom of bent cap)
b) Soundings taken to waterline are adjusted to the initial water level with a correction factor.

7.8.3.4 Stationing

Consistent stationing shall be used when documenting inspections. Stationing established on previous reports or on bridge plans will be used. Abutments and or piers are labeled left and right when looking downstream. If a flow cannot be determined a compass direction will be used.

7.8.3.5 Sounding Location Determination

Soundings are frequently obtained during underwater inspections. Each dive bridge should have at least a stream bed profile obtained along the upstream and downstream ends of the bridge across the channel. They will be useful in documenting future stream bed changes that may affect the structure. The profiles should be re-taken whenever stream bed changes are suspected, such as after high water events.

Scour Critical Bridges should have soundings taken at each inspection. At a minimum they should be taken along the upstream and downstream ends of the bridge across the channel. For new bridges soundings are frequently obtained in a grid pattern within limits as described below.

When soundings are taken during an inspection the following sounding locations should be considered. The objective is to identify any riverbed scour. Divers should use good judgment for sounding locations based on stream bed features and historic inspection data.

- 10’ intervals along face of exposed footing
- 10’-20’ grid beneath bridge, when practical (initial Level IV inspection)
- Continue upstream and downstream 20’ +/- (use judgment)
- 10’ (or convenient measurement) across channel at upstream or downstream end, or a location of greatest scour or highest footing exposure (Level II inspection)

7.8.3.6 Defect Documentation

Divers will note any defects during an underwater inspection that should include the following:

- Scour
- Exposed footings
- Voids in substructure
- Undermining
- Decay/Section Loss
- Cracks

7.9 REPORT PREPARATION

At the completion of an underwater inspection, a dive report will be prepared by the Dive Master or his designee to detail the results of the inspection. If deficiencies are found, sufficient measurements shall be recorded to fully document the condition. Sketches, including plan, elevation, and sectional views shall be drawn when necessary to fully illustrate any deficiency. Reports will be submitted to the Underwater Operations Engineer in a timely manner.

The following reports are used during underwater inspections.

- Created within 4D
  - Routine Underwater Inspection Report
  - Underwater Special Inspection Report
- Not created in 4D
  - Element Level Inspection Report (formerly Pontis & included in Routine Inspection Reports)
  - Diver Activity Report (See Attachment 7-5)
  - Flood Inspection Report

7.10 CRITICAL DEFECT NOTIFICATION

The Bridge Inspection Engineer should be contacted from the bridge site prior to the report being written when critical defects that may affect the structural integrity of the bridge, or the public's safety, are initially observed (refer to Section 4.7).

7.11 FLOOD INSPECTIONS

- Scour Critical bridges should be a priority
- Part time divers may be activated to full time status
- Use Diver Activity Report for reporting
- Underwater Operations Engineer maintains a daily log of structures inspected, with status
- Submit inspection status report to Bridge Inspection Engineer weekly

7.12 INSPECTION REPORT REVIEW AND DISTRIBUTION

Upon completion of a dive inspection, the following steps shall be done in the underwater report writing and distribution:

1. Dive Master prepares the report and marks it complete in 4D when it is ready for review
2. The report is reviewed electronically within 4D by Underwater Operations Engineer. When acceptable the report is approved with a check mark in 4D
3. The report is then signed by the Dive Master and the Underwater Operations Engineer
4. Copies of the report are made and distributed as follows:

   A. Internal Distribution
      - One Copy to the Bridge Inspection Engineer for the NBIS file
      - Original report in the Dive Files located in Boston
      - Two Copies are filed in Westwood

   B. Distribution of Municipally Owned structures
      - One copy to Municipality via letter of transmittal signed by the State Bridge Engineer (see Attachment 7-6)
      - A copy of the letter of transmittal is filed in the NBIS file

C. Distribution of MassDOT owned structures
- Reports are periodically forwarded to the district DHD's with a letter of transmittal signed by the State Bridge Engineer (see Attachment 7-7)
- A copy of the transmittal is filed in the Dive report file in the respective district correspondence folder

7.13 UNDERWATER ELEMENTS

The following are guidelines for areas of concern during underwater inspections.

7.13.1 Footing or Foundations

- Type
  - Spread
  - Pile supported
- Material
  - Concrete
  - Timber cribbing
  - Stone masonry
- Condition
  - Timber
    - Decay
    - Marine borer attack
  - Concrete
    - Deterioration
    - Cracking (location and size)
  - Stone Masonry
    - Check for missing stones
    - Measure depth of penetration between stones if mortar is missing
    - Check for significant cracks
    - Check for misalignment or displacement
    - Check for signs of settlement
- Exposed dimensions
  - Location (stations)
  - Exposed length
  - Exposed height
  - Offset from abutment or pier stem (toe)
- Covered footing
  - Probe, dig, etc. to determine the bottom of footing

7.13.2 Scour

- Indicate location and depth
- Define limits with soundings
- Soil deposition
  - Location
  - Height
- Elevation of water during flooding noted by:

- Discoloration of concrete
- Debris deposited on bridge seats

7.13.3 Undermining

- Dimensions (L x H x Pen.)
- Location

7.13.4 Sheeting

- Type
  - Steel
  - Timber
- Condition
- Height of exposure above footing or mudline
- Thickness
- Measure one section of sheeting to determine size and shape
- Measure offset from abutment or pierwall
- Measure any separation from footing

7.13.5 Piles

- Type
  - Vertical
  - Battered
- Material
  - Timber
  - Concrete
  - Steel (concrete filled)
- Condition
  - Timber piles
    - Inspect for marine borer activity
    - Inspect bolt connections for corrosion
    - Probe wood to detect decay
    - Take caliper measurement to document section loss
    - Inspect for other deterioration, delamination
    - Locate and measure size of any splits or checks
    - Core a sample of wood pile (if necessary)
  - Concrete piles
    - Determine condition of concrete
    - Measure cross-sectional loss
    - Check for erosion of concrete and spalls
    - Check condition of any protective jackets
    - Check for exposed reinforcement
    - Check for cracks
    - Inspect for abrasion or delamination

- Steel piles
  - Check for collision damage
  - Measure cross-section loss
  - Inspect for deterioration
  - Inspect the condition of any protective jackets
- Collision Damage
  - Inspect for broken piles
  - Inspect for missing piles
  - Inspect for cracks and splits
  - Inspect channel bottom for indication of movement
- Spacing (center to center)

7.13.6 Pile Bents

- Condition
  - Piles
  - Bracing
    - Horizontal bracing
    - Diagonal bracing
  - Fasteners
  - Impact damage
  - Missing piles

7.13.7 Fender System

Inspect for material defects and collision damage on the following elements (see inspection procedures for bents):

- Piles
- Diagonal bracing
- Horizontal bracing
- Fasteners
- Wales
- Ladders

7.13.8 Scour Countermeasures

- Type
  - Riprap
  - Dumped stone
  - Cement/grout bags, sand bags
  - Other
- Location
- Condition
- Size (dimensions)

7.13.9 Previous Underwater Repairs

- Type

- Location
- Condition

7.13.10 Soil – Bottom Material

- Visual classification
- Location
- Depth
    - Probe with steel bar or rod

7.13.11 Marine Growth

- Type
- Location
- Thickness

7.13.12 Debris

- Determine amount, type and location
- Estimate reduction of waterway opening
- Note hazards to divers

7.13.13 Photographs

- Visibility, camera availability, and dive conditions permitting (if helpful)

7.13.14 Sketches

- Plan view
- Elevation (if helpful)
- Section (if helpful)

7.14 CHAPTER 7 ATTACHMENTS

MASSACHUSETTS HIGHWAY DEPARTMENT PAGE 1 OF 2

UNDERWATER OPERATIONS TEAM

DIVERS ACTIVITY REPORT

2-DIST	B.I.N.	BR. DEPT. NO.
5	45G	B-17-017

CITY/TOWN	8-STRUCTURE NO.	LEVEL OF INSP.	INSPECTION DATE
BOURNE-WAREHAM	B17017-45G-DOT-NBI	I	11/6/12
7-FACILITY CARRIED	**ACCESS TO BRIDGE**	**UNDERWATER OPERATIONS ENGINEER**	
US 6/ST 28	BOAT	RANDI E. BONICA Randi E. Bonica	
6-FEATURES INTERSECTED	**DEPTH** / **VISIBILITY**	**TEAM LEADER (DIVE MASTER)**	**REPORT SUBMITTED BY:**
COHASSET NARROWS	10' / 15'	CARRIE LAVALLEE	Carrie Lavallee
BOTTOM CONDITION	**CURRENT**	**TEAM MEMBERS**	
CONC. DEBRIS & GRAVEL	TIDAL	R. BONICA, W. COLLERAN, G. BROZ & B. FITZGERALD	

REMARKS

General:
At the request of Kevin Morrissey, District 5 Resident Engineer, the MassDOT Underwater Operations Dive Team conducted a bottom search to locate any debris remaining from the removed sections of Pier #1, Pier #2, Pier #3, and Pier #4. Piers are numbered left to right when facing downstream.

Observations:
The divers noted only smaller pieces of concrete at the mudline at Pier #1. The smaller pieces were 1' to 2' diameter. The divers noted many large and small pieces of concrete at the mudline at Pier #2, Pier #3, and Pier #4. The smaller pieces were 1' to 2' diameter and the larger pieces were 3' to 4' diameter.

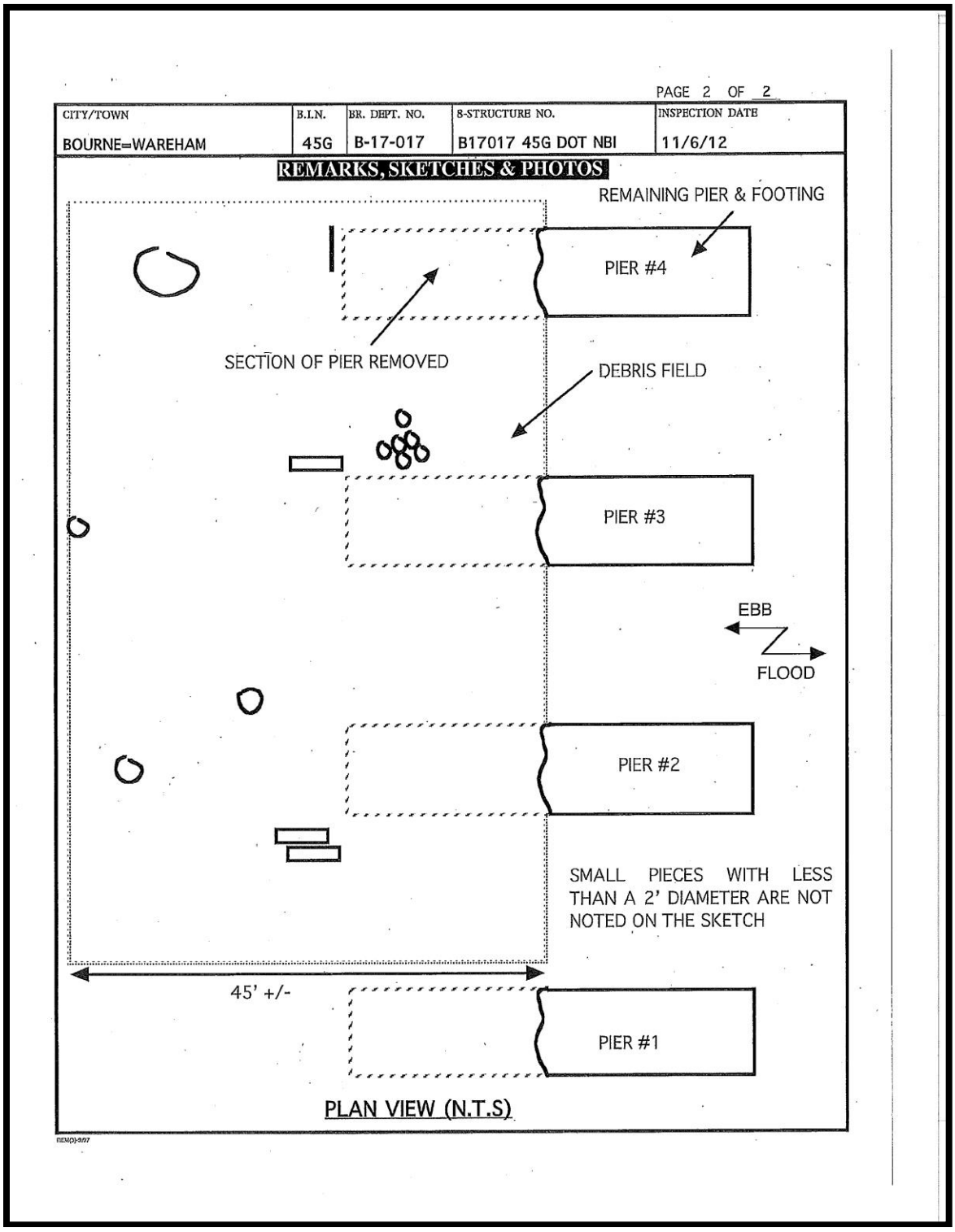
Pier #2:
At 30' downstream from the remaining pier section a 4' diameter stone was noted. At 20' downstream from the remaining pier section and 30' to the right, a 3' diameter stone was noted. In line with the remaining pier section and 5' to the left, two granite blocks with a height of 2', a width of 1.5' and a length of 6' were noted.

Pier #3:
At 45' downstream from the remaining pier section a 3' diameter piece of concrete was noted. In line with the remaining pier section and 5' to the right, a granite block with a height of 2', a width of 1.5' and a length of 4' was noted. At 3' upstream from the remaining pier section a group of 6 concrete pieces with 2.5' diameters were noted.

Pier #4:
In line with the remaining pier section, two pieces of timber sheeting with a height of 5' were noted. In line with the remaining pier section, a 10' diameter mound of concrete debris with a height of 4' was noted. This mound was between the remaining pier section and the new steel sheeting.

DIVEPI(02)-498

Attachment 7-1: Level I Divers Activity Report, Page 1 of 2



Attachment 7-1: Level I Divers Activity Report, Page 2 of 2

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION PAGE 1 OF 6

UNDERWATER OPERATIONS TEAM
ROUTINE UNDERWATER INSPECTION REPORT

2-DIST	B.I.N.	BR. DEPT. NO.
05	45K	W-06-016

CITY/TOWN	8-STRUCTURE NO.	LEVEL OF INSPECTION	93B-DATE INSPECTED
WAREHAM	W06016-45K-DOT-NBI	II	DEC 11, 2012

07-FACILITY CARRIED	ACCESS TO BRIDGE	UNDERWATER OPERATIONS ENGINEER
US 6 MARION RD	EMBANKMENT	RANDI E. BONICA Randi E. Bonica

06-FEATURES INTERSECTED	DEPTH	VISIBILITY	TEAM LEADER (DIVE MASTER)	Report submitted by:
WATER WEWEANTIC RIVER	9 m	0.5 m	RANDI E. BONICA	R. Bonica

BOTTOM CONDITION	CURRENT	TEAM MEMBERS
GRAVEL, BOULDERS	TIDAL/SWIFT	W. J. COLLERAN, B. FITZGERALD, E. P. TERNOSKY

ITEM 60 *SUBSTRUCTURE* — 4

		DEF
1. Abutments	N	
a. Pedestals	N	-
b. Bridge Seats	N	-
c. Backwalls	N	-
d. Breastwalls	N	-
e. Wingwalls	N	-
f. Slope Paving/Rip-Rap	N	-
g. Pointing	N	-
h. Footings	N	-
i. Piles	N	-
j. Scour	N	-
k. Settlement	N	-
l.	N	-
2. Piers or Bents	4	
a. Pedestals	N	-
b. Caps	N	-
c. Columns	N	-
d. Stems/Webs/Pierwalls	5	M-P
e. Pointing	5	M-P
f. Footing	5	M-P
g. Piles	H	-
h. Scour	4	S-P
i. Settlement	7	-
j.	N	-
k.	N	-
3. Pile Bents	N	
a. Pile Caps	N	-
b. Piles	N	-
c. Diagonal Bracing	N	-
d. Horizontal Bracing	N	-
e. Fasteners	N	-
UNDERMINING (Y/N)		Y

ITEM 61 *CHANNEL & CHANNEL PROTECTION* — 4

		DEF
1. Channel Scour	4	S-P
2. Embankment Erosion	7	-
3. Debris	7	-
4. Vegetation	7	-
5. Utilities	X	-
6. Rip-Rap/Slope Protection	7	-
7. Aggradation	7	-
8. Fender System	N	-
a. Piles	N	-
b. Diagonal Bracing	N	-
c. Horizontal Bracing	N	-
d. Wales	N	-
e. Fasteners	N	-
f. Ladders	N	-
9.	N	-

ITEM 59 *SUPERSTRUCTURE*

		DEF
	N	-
	N	-
	N	-

ITEM 62 *CULVERTS* — N

		DEF
1. Roof	N	-
2. Floor	N	-
3. Walls	N	-
4. Headwall	N	-
5. Wingwall	N	-
6. Pipe	N	-
7. Protective Coating	N	-
8. Embankment	N	-
9. Wearing Surface	N	-
10. Railing	N	-
11. Sidewalks	N	-
12. Utilities	N	-
13. Member Alignment	N	-
14. Deformation	N	-
15. Scour	N	-
16. Settlement	N	-
17.	N	-
18.	N	-
UNDERMINING (Y/N)		N

DEFICIENCY REPORTING GUIDE

DEFICIENCY: A defect in a structure that requires corrective action.

CATEGORIES OF DEFICIENCIES:

M= Minor Deficiency- Deficiencies which are minor in nature, generally do not impact the structural integrity of the bridge and could easily be repaired. Examples include but are not limited to: Spalled concrete, Minor scouring, etc.

S= Severe/Major Deficiency- Deficiencies which are more extensive in nature and need more planning and effort to repair. Examples include but are not limited to: Moderate to major deterioration in concrete, Exposed and corroding rebars, Deteriorated timber piles, Considerable settlement, Considerable scouring or undermining, etc.

C-S= Critical Structural Deficiency- A deficiency in a structural element of a bridge that poses an extreme unsafe condition due to the failure or imminent failure of the element which will affect the structural integrity of the bridge.

C-H= Critical Hazard Deficiency- A deficiency in a component or element of a bridge that poses an extreme hazard or unsafe condition to the public, but does not impair the structural integrity of the bridge. Examples include but are not limited to: Any part of piles or fender system which are projecting outward and may become a safety hazard for the navigational traffic, etc.

URGENCY OF REPAIR:

I=Immediate- [Inspector(s) immediately contact District Bridge Inspection Engineer (DBIE) to report the Deficiency and to receive further instruction from him/her.]

A=ASAP- [Action/Repair should be initiated by District Maintenance Engineer or the responsible party (if not a State owned bridge) upon receipt of the Inspection Report.]

P=Prioritize- [Shall be prioritized by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) and repairs made when funds and/or manpower is available.]

X=UNKNOWN N=NOT APPLICABLE H=HIDDEN/INACCESSIBLE R=REMOVED

DIVE-P1(V3)-4/98

Attachment 7-2: Level II Underwater Inspection Report, Page 1 of 7

PAGE 2 OF 6

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WAREHAM	45K	W-06-016	W06016-45K-DOT-NBI	DEC 11, 2012

REMARKS

GENERAL REMARKS

This structure is a three span bridge dated 1956. When the bridge was widened new piers were added at the downstream end of the existing piers. The footings for the two sections of pier do not have any space between them. The new and the old sections of each pier are both founded on piles. The two sections of pier have a common concrete pier cap. See attached sketch on Page 5. Both piers have granite facing in the tidal zone. Both abutments are in the dry at low tide and were not inspected for this report.
1) Orientation - Abutments and piers are labeled left and right when facing downstream.
2) Sta 1+00 is at the upstream face of the new section of the pier. See sketch on Page 5.

Note: Tides are approximately 1/2 hour after tides at Marion, Sippican Harbor. Bridge is best inspected at slack tide.

ITEM 60 - SUBSTRUCTURE

Item 60.2 - Piers or Bents
Item 60.2.d - Stems/Webs/Pierwalls
Left Pier:
There are random areas of minor concrete deterioration on the right side of the pier, just above the footing. The largest area measures: 1.0' L x 0.7' H x 1.7' P. The deterioration is into an area of concrete laitance. There are random cracked blocks in the upper tidal zone.

Right Pier:
The old pier has minor concrete deterioration with laitance at the bottom of the concrete pierwall, just above the tremie. The pier from the nose to the angle points is approximately 4'.
Right Side - Deterioration is from the upstream nose, to the angle point, and continues downstream an additional 5' from the angle point. Maximum height is 1.0' and maximum penetration is 0.4'.
There are minor remnants of timber formwork against the right face of the old section of the pier.
Left Side - There is deterioration from the upstream nose to the angle point. Maximum height is 1.0' and maximum penetration is 0.3'.

Item 60.2.e - Pointing
Left Pier:
There is minor pointing loss in the tidal zone but the joints are generally tight. Maximum penetration in the right side is 3'+ and maximum penetration in the left side is 2.0'.

Right Pier:
There is minor pointing loss in the tidal zone but the joints are generally tight. Maximum joint penetration in the right side is 1.7', left side is 1.3', and 3.0'+ at the upstream and downstream noses.

Item 60.2.f - Footing
Left Pier:
The left face of the old section has steel sheeting intermittently exposed 2.0' to 2.6' off the pier with a maximum height of exposure of 4.0'.
There is steel sheeting which is cut off at the top of the footing at the new section of pier. The maximum exposed height along the downstream nose is 16.9'.

Undermining:
At the downstream end of the right face of the old section and continuing into the new section there is a void at the mudline. For measuring purposes Sta 1+00 is at the upstream face of the new section of the pier. The void extends approximately 3.0' downstream of Sta 1+00 where it meets steel sheeting. The void extends approximately 11' upstream of Sta 1+00 where it is covered by boulders. The maximum height of the void is 1.2' and the maximum penetration is 12.7'. The width of the footing is approximately 9', so the undermining goes completely under the footing and beneath the mudline on the left side of the pier. See Void Monitoring Chart on Page 6.

REM.(2)7-86

Attachment 7-2: Level II Underwater Inspection Report, Page 2 of 7

PAGE 3 OF 6

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WAREHAM	45K	W-06-016	W06016-45K-DOT-NBI	DEC 11, 2012

REMARKS

Item 60.2.f - Footing (Cont'd)

This undermining may have been caused by a washout of concrete laitance in addition to a scouring out of bottom materials.

Right Pier:
The sheeting at the new section of the pier is cut off at the top of the footing. The exposed height along the downstream nose is 14.2'.
Right Side - There is deterioration at the mudline starting 10.0' upstream of the downstream nose of the old pier (10' L x 1.0' H x 1.3' P).
Left Side - There is deterioration at the mudline from the downstream angle point to the downstream nose of the old pier (4.0' L x 0.6' H x 0.6' P).

Item 60.2.h - Scour
Left Pier:
The left face of the old section has steel sheeting intermittently exposed 2.0' to 2.6' off the pier with a maximum height of exposure of 4.0'.
There is steel sheeting which is cut off at the top of the footing at the new section of pier. The maximum exposed height along the downstream nose is 16.9'.

Undermining:
At the downstream end of the right face of the old section and continuing into the new section there is a void at the mudline. For measuring purposes Sta 1+00 is at the upstream face of the new section of the pier. The void extends approximately 3.0' downstream of Sta 1+00 where it meets steel sheeting. The void extends approximately 11' upstream of Sta 1+00 where it is covered by boulders. The maximum height of the void is 1.2' and the maximum penetration is 12.7'. The width of the footing is approximately 9', so the undermining goes completely under the footing and beneath the mudline on the left side of the pier. See Void Monitoring Chart on Page 6.
This undermining may have been caused by a washout of concrete laitance in addition to a scouring out of bottom materials.

Right Pier:
The sheeting at the new section of the pier is cut off at the top of the footing. The exposed height at the downstream nose is 14.2'.

ITEM 61 - CHANNEL AND CHANNEL PROTECTION

Item 61.1 - Channel Scour
Left Pier:
The left face of the old section has steel sheeting intermittently exposed 2.0' to 2.6' off the pier with a maximum height of exposure of 4.0'.
There is steel sheeting which is cut off at the top of the footing at the new section of pier. The maximum exposed height along the downstream nose is 16.9'.

Undermining:
At the downstream end of the right face of the old section and continuing into the new section there is a void at the mudline. For measuring purposes Sta 1+00 is at the upstream face of the new section of the pier. The void extends approximately 3.0' downstream of Sta 1+00 where it meets steel sheeting. The void extends approximately 11' upstream of Sta 1+00 where it is covered by boulders. The maximum height of the void is 1.2' and the maximum penetration is 12.7'. The width of the footing is approximately 9', so the undermining goes completely under the footing and beneath the mudline on the left side of the pier. See Void Monitoring Chart on Page 6.
This undermining may have been caused by a washout of concrete laitance in addition to a scouring out of bottom materials.

REM.(2)7-98

Attachment 7-2: Level II Underwater Inspection Report, Page 3 of 7

PAGE 4 OF 6

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8. STRUCTURE NO.	INSPECTION DATE
WAREHAM	45K	W-06-016	W06016-45K-DOT-NBI	DEC 11, 2012

REMARKS

Item 61.1 - Channel Scour (Cont'd)

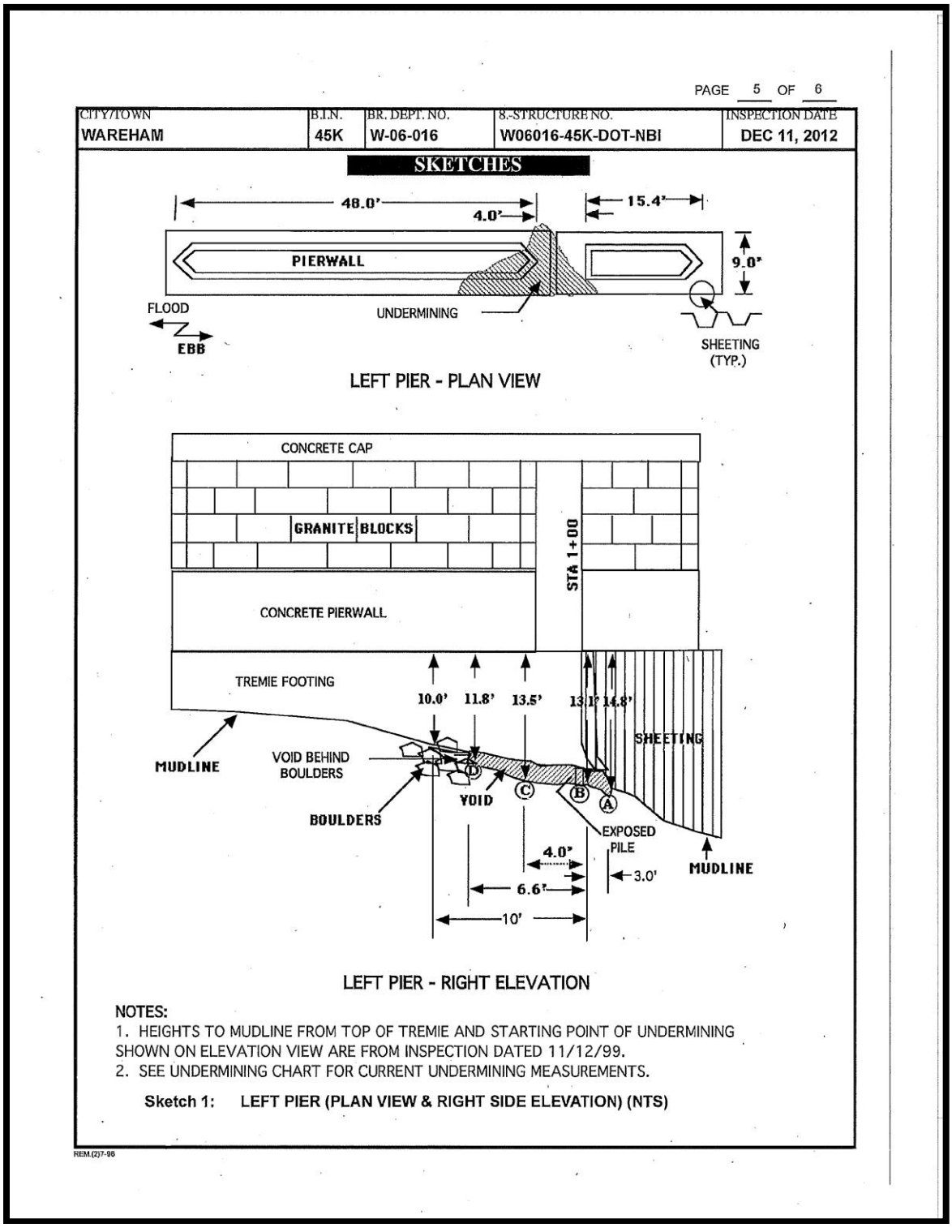
Right Pier:
The sheeting at the new section of the pier is cut off at the top of the footing. The exposed height at the downstream nose is 14.2'.

Item 61.6 - Rip-Rap/Slope Protection
Right Abutment:
Riprap along the right abutment is slumped at the downstream end.
Left Pier:
There are boulders across the upstream nose extending down along the right face to the undermining at the mudline.

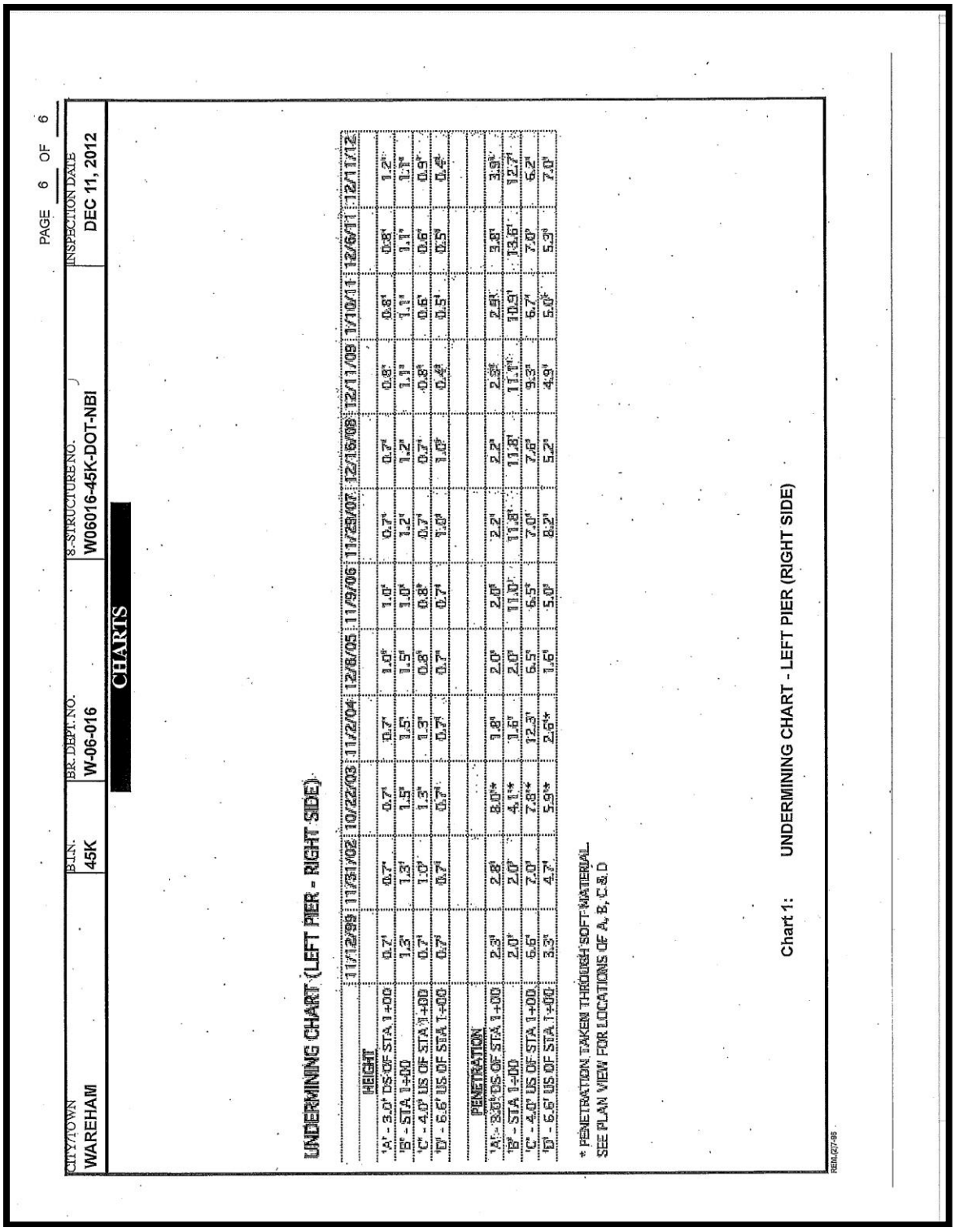
Sketch / Chart Log
Sketch 1 : LEFT PIER (PLAN VIEW & RIGHT SIDE ELEVATION) (NTS)
Chart 1 : UNDERMINING CHART - LEFT PIER (RIGHT SIDE)

REM.(2)7-96

Attachment 7-2: Level II Underwater Inspection Report, Page 4 of 7



Attachment 7-2: Level II Underwater Inspection Report, Page 5 of 7



PAGE 6 OF 6

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WAREHAM	45K	W-06-016	W06016-45K-DOT-NBI	DEC 11, 2012

CHARTS

UNDERMINING CHART (LEFT PIER - RIGHT SIDE)

	11/12/99	11/31/02	10/22/03	11/2/04	12/8/05	11/9/06	11/29/07	12/15/08	12/11/09	1/10/11	12/6/11	12/11/12
HEIGHT												
'A' - 3.0' DS OF STA 1+00	0.7'	0.7'	0.7'	0.7'	1.0'	1.0'	0.7'	0.7'	0.8'	0.8'	0.8'	1.2'
'B' - STA 1+00	1.5'	1.3'	1.5'	1.5'	1.5'	1.0'	1.2'	1.2'	1.1'	1.1'	1.1'	1.1'
'C' - 4.0' US OF STA 1+00	0.7'	1.0'	1.3'	1.3'	0.8'	0.8'	0.7'	0.7'	0.8'	0.6'	0.6'	0.9'
'D' - 6.6' US OF STA 1+00	0.7'	0.7'	0.7'	0.7'	0.7'	0.7'	1.0'	1.0'	0.4'	0.5'	0.5'	0.4'
PENETRATION												
'A' - 3.0' DS OF STA 1+00	2.3'	2.8'	8.0'*	1.8'	2.0'	2.0'	2.2'	2.2'	2.3'	2.5'	3.8'	3.9'
'B' - STA 1+00	2.0'	2.0'	4.1'*	1.6'	2.0'	11.0'	11.8'	11.8'	11.1'*	10.9'	13.6'	12.7'
'C' - 4.0' US OF STA 1+00	6.6'	7.0'	7.8'*	12.3'	6.5'	6.5'	7.0'	7.6'	9.3'	6.7'	7.0'	6.2'
'D' - 6.6' US OF STA 1+00	3.3'	4.7'	5.9'*	2.6'*	1.6'	5.0'	8.2'	5.2'	4.9'	5.0'	5.3'	7.0'

* PENETRATION TAKEN THROUGH SOFT MATERIAL
SEE PLAN VIEW FOR LOCATIONS OF A, B, C & D

Chart 1: UNDERMINING CHART - LEFT PIER (RIGHT SIDE)

REVISED 7-98

Attachment 7-2: Level II Underwater Inspection Report, Page 6 of 7

Element Data Collection Form

UNDERWATER OPERATIONS DOT

Month	Day	Year
12	11	2012

Bridge Number: W-06-016 Town: WAREHAM

BIN: 45K District: 5

Bridge Key Number: W0601645KDOTNBI

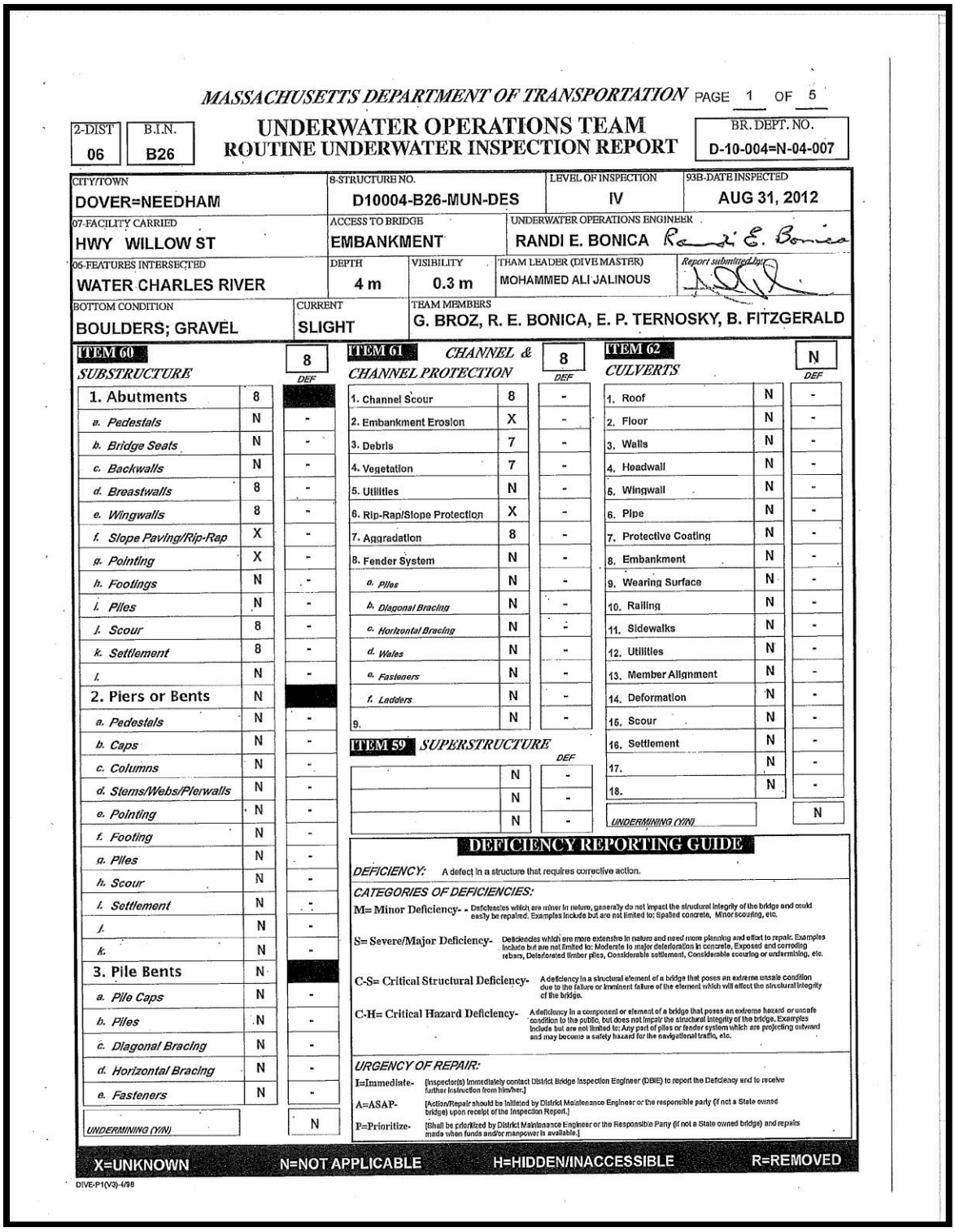
Inspectors: BONICA (*Leader*); COLLERAN, FITZGERALD, TERNOSKY (*Member*)

Elem. #	Element Name	Units	Env-iron.	Total Quantity	Condition States (Quantity or Percent) * 1	2	3	4	5	Q or P *
211	OTHER PIERWALLS	LF	3	127		127				Q
220	SUBMERGED FOOTING	EA	3	2	1	1				Q
361	SCOUR	EA	3	1		1				Q

* It is okay to switch between Quantity and Percent for different Elements.

1

Attachment 7-2: Level II Underwater Inspection Report, Page 7 of 7



MASSACHUSETTS DEPARTMENT OF TRANSPORTATION PAGE 1 OF 5

2-DIST	B.I.N.
06	B26

UNDERWATER OPERATIONS TEAM
ROUTINE UNDERWATER INSPECTION REPORT

BR. DEPT. NO.: D-10-004=N-04-007

CITY/TOWN	8-STRUCTURE NO.	LEVEL OF INSPECTION	93B-DATE INSPECTED
DOVER=NEEDHAM	D10004-B26-MUN-DES	IV	AUG 31, 2012

07-FACILITY CARRIED	ACCESS TO BRIDGE	UNDERWATER OPERATIONS ENGINEER
HWY WILLOW ST	EMBANKMENT	RANDI E. BONICA Randi E. Bonica

06-FEATURES INTERSECTED	DEPTH	VISIBILITY	TEAM LEADER (DIVE MASTER)	Report submitted by:
WATER CHARLES RIVER	4 m	0.3 m	MOHAMMED ALI JALINOUS	

BOTTOM CONDITION	CURRENT	TEAM MEMBERS
BOULDERS; GRAVEL	SLIGHT	G. BROZ, R. E. BONICA, E. P. TERNOSKY, B. FITZGERALD

ITEM 60 SUBSTRUCTURE		8 DEF
1. Abutments	8	
a. Pedestals	N	-
b. Bridge Seats	N	-
c. Backwalls	N	-
d. Breastwalls	8	-
e. Wingwalls	8	-
f. Slope Paving/Rip-Rap	X	-
g. Pointing	X	-
h. Footings	N	-
i. Piles	N	-
j. Scour	8	-
k. Settlement	8	-
l.	N	-
2. Piers or Bents	N	
a. Pedestals	N	-
b. Caps	N	-
c. Columns	N	-
d. Stems/Webs/Pierwalls	N	-
e. Pointing	N	-
f. Footing	N	-
g. Piles	N	-
h. Scour	N	-
i. Settlement	N	-
j.	N	-
k.	N	-
3. Pile Bents	N	
a. Pile Caps	N	-
b. Piles	N	-
c. Diagonal Bracing	N	-
d. Horizontal Bracing	N	-
e. Fasteners	N	-
UNDERMINING (Y/N)		N

ITEM 61 CHANNEL & CHANNEL PROTECTION		8 DEF
1. Channel Scour	8	-
2. Embankment Erosion	X	-
3. Debris	7	-
4. Vegetation	7	-
5. Utilities	N	-
6. Rip-Rap/Slope Protection	X	-
7. Aggradation	8	-
8. Fender System	N	-
a. Piles	N	-
b. Diagonal Bracing	N	-
c. Horizontal Bracing	N	-
d. Wales	N	-
e. Fasteners	N	-
f. Ladders	N	-
9.	N	-

ITEM 59 SUPERSTRUCTURE		DEF
	N	-
	N	-
	N	-

ITEM 62 CULVERTS		N DEF
1. Roof	N	-
2. Floor	N	-
3. Walls	N	-
4. Headwall	N	-
5. Wingwall	N	-
6. Pipe	N	-
7. Protective Coating	N	-
8. Embankment	N	-
9. Wearing Surface	N	-
10. Railing	N	-
11. Sidewalks	N	-
12. Utilities	N	-
13. Member Alignment	N	-
14. Deformation	N	-
15. Scour	N	-
16. Settlement	N	-
17.	N	-
18.	N	-
UNDERMINING (Y/N)		N

DEFICIENCY REPORTING GUIDE

DEFICIENCY: A defect in a structure that requires corrective action.

CATEGORIES OF DEFICIENCIES:

M= Minor Deficiency- Deficiencies which are minor in nature, generally do not impact the structural integrity of the bridge and could easily be repaired. Examples include but are not limited to: Spalled concrete, Minor scouring, etc.

S= Severe/Major Deficiency- Deficiencies which are more extensive in nature and need more planning and effort to repair. Examples include but are not limited to: Moderate to major deterioration in concrete, Exposed and corroding rebars, Deteriorated timber piles, Considerable settlement, Considerable scouring or undermining, etc.

C-S= Critical Structural Deficiency- A deficiency in a structural element of a bridge that poses an extreme unsafe condition due to the failure or imminent failure of the element which will affect the structural integrity of the bridge.

C-H= Critical Hazard Deficiency- A deficiency in a component or element of a bridge that poses an extreme hazard or unsafe condition to the public, but does not impair the structural integrity of the bridge. Examples include but are not limited to: Any part of piles or fender system which are projecting outward and may become a safety hazard for the navigational traffic, etc.

URGENCY OF REPAIR:

I=Immediate- [Inspector(s) immediately contact District Bridge Inspection Engineer (DBIE) to report the Deficiency and to receive further instruction from him/her.]

A=ASAP- [Action/Repair should be initiated by District Maintenance Engineer or the responsible party (if not a State owned bridge) upon receipt of the Inspection Report.]

P=Prioritize- [Shall be prioritized by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) and repairs made when funds and/or manpower is available.]

X=UNKNOWN N=NOT APPLICABLE H=HIDDEN/INACCESSIBLE R=REMOVED

DIVE-P1(V3)-4/98

Attachment 7-3: Level IV Underwater Inspection Report, Page 1 of 6

PAGE 2 OF 5

CITY/TOWN	B.I.N.	BR. DEPT. NO.	STRUCTURE NO.	INSPECTION DATE
DOVER=NEEDHAM	B26	D-10-004=N-04-007	D10004-B26-MUN-DES	AUG 31, 2012

REMARKS

GENERAL REMARKS

1) Orientation - The abutments are labeled left and right when facing downstream.
2) Sta 10+00 is at the upstream end, at edge of coping.
3) Single span precast concrete arch supported on gravity abutment on top of bedrock (East side) and Steel H-Piles (West side). Originally constructed in 1847, replaced in 1930. It is currently under construction.

ITEM 60 - SUBSTRUCTURE

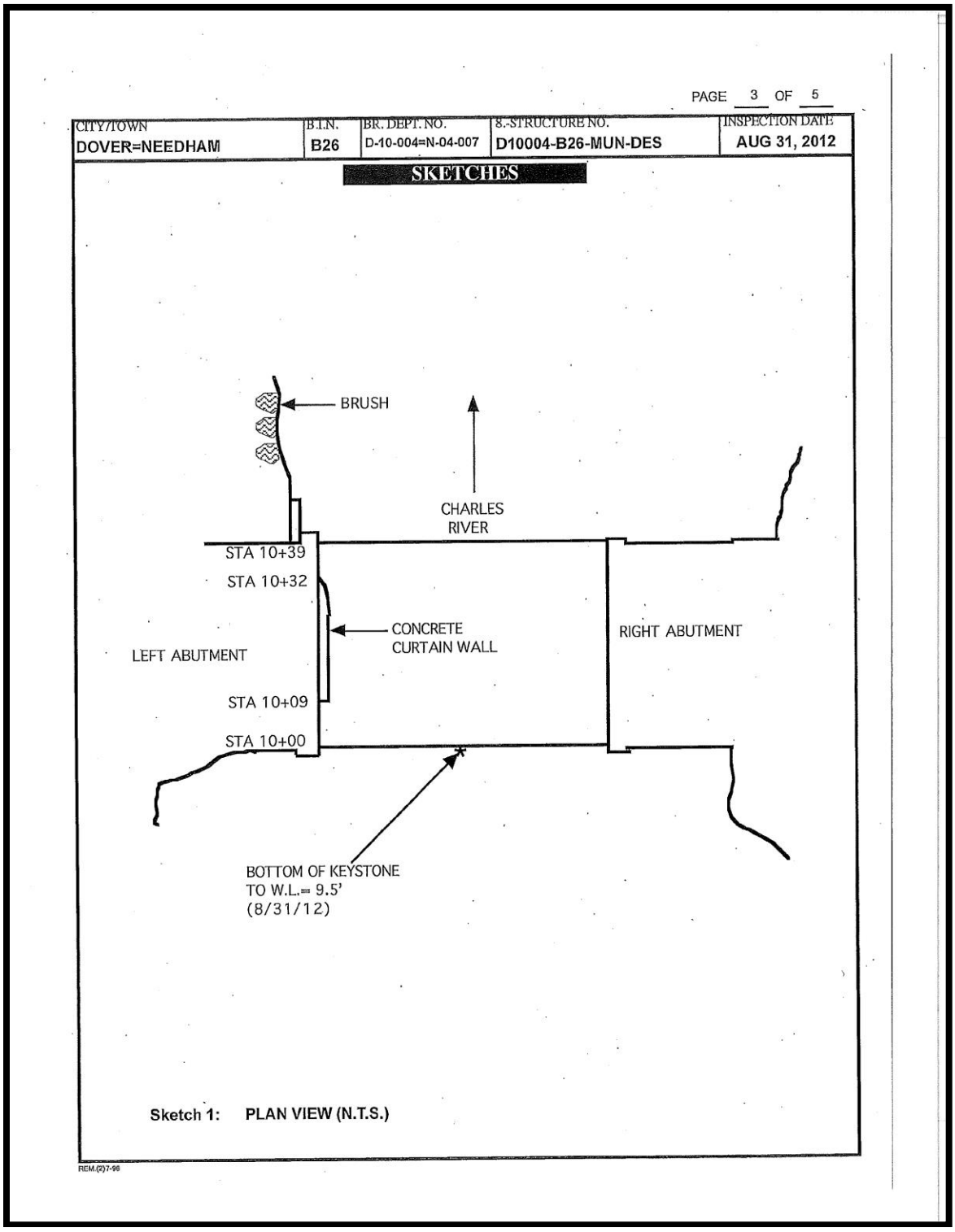
Item 60.1 - Abutments
Item 60.1.d - Breastwalls
Left Abutment:
There are a number of nails and threaded rods sticking out of the vertical face of the breastwall (Contractor to remove prior to the end of construction). There is a concrete curtain wall located from Sta. 10+09 to 10+32, with a toe width of 1' and max. exposed height of 2'.

Right Abutment:
There are a number of nails and threaded rods sticking out of the vertical face of the breastwall (Contractor to remove prior to the end of construction).

Sketch Log
Sketch 1 : PLAN VIEW (N.T.S.)
Sketch 2 : SOUNDINGS - (N.T.S.)
Sketch 3 : ELEVATION VIEW - LOOKING UPSTREAM (N.T.S.)

REM.(2)7-86

Attachment 7-3: Level IV Underwater Inspection Report, Page 2 of 6

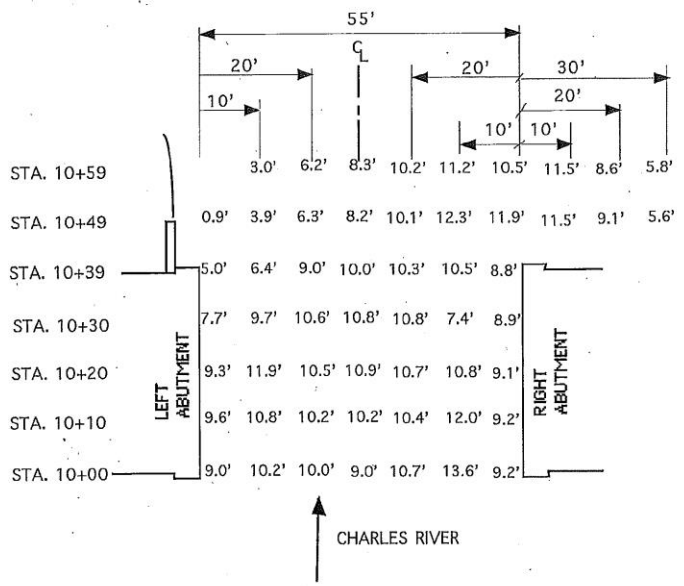


Attachment 7-3: Level IV Underwater Inspection Report, Page 3 of 6

PAGE 4 OF 5

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
DOVER=NEEDHAM	B26	D-10-004=N-04-007	D10004-B26-MUN-DES	AUG 31, 2012

SKETCHES



Notes

1. Water control shot (Y) = Waterline to bottom of Keystone, upstream end.
2. For comparison all soundings are to be adjusted to 2012 water level.
3. STA. 10+00 is located at upstream end of the abutments.
4. No soundings were taken at the upstream end of the bridge because of a construction barge.

Sketch 2: SOUNDINGS - (N.T.S.)

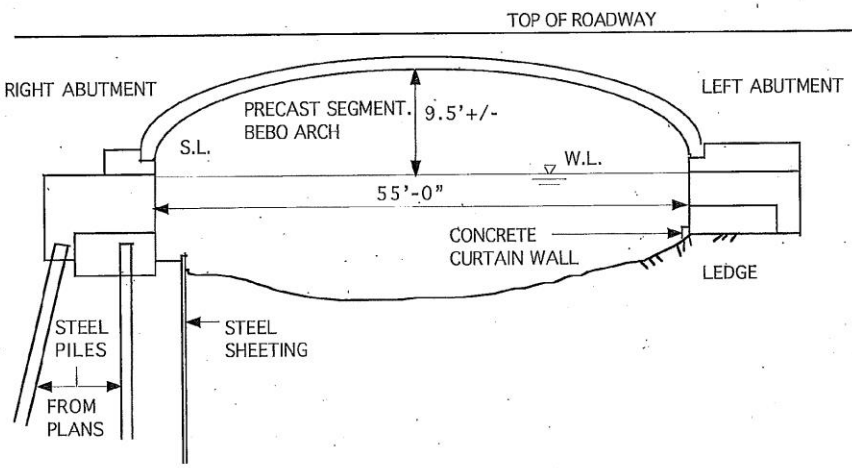
REM.(2)7-96

Attachment 7-3: Level IV Underwater Inspection Report, Page 4 of 6

PAGE 5 OF 5

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8. STRUCTURE NO.	INSPECTION DATE
DOVER=NEEDHAM	B26	D-10-004=N-04-007	D10004-B26-MUN-DES	AUG 31, 2012

SKETCHES



Sketch 3: ELEVATION VIEW - LOOKING UPSTREAM (N.T.S.)

REM.(2)7-68

Attachment 7-3: Level IV Underwater Inspection Report, Page 5 of 6

Element Data Collection Form

UNDERWATER OPERATIONS MASSDOT

Month	Day	Year
8	31	12

Bridge Number: D-10-004 Town: Blackstone

BIN: B26 District: 6

Bridge Key Number: D10004 B26 MUN DES

Inspectors: M. Jalinous (*Leader*), R. Bonica, G. Broz, B. Fitzgerald, E. Ternosky (*Member*)

Elem. #	Element Name	Units	Env-iron.	Total Quantity	Condition States (Quantity or Percent) * 1	2	3	4	5	Q or P *
215	ABUTMENT	LF	2	82	82					Q
144	ARCH	LF	2	39	39					Q

* It is okay to switch between Quantity and Percent for different Elements.

1

Attachment 7-3: Level IV Underwater Inspection Report, Page 6 of 6

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION PAGE 1 OF 4

UNDERWATER OPERATIONS TEAM
UNDERWATER SPECIAL MEMBER INSPECTION

2-DIST	B.I.N.	BR. DEPT. NO.
04	2PV	L-04-017

CITY/TOWN	8-STRUCTURE NO.	93b-U/W ROUTINE INSP DATE	U/W-SPECIAL MEMBER INSP DATE
LAWRENCE	L04017-2PV-MUN-NBI	Sep 30, 2009	APR 25, 2011

7-FACILITY CARRIED	ACCESS TO BRIDGE	UNDERWATER OPERATIONS ENGINEER
HWY CANAL ST	EMBANKMENT	JOHN B. DESMOND

6-FEATURES INTERSECTED	CURRENT	TEAM LEADER (DIVE MASTER)
WATER SPICKET RIVER	MODERATE	WILLIAM J. COLLERAN

BOTTOM CONDITION	DEPTH	VISIBILITY	Report submitted by:
GRAVEL & BOULDERS	2.5 m	1.2 m	

NEXT U/W ROUTINE INSPECTION DATE	92b-U/W ROUTINE FREQ	TEAM MEMBERS
SEP 30, 2011	Y24	B. FITZGERALD, R. E. BONICA, G. BROZ, J. B. DESMOND

MEMBER / CONDITION Requiring Special Member Inspection

ITEM	MEMBER	REMARKS	CONDITION previous (0-9)	CONDITION present (0-9)	Deficiencies
60.1.	Abutments		3	3	-
60.1. Abutments	d.Breastwalls	See remarks in comments section.	3	3	S-A
60.1. Abutments	k.Settlement	See remarks in comments section.	3	3	S-A

	I-59	I-60	I-61	I-62
(Overall Previous Condition)	-	3	-	-
(Overall Current Condition)	-	3	-	-

CONDITION RATING GUIDE

	CODE	CONDITION	DEFECTS
	N	NOT APPLICABLE	
G	9	EXCELLENT	Excellent condition.
G	8	VERY GOOD	No problem noted.
G	7	GOOD	Some minor problems.
F	6	SATISFACTORY	Structural elements show some minor deterioration.
F	5	FAIR	All primary structural elements are sound but may have minor section loss,cracking,spalling or scour.
P	4	POOR	Advance section loss, deterioration, spalling or scour.
P	3	SERIOUS	Loss of section, deterioration, spalling or scour have seriously effected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
C	2	CRITICAL	Advance deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close bridge until corrective action is taken.
C	1	"IMMINENT" FAILURE	Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put it back in light service.
	0	FAILED	Out of service - beyond corrective action.

X=UNKNOWN N=NOT APPLICABLE H=HIDDEN/INACCESSIBLE R=REMOVED

S.M.-P1(V2)-8/02

Attachment 7-4: Example of an Underwater Special Member Inspection, Page 1 of 4

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8-STRUCTURE NO.	INSPECTION DATE
LAWRENCE	2PV	L-04-017	L04017-2PV-MUN-NBI	APR 25, 2011

REMARKS

GENERAL REMARKS
This bridge is a single span fieldstone arch structure.
1) Orientation - Abutments are labeled left and right when facing downstream.
2) Sta 10+00 is at the upstream end of the granite block arch.
3) **Site Conditions:** The bridge is adjacent to a hazardous material clean-up site at the Oxford Mills Demolition Project. Access for this inspection was through the hospital parking lot, around a chain link fence and down a steep slope at the upstream left side of the bridge.

ITEM 60 - SUBSTRUCTURE

Item 60.1 - Abutments
Item 60.1.d - Breastwalls
Left Abutment:
There are random areas of loose and missing chinking stones and small blocks resulting in voids in the breastwall. Numerous fieldstones below the springline and granite blocks above the springline are cracked, split and missing.

Sta 10+09 to 10+14.5: There is a void at the mudline 5.5' long, 3.0' high and 3.0' maximum penetration.
Sta 10+32 to 10+37: There is a stone just above the mudline with a 0.4' wide vertical split. The split runs parallel to the face of the abutment. This block is displaced toward the channel 0.5'.

Right Abutment:
There are random areas of missing chinking stones and small blocks resulting in voids in the breastwall. Numerous fieldstones below the springline and granite blocks above the springline are cracked.

The most significant area is between Sta 10+10 and 10+23. The largest void measures 7.0' long, 4.7' high and 3.6' penetration. Stones in the area of this void are loose and displaced (See Partial Elevation). A previously split and displaced block appears to have only part of that block remaining.

Sta 10+03: There is a void at the mudline. Void length is 3.5', height is 1.5' and penetration is 2.8'.
Sta 10+30: There is a void at the mudline. Void length is 1.5', height is 0.7' and penetration is 2.1'.

Item 60.1.k - Settlement
Left Abutment:
There are random areas of loose and missing chinking stones and small blocks resulting in voids in the breastwall. Numerous fieldstones below the springline and granite blocks above the springline are cracked, split and missing.

Sta 10+09 to 10+14.5: There is a void at the mudline 5.5' long, 3.0' high and 3.0' maximum penetration.
Sta 10+32 to 10+37: There is a stone just above the mudline with a 0.4' wide vertical split. The split runs parallel to the face of the abutment. This block is displaced toward the channel 0.5'.

Right Abutment:
There are random areas of missing chinking stones and small blocks resulting in voids in the breastwall. Numerous fieldstones below the springline and granite blocks above the springline are cracked.

The most significant area is between Sta 10+10 and 10+23. The largest void measures 7.0' long, 4.7' high and 3.6' penetration. Stones in the area of this void are loose and displaced (See Partial Elevation). A previously split and displaced block appears to have only part of that block remaining.

Sta 10+03: There is a void at the mudline. Void length is 3.5', height is 1.5' and penetration is 2.8'.
Sta 10+30: There is a void at the mudline. Void length is 1.5', height is 0.7' and penetration is 2.1'.

Attachment 7-4: Example of an Underwater Special Member Inspection, Page 2 of 4

PAGE 3 OF 4

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
LAWRENCE	2PV	L-04-017	L04017-2PV-MUN-NBI	APR 25, 2011

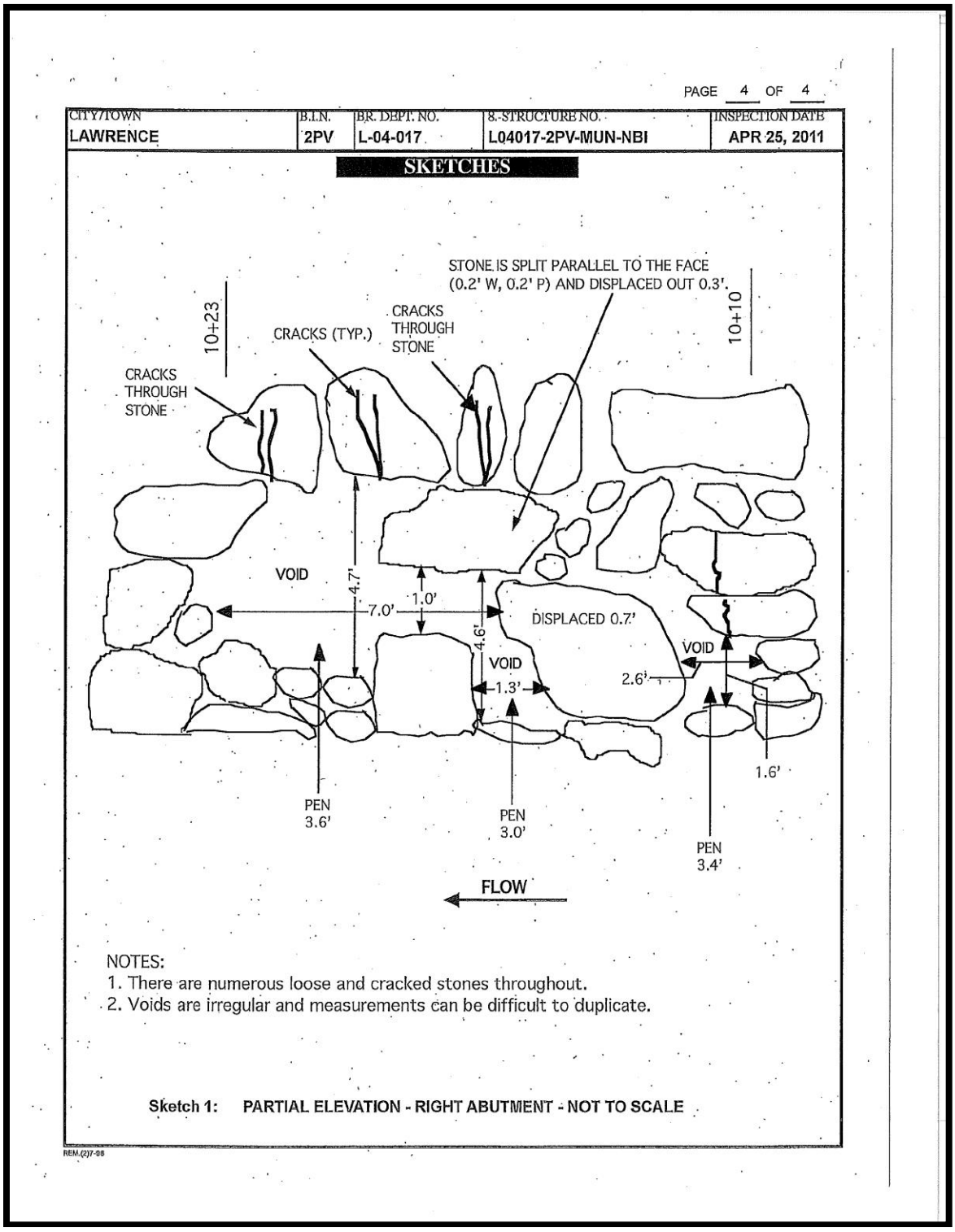
REMARKS

Sketch Log

Sketch 1 : PARTIAL ELEVATION - RIGHT ABUTMENT - NOT TO SCALE

REM.(2)7-99

Attachment 7-4: Example of an Underwater Special Member Inspection, Page 3 of 4



Attachment 7-4: Example of an Underwater Special Member Inspection, Page 4 of 4

Massachusetts Department of Transportation

UNDERWATER OPERATIONS TEAM

DIVERS ACTIVITY REPORT

PAGE 1 OF 1

2-DIST	B.I.N.	BR. DEPT. NO.
4	33A	B-21-005

CITY/TOWN	8-STRUCTURE NO.	LEVEL OF INSP.	93b- INSPECTION DATE
BRAINTREE	B21005-33A-MUN-NBI	I	4/7/10
7-FACILITY CARRIED	**ACCESS TO BRIDGE**	**UNDERWATER OPERATIONS ENGINEER**	
ADAMS STREET	EMBANKMENT	JOHN B. DESMOND	
6-FEATURES INTERSECTED	**DEPTH / VISIBILITY**	**TEAM LEADER (DIVE MASTER)**	*Report submitted by:*
MONATIQUOT RIVER	5' / 5'	A. BONDESON	
BOTTOM CONDITION	**CURRENT**	**TEAM MEMBERS**	
BOULDERS, GRAVEL	SWIFT	BROZ, DESMOND, KYRIAZIDIS, PRENDERGAST	

STORM DAMAGE INSPECTION
(HEAVY RAINS - SPRING 2010)

[X] MAJOR FLOOD DAMAGE

[ ] MINOR FLOOD DAMAGE

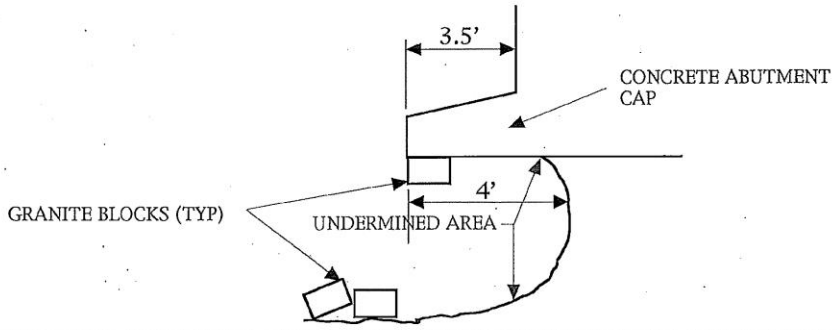
[X] DEBRIS BUILDUP

[ ] NO APPARENT FLOOD DAMAGE

Right Abutment:
There is undermining at the upstream end of the bridge under the concrete abutment cap (15'L x 2.6'H x 4'P). Some granite blocks under concrete abutment cap in the undermined area are missing.

The upstream right concrete retaining wall has undermining along the full length, maximum demensions 1'H x 1'P (maximum dimensions).

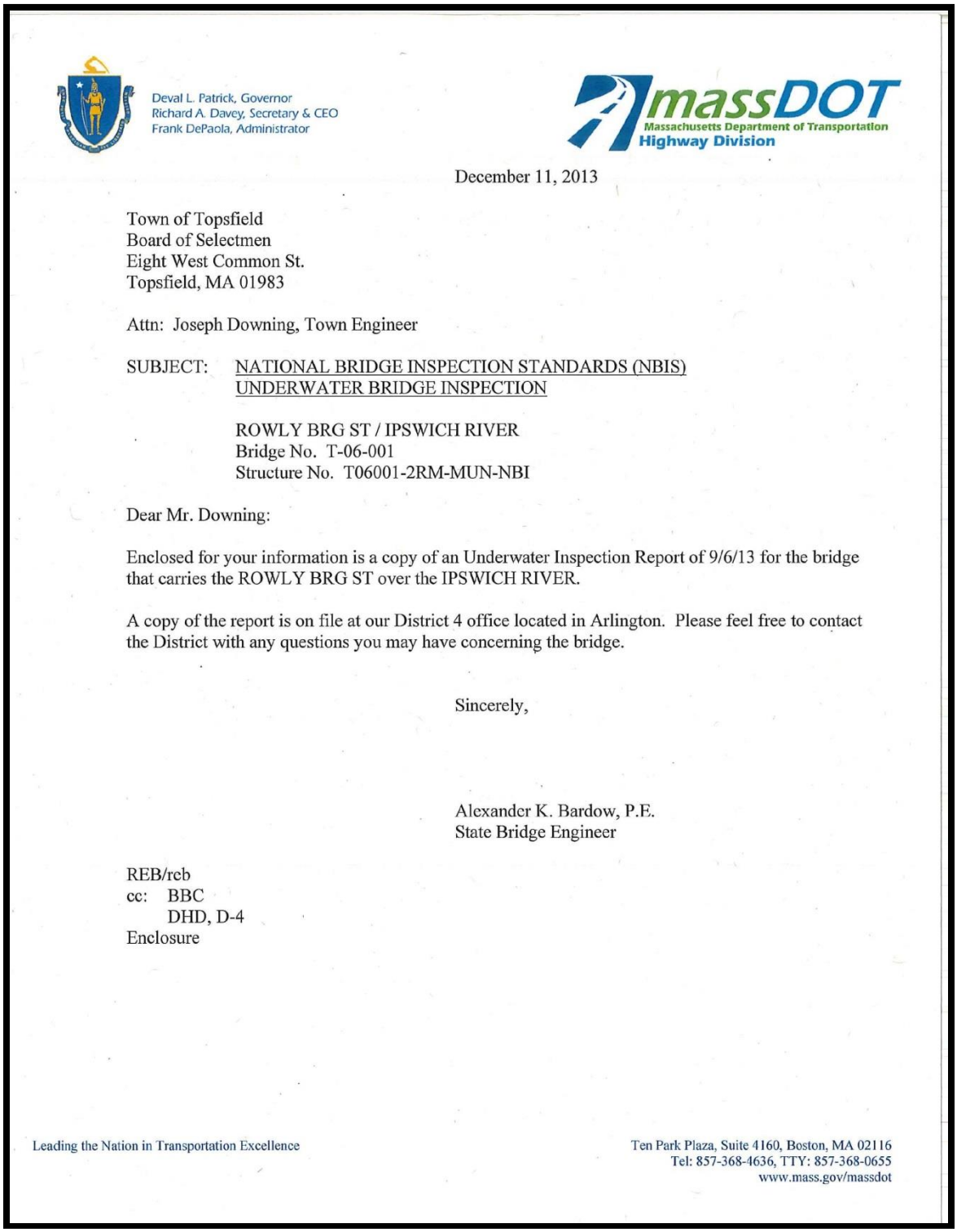
NOTE: Plans show drilled shafts supporting the abutment.



UNDERMINED ELEVATION AT UPSTREAM END SECTION LOOKING DOWNSTREAM

DIVE-P1(V0)-4/09

Attachment 7-5: Example of a Divers Activity Report – Flood Inspection



Deval L. Patrick, Governor
Richard A. Davey, Secretary & CEO
Frank DePaola, Administrator

massDOT
Massachusetts Department of Transportation
Highway Division

December 11, 2013

Town of Topsfield
Board of Selectmen
Eight West Common St.
Topsfield, MA 01983

Attn: Joseph Downing, Town Engineer

SUBJECT: NATIONAL BRIDGE INSPECTION STANDARDS (NBIS)
UNDERWATER BRIDGE INSPECTION

ROWLY BRG ST / IPSWICH RIVER
Bridge No. T-06-001
Structure No. T06001-2RM-MUN-NBI

Dear Mr. Downing:

Enclosed for your information is a copy of an Underwater Inspection Report of 9/6/13 for the bridge that carries the ROWLY BRG ST over the IPSWICH RIVER.

A copy of the report is on file at our District 4 office located in Arlington. Please feel free to contact the District with any questions you may have concerning the bridge.

Sincerely,

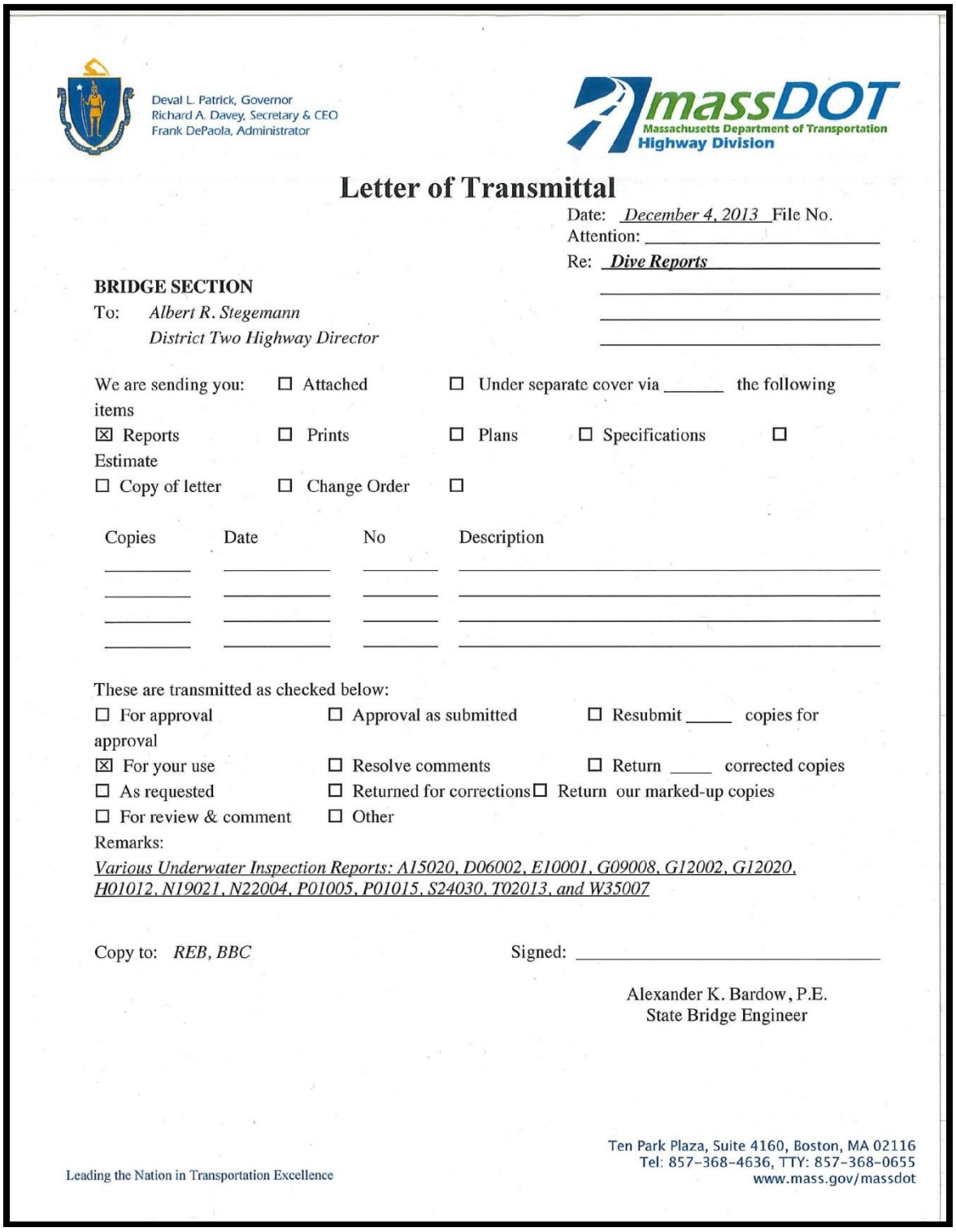
Alexander K. Bardow, P.E.
State Bridge Engineer

REB/rcb
cc: BBC
DHD, D-4
Enclosure

Leading the Nation in Transportation Excellence

Ten Park Plaza, Suite 4160, Boston, MA 02116
Tel: 857-368-4636, TTY: 857-368-0655
www.mass.gov/massdot

Attachment 7-6: Example of a Municipality letter of transmittal



Deval L. Patrick, Governor
Richard A. Davey, Secretary & CEO
Frank DePaola, Administrator

massDOT Massachusetts Department of Transportation Highway Division

Letter of Transmittal

Date: *December 4, 2013* File No.
Attention: _____
Re: ***Dive Reports***

BRIDGE SECTION
To: *Albert R. Stegemann*
District Two Highway Director

We are sending you: ☐ Attached ☐ Under separate cover via _____ the following items
☒ Reports ☐ Prints ☐ Plans ☐ Specifications ☐ Estimate
☐ Copy of letter ☐ Change Order ☐

Copies	Date	No	Description

These are transmitted as checked below:
☐ For approval ☐ Approval as submitted ☐ Resubmit _____ copies for approval
☒ For your use ☐ Resolve comments ☐ Return _____ corrected copies
☐ As requested ☐ Returned for corrections ☐ Return our marked-up copies
☐ For review & comment ☐ Other

Remarks:
Various Underwater Inspection Reports: A15020, D06002, E10001, G09008, G12002, G12020, H01012, N19021, N22004, P01005, P01015, S24030, T02013, and W35007

Copy to: *REB, BBC*

Signed: _____

Alexander K. Bardow, P.E.
State Bridge Engineer

Leading the Nation in Transportation Excellence

Ten Park Plaza, Suite 4160, Boston, MA 02116
Tel: 857-368-4636, TTY: 857-368-0655
www.mass.gov/massdot

Attachment 7-7: Example of state owned letter of transmittal