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

MassDOT
Massachusetts Department of Transportation
Highway Division

September 12, 2014

Stephen A. Casazza, P.E., City Engineer
City Engineering Office
119 School Street
Waltham, MA 02451-4596

SUBJECT: **Beaver Street Culvert W-04-016 (7YW)**

Dear Mr. Casazza:

As per your request on July 8, 2014, enclosed please find a copy of the September 3, 2014 Initial Culvert & Special Member Inspection report for bridge W04016 (7YW).

Questions regarding the content of the report may be directed to the District Bridge Inspection Engineer, Thomas Weil, at (781) 674-2172.

Sincerely,

Paul D. Stedman,
Acting District Highway Director

DJC / TW / cab
cc: Brian Clang - BIE, D-4 DHD, D-4 DBIE, Prem Kapoor-DBE
Enclosures

519 Appleton Street, Arlington, MA 02476
Tel: 781-641-8300
www.mass.gov/massdot

CITY OF WALTHAM
Engineering Department

Stephen A. Casazza, P.E.
City Engineer

July 8, 2014

Mr. Paul Stedman
MassDot
Acting District Highway Director – District 4
519 Appleton Street
Arlington, MA 02476

Re: Beaver Street – Culvert
W-04-016, Waltham, MA

Dear Mr. Stedman:

I am writing to request that a bridge inspection be performed on the Beaver Street Culvert Bridge #W-04-016. Last week the City Public Works Department responded to a sinkhole report and installed a "road" plate over the sinkhole.

The City is preparing an RFP to have the Beaver Street Culvert replaced. We are concerned that the sinkhole may be an indication of a structural issue. We are exploring design/build options for replacing this structure, however we anticipate it will take at least six months before any work is undertaken.

If you should have any questions, please do not hesitate to contact me at 781-314-3830 or scasazza@city.waltham.ma.us.

Yours truly,

Stephen A. Casazza, P.E.
City Engineer

cc: Prem Kapor, MassDot
Lisa Goyer, P.E., Assistant City Engineer
Michael Chiasson, CPW Director

STRUCTURES INSPECTION FIELD REPORT

INITIAL CULVERT & SPECIAL MEMBER INSPECTION

2-DIST	B.I.N.	BR. DEPT. NO.
04	7YW	W-04-016

CITY/TOWN	8.-STRUCTURE NO.	11-Kilo. POINT	41-STATUS	90-ROUTINE INSP. DATE
WALTHAM	W04016-7YW-MUN-BRI	000.000	A:OPEN	SEP 3, 2014

07-FACILITY CARRIED	MEMORIAL NAME/LOCAL NAME	27-YR BUILT	106-YR REBUILT	YR REHAB'D (NON 106)
HWY BEAVER ST		1850	1900	0000

06-FEATURES INTERSECTED	26-FUNCTIONAL CLASS	DIST. BRIDGE INSPECTION ENGINEER
WATER BEAVER BROOK	Urban Minor Arterial	T. G. Weil

43-STRUCTURE TYPE	22-OWNER	21-MAINTAINER	TEAM LEADER L. Hayes
219 : Concrete continuous Culvert	City/ Municipal Highway A	City/ Municipal Highway A	

107-DECK TYPE	WEATHER	TEMP. (air)	TEAM MEMBERS
1 : Concrete Cast-in-Place	clear	27°C	J. ROY, A. MARLIN JRR AM

TYPE OF CULVERT:

SHAPE:	RECTANGULAR
MATERIAL:	CONCRETE
COATING:	NONE

BARRELS: (In Meters)

SIZE:	*NUMBER:*
2.20mx1.77m	1

DEPTH OF COVER (To the nearest tenth of a meter) — E: 0.4, W: 0.4

CURB REVEAL (In millimeters) — N, N

ITEM 62 *CULVERT & RETAINING WALLS* — 2

I62 (Dive Report): N — I62 (This Report): 2

	Dive Rpt.	This Rpt.	DEF
1. Roof	N	2	S-A
2. Floor	N	N	-
3. Walls	N	2	S-A
4. Headwall	N	N	-
5. Wingwall	N	3	S-A
6. Pipe	N	N	-
7.Protective Coating	N	N	-
8.Embankment	N	N	-
9.Wearing Surface	N	5	M-P
10.Railing	N	0	S-A
11.Sidewalks	N	N	-
12.Utilities	N	4	S-A
13.Member Alignment	N	2	S-A
14.Deformation	N	N	-
15.Scour	N	2	S-A
16.Settlement	N	2	S-A
17.	N	N	-
18.	N	N	-

UNDERMINING (Y/N) If YES please explain: Y

COLLISION DAMAGE: *Please explain* — None (X) Minor ( ) Moderate ( ) Severe ( )

LOAD VIBRATION: *Please explain* — None ( ) Minor (X) Moderate ( ) Severe ( )

ITEM 61 *CHANNEL & CHANNEL PROTECTION* — 2

	Dive Rpt.	This Rpt.	DEF
1.Channel Scour	N	2	S-A
2.Embankment Erosion	N	3	S-A
3.Debris	N	4	S-A
4.Vegetation	N	6	M-P
5. Utilities	N	4	S-A
6. Rip-Rap/Slope Protection	N	3	S-A
7. Aggradation	N	4	S-A

STREAM FLOW VELOCITY: Tidal ( ) High ( ) Moderate ( ) Low (X)

ITEM 61 (Dive Report): N

ITEM 61 (This Report): 2

93b-U/W INSP DATE: 00/00/00

APPROACH CONDITION

		DEF
a. Appr. pavement condition	6	M-P
b. Appr. Roadway Settlement	8	-
c. Appr. Sidewalk Settlement	N	-
d.	N	-

WEIGHT POSTING

Not Applicable X

	H	3	3S2	Single
Actual Posting	N	N	N	N
Recommended Posting	N	N	N	N

Waived Date: 00/00/00 EJDMT Date: 00/00/00

Signs In Place (Y=Yes,N=No, NR=NotRequired) Legibility/ Visibility

At bridge N	At bridge S	Advance N	Advance S

ITEM 36 *TRAFFIC SAFETY*

	36	COND	DEF
A. Bridge Railing	0	0	S-A
B. Transitions	0	0	S-A
C. Approach Guardrail	0	3	S-A
D. Approach Guardrail Ends	0	0	S-A

ACCESSIBILITY (Y/N/P):

	Needed	Used		Needed	Used
Ladder	N	N	Other:		
Boat	N	N		N	N
Waders	Y	Y			

TOTAL HOURS 10

PLANS (Y/N): N

(V.C.R.) (Y/N): N

TAPE#: _____

RATING

Rating Report (Y/N): N

Date: 00/00/00

Inspection data at time of existing rating

I 62: - Date : 00/00/00

(To be filled out by DBIE)

Request for Rating or Rerating (Y/N): N

If YES please give priority: HIGH ( ) MEDIUM ( ) LOW ( )

REASON: _____

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

STRUCTURES INSPECTION FIELD REPORT

INITIAL CULVERT & SPECIAL MEMBER INSPECTION

2-DIST	B.I.N.	BR. DEPT. NO.
04	7YW	W-04-016

CITY/TOWN	8.-STRUCTURE NO.	11-Kilo. POINT	90-ROUTINE INSP. DATE	93*-SPEC. MEMB. INSP. DATE
WALTHAM	W04016-7YW-MUN-BRI	000.000	Sep 3, 2014	Sep 3, 2014

07-FACILITY CARRIED	MEMORIAL NAME/LOCAL NAME	27-YR BUILT	106-YR REBUILT	*YR REHAB'D (NON 106)
HWY BEAVER ST		1850	1900	0000

06-FEATURES INTERSECTED	26-FUNCTIONAL CLASS	DIST. BRIDGE INSPECTION ENGINEER T. G. Weil
WATER BEAVER BROOK	Urban Minor Arterial	TW

43-STRUCTURE TYPE	22-OWNER	21-MAINTAINER	TEAM LEADER L. Hayes
219 : Concrete continuous Culvert	City/ Municipal Highway A	City/ Municipal Highway A	

107-DECK TYPE	WEATHER	TEMP. (air)	TEAM MEMBERS
1 : Concrete Cast-in-Place	clear	27°C	J. ROY, A. MARLIN SRR AM

WEIGHT POSTING — *Not Applicable* X

	H	3	3S2	Single
Actual Posting	N	N	N	N
Recommended Posting	N	N	N	N

Waived Date: 00/00/00 EJDMT Date: 00/00/00

Signs In Place (Y=Yes,N=No, NR=NotRequired) / Legibility/ Visibility

	At bridge		Advance	
	N	S	N	S
Signs In Place				
Legibility/ Visibility	/	/	/	/

PLANS (Y/N): N

(V.C.R.) (Y/N): N

TAPE#:

RATING

Rating Report (Y/N): N Date: ----

Request for Rating or Rerating (Y/N): N

If YES please give priority: HIGH ( ) MEDIUM ( ) LOW ( )

REASON: TW

Inspection data at time of existing rating

I 58: - I 59: - I 60: - I 62: - Date :00/00/00

SPECIAL MEMBER(S):

	MEMBER	CRACK (Y/N):	WELD'S CONDITION (0-9)	LOCATION OF CORROSION, SECTION LOSS (%), CRACKS, COLLISION DAMAGE, STRESS CONCENTRATION, ETC.	CONDITION PREVIOUS (0-9)	CONDITION PRESENT (0-9)	INV. RATING OF MEMBER FROM RATING ANALYSIS H-20	3	3S2	Deficiencies
A	Item 61.1 - Channel Scour	N		See remarks in comments section.	N	2	Not Rated			S-A
B	Item 62.1 - Roof	N		See remarks in comments section.	N	2	Not Rated			S-A
C	Item 62.3 - Walls	N		See remarks in comments section.	N	2	Not Rated			S-A
D	Item 62.13 - Member Alignment	N		See remarks in comments section.	N	2	Not Rated			S-A
E	Item 62.15 - Scour	N		See remarks in comments section.	N	2	Not Rated			S-A

List of field tests performed:

-

	I-58	I-59	I-60	I-62
(Overall Previous Condition)	-	-	-	-
(Overall Current Condition)	-	-	-	2

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 pot holes, Minor corrosion of steel, Minor scouring, Clogged drainage, 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 corroded rebars, Considerable settlement, Considerable scouring or undermining, Moderate to extensive corrosion to structural steel with measurable loss of section, 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: Loose concrete hanging down over traffic or pedestrians, A hole in a sidewalk that may cause injuries to pedestrians, Missing section of bridge railing, 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

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

SPECIAL MEMBER(S):

	MEMBER	CRACK (Y/N):	WELD'S CONDITION (0-9)	LOCATION AND DESCRIPTION OF DAMAGE	CONDITION PREVIOUS (0-9)	CONDITION PRESENT (0-9)	INV. RATING OF MEMBER FROM RATING ANALYSIS H-20	3	3S2	Deficiencies
F	62.16. Settlement	N		See remarks in comments section.	N	2	Not Rated			S-A

RTB(2)7-96

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

REMARKS, PHOTOS & SKETCHES

BRIDGE ORIENTATION

For this report the approaches are South and North and the elevations are West and East. Beaver Brook flows from East to West.

ITEM 62 - CULVERT

Item 62.1 - Roof

The roof of the culvert utilizes railroad rails as the longitudinal reinforcement of the roof. There are several locations where these rails are exposed due to spalls and holes in the roof of the culvert. Two of these rails are unsupported at the South wall.

On the West side of the culvert there is a large hole in the roof of the culvert that measures 124" (full width), 29" wide on the North wall and 48" wide along the South wall. The concrete roof is between 12" and 14" thick at this location. This hole is 29" deep; the bottom of the steel plate that has been installed on the wearing surface to bridge this hole is visible. Several steel rails are fully exposed along the edges of this hole and one is unsupported and sagging at the South end due to the missing section of the Southeast end of the wall (see description in Item 62.3, Walls). There are exposed longitudinal and transverse #4 reinforcement bars at the hole in the roof that have 100 percent section loss (see Photo #1 through #5).

The concrete along the West edge of the roof is severely deteriorated. It appears that approximately 12" to 18" of the deck has spalled off over the channel. There are exposed longitudinal and transverse #4 reinforcement bars that have 100 percent section loss. There are several fully exposed rails at this location,

CONDITION RATING GUIDE

	CODE	CONDITION	DEFECTS
	N	NOT APPLICABLE	Use if structure is not a culvert.
G	9	EXCELLENT	No deficiencies.
G	8	VERY GOOD	No noticeable or noteworthy differences which affect the condition of the culvert. Insignificant scrape marks caused by drift.
G	7	GOOD	Shrinkage cracks, light scaling, and insignificant spalling, which does not expose reinforcing steel. Insignificant damage caused by drift with not misalignment and not requiring corrective action. Some minor scouring has occurred near curtain walls, wingwalls, or pipes. Metal culverts have a smooth symmetrical curvature with superficial corrosion and no pitting.
F	6	SATISFACTORY	Deterioration or initial disintegration, minor chloride contamination, cracking with some leaching, or spalls on concrete or masonry walls and slabs. Local minor scouring at curtain walls, wingwalls, or pipes. Metal culverts have a smooth curvature, non-symmetrical shape, significant corrosion or moderate pitting.
F	5	FAIR	Moderate to major deterioration, or disintegration, extensive cracking and leaching, or spalls on concrete or masonry walls and slabs. Minor settlement or misalignment. Noticeable scouring or erosion at curtain walls, wingwalls, or pipes. Metal culverts have significant distortion and deflection in one section, significant corrosion or deep pitting.
P	4	POOR	Large spalls, heavy scaling, wide cracks, considerable efforescence, or opened construction joints permitting loss of backfill. Considerable settlement or misalignment. Considerable scouring or erosion at curtain walls, wingwalls, or pipes. Metal culverts have significant distortion and deflection throughout, extensive corrosion or deep pitting.
P	3	SERIOUS	Any condition described in Code 4 but which is excessive in scope. Severe movement or differential settlement of the segments, or loss of fill. Holes may exist in walls or slabs. Integral wingwalls, nearly severed from culvert. Severe scour or erosion at curtain walls, wingwalls, or pipes. Metal culverts have extreme distortion and deflection in one section, extensive corrosion, or deep pitting with scattered perforations.
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 the bridge until corrective action is taken.
C	1	"IMMINENT" FAILURE	Bridge closed. Corrective action may put back in light service.
	0	FAILED	Bridge closed. Replacement necessary.

DEFICIENCY REPORTING GUIDE

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

CATEGORIES OF DEFICIENCIES:

M= Minor Deficiency - (Examples include but are not limited to: Spalled concrete, minor to moderate corrosion to steel culverts, minor settlement or misalignment, minor scouring, minor damage to guardrail, etc.)

S= Severe/Major Deficiency - (Examples include but are not limited to: Large spalls, wide cracks, moderate to major deterioration in concrete, considerable settlement, considerable scouring or undermining, extensive corrosion and deflection in steel culverts, etc.)

C-S= Critical Deficiency - A deficiency in a structural component or element of a bridge that poses an extreme hazard or unsafe condition to the public. (Follow-up Critical Deficiency Report must be submitted separately)

URGENCY OF REPAIR:

I = Immediate- [Inspector(s) stay at the bridge until the District Maintenance crew or the responsible Agency crew(if not a State bridge) show up and corrective action is taken.]

A = ASAP- [Action will be taken by the District Maintenance Engineer or the Responsible Agency (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].

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

REMARKS

Item 62.1 - Roof (Cont'd)
one of which is unsupported at the South wall (see Photo #6 & #7).

Item 62.2 - Floor
The culvert does not have a floor; see Item 62.15, Scour.

Item 62.3 - Walls
The walls of the culvert appear to be a 14" thick concrete fill that has been poured in front of a fieldstone wall. It appears that the walls are unreinforced; no rebar is visible at any of the cracks, holes or spalled areas along the ends of both walls.

The South wall has a full height spall at the West end that is at least 16" wide. The concrete is deteriorated. There is a rail from the roof reinforcement that is unsupported at this location and sagging. The adjoining rail supporting the roof has little bearing on the wall at this location. The top of the South wall appears to be crushing over a length of 14" at the Southwest corner (see Photo #8, #9 & #10).

The South wall has a full height crack located 14'-10" from the West edge of the culvert that is between 3/4" to 1-1/2" in width that has split the South wall into two sections. The base of both sections of the South wall are leaning in towards the channel. There is visible movement of the Western end of the South wall at the location of the crack; there is a 1" displacement at the waterline. The Eastern section of the wall consistently measures 9/16" over 24" out of plumb and the Western section measures 1-1/4" over 24" out of plumb. There is settlement of the Western section of wall at the location of the crack; the crack between the top of wall and roof is 3/4" thick for a length of 25" and transitions to a 1/8" wide crack for another 48" going towards the Southwest corner (see Photo #11, #12 & #13).

There is a large hole at the Southeast corner between the wall and Southeast wingwall that measures 42" high, 29" wide at the base and 45" wide at the top and is in excess of 36" deep due to the loss of backfill material behind the wall. No reinforcement bar is visible at this location (see Photo #14).

The North wall is spalled full height at the Northwest corner of the culvert (see Photo #15).

There is a full height crack in the North wall that is hairline at the top to 3/8" thick at the waterline, and is located 14'-4" from the West edge of the culvert. There is a spall in the face of the wall at the waterline measuring 26" wide x 3" deep that appears to go down to the footing, The footing is undermined and spalled below this location (see Photo #16).

There is a large spall at the Northeast corner between the wall and Northeast wingwall that is 43" in height, 2" wide at the base and 14" wide at the top and 7" deep. No reinforcement bar is visible at this location (see Photo #17).

Item 62.5 - Wingwall
The Southwest and Northwest wingwalls consist of stacked fieldstone. There is little to no mortar left in the face of these walls. Both walls are undermined, leaning towards the channel and collapsing (see Photo #18 through #21).

The Southeast and Northeast wingwalls are cast in place concrete. These are in overall good condition with no signs of significant damage. There is a loss of backfill material from behind the Southeast wingwall (see Photo #22).

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

REMARKS

Item 62.9 - Wearing Surface
The wearing surface has longitudinal cracks in the asphalt patch over the steel plates on the Northbound travel lane (see Photo #23).

Item 62.10 - Railing
Type SS guardrail act as the bridge rail on the East side of the Northbound roadway. There is no railing along the West side of the Southbound roadway.

Item 62.12 - Utilities
A 12" CI pipe is fully exposed along the West side of the bridge; see description in Item 62.1 - Roof.

Item 62.13 - Member Alignment
There is misallignment of the South wall as outlied in Item 62.3 - Walls.

Item 62.15 - Scour
The channel has degraded under the structure and has undermined portions of the footings of both the North and South walls. The channel depth outside the culvert is approximately 16" at the East and West ends. The channel depth is in excess of 48" at several locations under the structure.

The footing of the Western half of the South wall is undermined in excess of 10" over a length of 14'-10". Actual scour depth under this wall is likely much deeper; the bottom of the channel is covered with a thick layer of organic material.

There are several isolated areas of the North wall where the footing is exposed and undermined.

Item 62.16 - Settlement
The Western half of the South wall is settling; see description in Item 62.3 - Walls.

Undermining Notes
Both footings are undermined in several locations due to degradation of the stream bed under the structure.

ITEM 61 - CHANNEL AND CHANNEL PROTECTION

Item 61.1 - Channel Scour
The channel has degraded under the structure and has undermined portions of the footings of both the North and South walls. The channel depth outside the culvert is approximately 16" at the East and West ends. The channel depth is in excess of 48" at several locations under the structure.

The footing of the Western half of the South wall is undermined in excess of 10" over a length of 14'-10". Actual scour depth under this wall is likely much deeper; the bottom of the channel is covered with a thick layer of organic material.

There are several isolated areas of the North wall where the footing is exposed and undermined.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

REMARKS

Item 61.2 - Embankment Erosion
There is erosion at the Southeast corner of the bridge; backfill material is washing out from behind the wingwall and South wall at this location (see Photo #14 & #22).

There is significant erosion and undermining of the Southwest embankment. The fieldstone wingwall at the Southwest corner has partially collapsed; the concrete face and numerous stones and boulders are in the channel. The remaining concrete section is leaning in towards the brook, and the RCP drain pipe at this location has broken (see Photo #24).

There is erosion and undermining of the Northwest embankment. The fieldstone portion of the wingwall has numerous voids at the waterline and the wall appears quite unstable; it has partially collapsed and is leaning in towards the channel. There are several trees and large roots that are growing out of the embankment above the wingwall that appear to have stabilized the remaining fieldstone wingwall. The concrete surrounding a RCP drain pipe at this location is undermined and has settled (see Photo #18).

Item 61.3 - Debris
The channel under the culvert is full of submerged debris. There are numerous branches, small logs and a a thick layer of organic material.

Item 61.4 - Vegetation
There is a large tree root that spans the West side of the culvert (see Photo #25, 26 & #27). This root is stabilizing the roadway subbase material and 12" cast iron utility that is fully exposed at this location

Item 61.5 - Utilities
There is a 12" cast iron pipe at the west edge of the deck that is exposed due to the loss of fill and deck concrete at this location. The pipe has significant corrosion (see Photo #25, #26 & #27).

Item 61.6 - Rip-Rap/Slope Protection
See Item 61.2, Embankment Erosion.

Item 61.7 - Aggradation
At the Southeast corner of the culvert there is a buildup of sand & gravel that is restricting the channel in front of the wingwall. Much of this material has washed out from behind the wingwall and the concrete roof & roadway material that has fallen through the large hole in the top of the culvert (see Photo #28).

APPROACHES

Approaches a - Appr. pavement condition
Transverse cracks are present in both approaches.

TRAFFIC SAFETY

Item 36a - Bridge Railing
Type SS guardrail act as the bridge rail on the East side of the Northbound roadway. The posts do not have spacers, the post spacing is in excessive (as much as 10') and does not meet the minimum requirements (see Photo #29 & #30).

There is no bridge railing along the West side of the Southbound roadway (see Photo #31).

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

REMARKS

Item 36b - Transitions

There is no bridge rail on the West side of the Southbound roadway, so there are no transitions.

The Type SS guardrail is continuous across the East side of the Northbound roadway.

Item 36c - Approach Guardrail

There is Type SS approach guardrail at the Northwest and Southwest corners of the culvert. The guardrail is continuous across the East side of the culvert. There is significant impact damage to all guardrail and essentially all of the posts at the Southwest and East guardrail are bent due to the impacts and inadequate spacing (see Photo #32 & #33).

Item 36d - Approach Guardrail Ends

All four corners consist of steel boxing glove ends. The guardrail ends on the Southeast and Southwest corners have impact damage (see Photo#33 & #34).

Photo Log

Photo 1 : Hole in the East side of the roof looking towards the South wall showing unsupported railroad rail and corroded reinforcement
Photo 2 : East end of roof has an unsupported rail and corroded reinforcement at the Southeast corner at the hole in the South wall
Photo 3 : Hole in deck on the East end looking towards the South Wall
Photo 4 : Hole in roof at the East end of the culvert measures 27" to the bottom of the steel street plates
Photo 5 : Hole on deck, East end looking towards the North wall
Photo 6 : Northwest corner showing spalled edge of roof and corroded reinforcement
Photo 7 : Southwest corner showing hole in roof and exposed and unsupported railroad rail
Photo 8 : South west wingwall is spalled 16" wide x full height
Photo 9 : Unsupported rail at Southwest corner of South wall, top of wall is crushing for a length of 14"
Photo 10 : Unsupported rail at Southwest corner spall of South wall
Photo 11 : South wall has a 1" displacement at water line
Photo 12 : South wall has a crack up to 1-1/4" wide. Tape was able to penetrate wall 29"
Photo 13 : South wall has a full height crack located 14'-10" from the West end
Photo 14 : Large hole at the Southeast corner of the bridge in the South wall
Photo 15 : North wall has a full height spall at the Northwest corner
Photo 16 : North wall has a full height crack; footing is exposed and undermined at this location
Photo 17 : Spall at Eastern end of the North wall measuring 43"high x 14" wide x 7" deep with active leakage
Photo 18 : Northwest wingwall is crumbling and leaning in towards the channel
Photo 19 : Northwest wingwall is undermined and leaning in towards the channel
Photo 20 : Southwest wingwall is undermined and leaning in towards channel
Photo 21 : Southwest wingwall leaning in towards channel
Photo 22 : Erosion at the Southeast corner, backfill material is washing out from behind wingwall and South wall
Photo 23 : Longitudinal cracking are present in the asphalt patch over the steel road plates on the Northbound travel lane
Photo 24 : Significant erosion and undercutting of the embankment at the Southwest corner
Photo 25 : Tree root & 12" CI pipe along West end of roof
Photo 26 : Tree root & corrosion on 12" CI pipe, Northwest corner
Photo 27 : Tree root spans the entire West edge of the culvert is retaining the 12" CI utility pipe
Photo 28 : Aggradation at the Southeast corner is restricting the channel flow at the upstream side of the culvert

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

REMARKS

Photo Log (Cont'd)

Photo 29 : Type SS guardrail at the East side of the Northbound travel lane showing excessive post spacing and bent posts
Photo 30 : Typical bent guardrail post at the East side of the Northbound roadway
Photo 31 : There is no bridge rail on the West side of the Southbound roadway
Photo 32 : Impact damage to the Southeast approach guardrail showing excessive spacing and bent posts
Photo 33 : Impact damage to the Southwest approach guardrail
Photo 34 : Southeast guardrail end showing impact damage

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 1: Hole in the East side of the roof looking towards the South wall showing unsupported railroad rail and corroded reinforcement

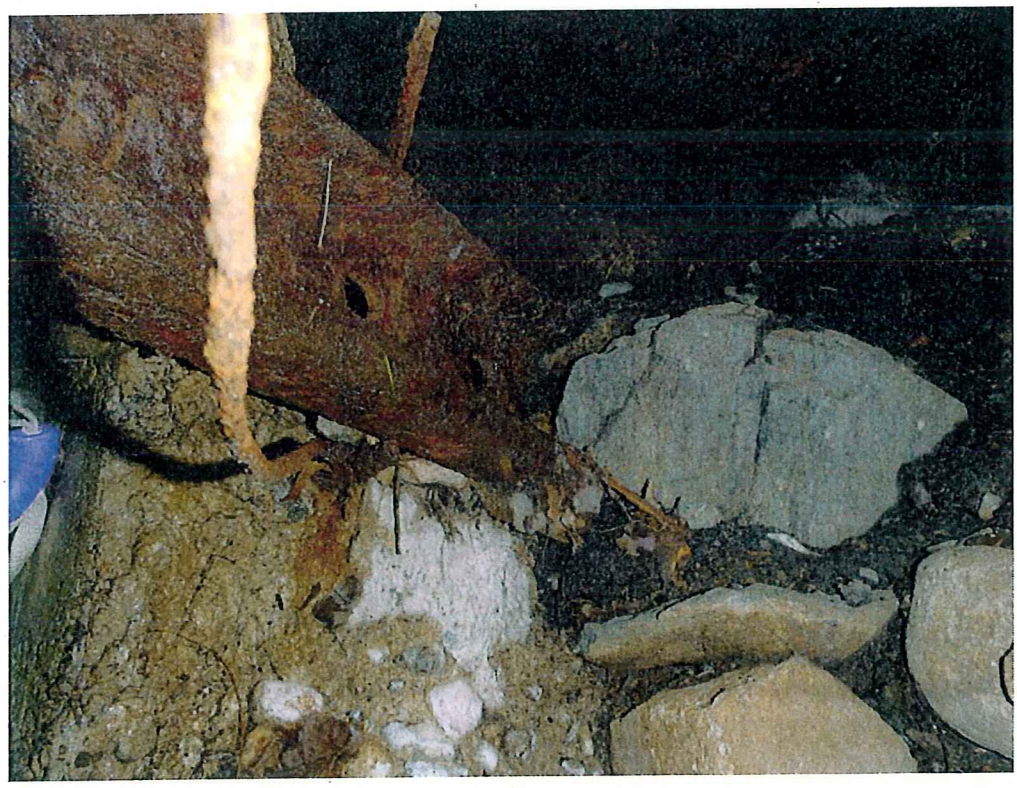

Photo 2: East end of roof has an unsupported rail and corroded reinforcement at the Southeast corner at the hole in the South wall

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 3: Hole in deck on the East end looking towards the South Wall

Photo 4: Hole in roof at the East end of the culvert measures 27" to the bottom of the steel street plates

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 5: Hole on deck, East end looking towards the North wall

Photo 6: Northwest corner showing spalled edge of roof and corroded reinforcement

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 7: Southwest corner showing hole in roof and exposed and unsupported railroad rail

Photo 8: South west wingwall is spalled 16" wide x full height

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 9: Unsupported rail at Southwest corner of South wall, top of wall is crushing for a length of 14"

Photo 10: Unsupported rail at Southwest corner spall of South wall

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 11: South wall has a 1" displacement at water line

Photo 12: South wall has a crack up to 1-1/4" wide. Tape was able to penetrate wall 29"

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WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

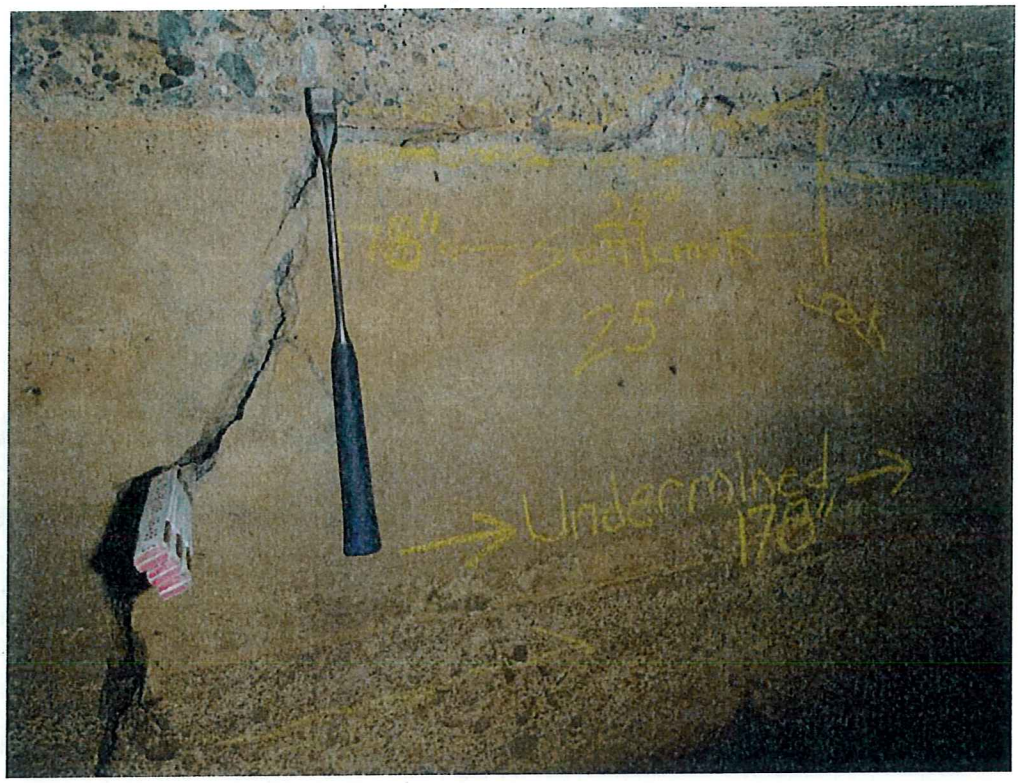

Photo 13: South wall has a full height crack located 14'-10" from the West end

Photo 14: Large hole at the Southeast corner of the bridge in the South wall

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 15: North wall has a full height spall at the Northwest corner

Photo 16: North wall has a full height crack; footing is exposed and undermined at this location

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

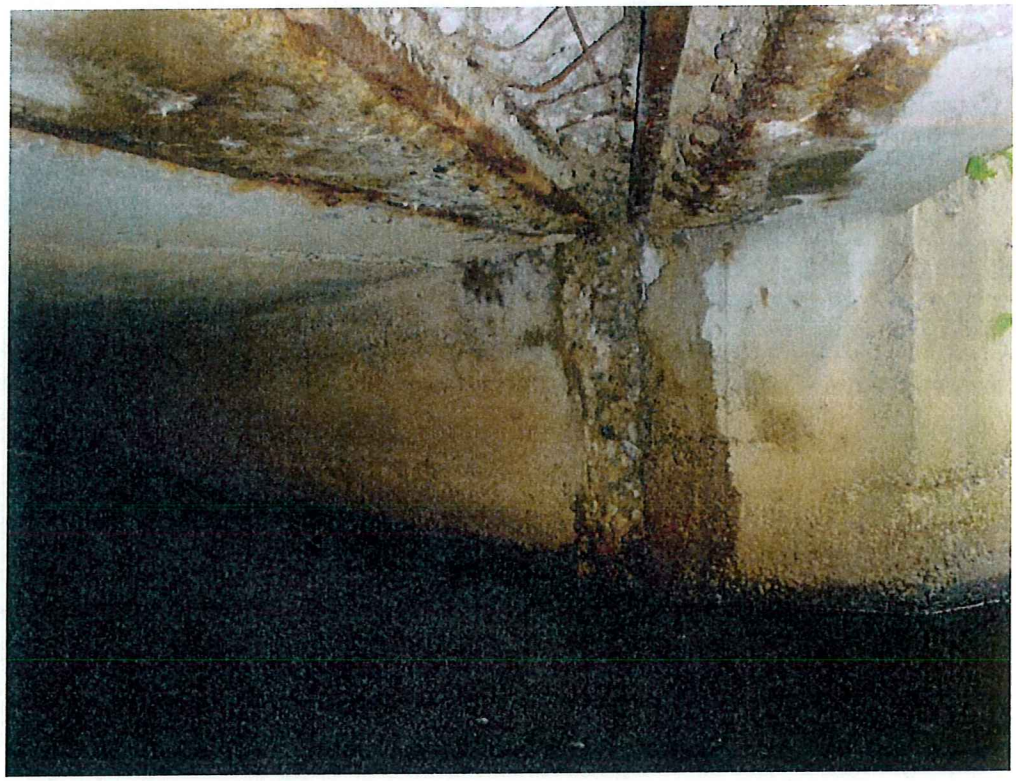

Photo 17: Spall at Eastern end of the North wall measuring 43"high x 14" wide x 7" deep with active leakage

Photo 18: Northwest wingwall is crumbling and leaning in towards the channel

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 19: Northwest wingwall is undermined and leaning in towards the channel

Photo 20: Southwest wingwall is undermined and leaning in towards channel

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

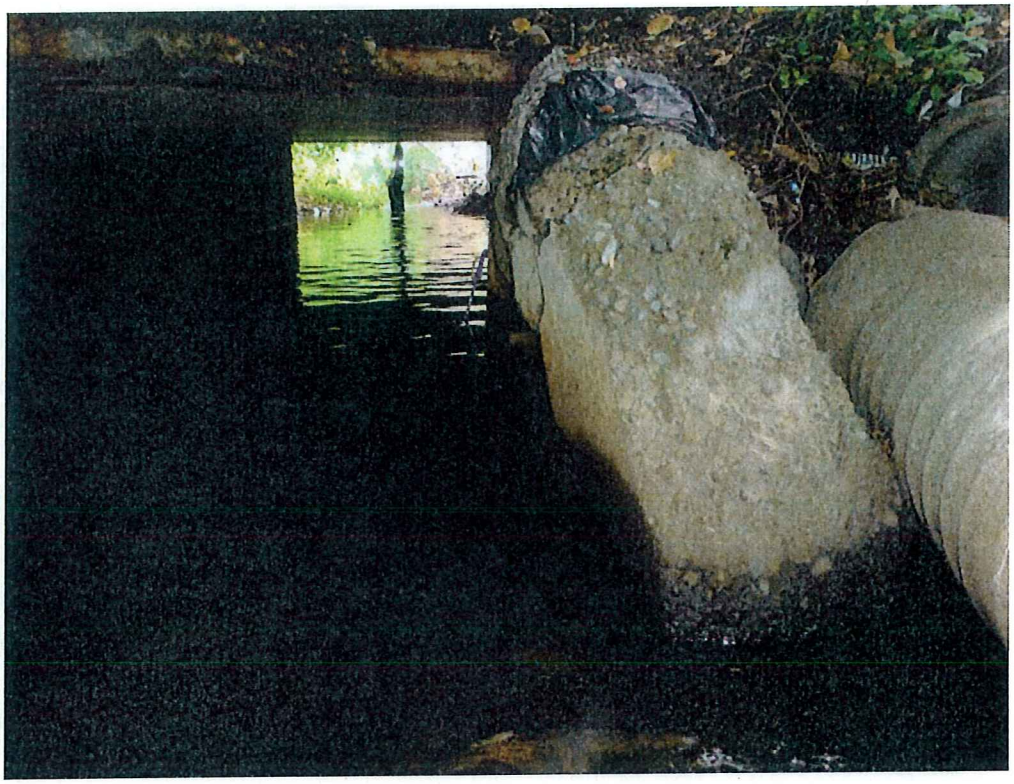

Photo 21: Southwest wingwall leaning in towards channel

Photo 22: Erosion at the Southeast corner, backfill material is washing out from behind wingwall and South wall

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 23: Longitudinal cracking are present in the asphalt patch over the steel road plates on the Northbound travel lane

Photo 24: Significant erosion and undercutting of the embankment at the Southwest corner

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 25: Tree root & 12" CI pipe along West end of roof

Photo 26: Tree root & corrosion on 12" CI pipe, Northwest corner

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 27: Tree root spans the entire West edge of the culvert is retaining the 12" CI utility pipe

Photo 28: Aggradation at the Southeast corner is restricting the channel flow at the upstream side of the culvert

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 29: Type SS guardrail at the East side of the Northbound travel lane showing excessive post spacing and bent posts

Photo 30: Typical bent guardrail post at the East side of the Northbound roadway

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 31: There is no bridge rail on the West side of the Southbound roadway

Photo 32: Impact damage to the Southeast approach guardrail showing excessive spacing and bent posts

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WALTHAM	7YW	W-04-016	W04016-7YW-MUN-BRI	SEP 3, 2014

PHOTOS

Photo 33: Impact damage to the Southwest approach guardrail

Photo 34: Southeast guardrail end showing impact damage

Pontis BMS Element Inspection

BDEPT# **W-04-016**

B.I.N. **7YW**

Item 8 **W04016-7YW-MUN-BRI**

Span Group **1**

Town **Waltham**

District **4**

Date **09/03/2014**

District Bridge Inspection Eng'r **Thomas G. Weil**

Inspecting Agency **Mass. Highway Dept.**

Team Leader **Laurance Hayes**

Team Member(s) **James Roy, Andrew Marlin**

El #	Element Name	Units	Env.	Total Q.	% or Q	State 1	State 2	State 3	State 4	State 5
241	Culvert, Concrete	length	2	40.0	☐ %	0.0	0.0	0.0	40.0	

Report Date: September 11, 2014

State Information

BDEPT#= W04016 Agency Br.No.
Town= Waltham L.O.
B.I.N= 7YW AASHTO= 002.0
RANK= 0 H.I.= NA FHWA Select List= N

Identification

(8) Structure Number W040167YWMUNBRI
(5) Inventory Route
(2) State Highway Department District 04
(3) County Code 017 (4) Place code 72600
(6) Features Intersected WATER BEAVER BROOK
(7) Facility Carried HWY BEAVER ST
(9) Location 1 MILE NE RT20
(11) Kilometerpoint 0000.000
(12) Base Highway Network N
(13) LRS Inventory Route & Subroute 000000000000
(16) Latitude 42DEG 22MIN 58.81 SEC
(17) Longitude 71DEG 12MIN 29.70 SEC
(98) Border Bridge State Code Share %
(99) Border Bridge Structure No. #

Structure Type and Material

(43) Structure Type Main: Concrete continuous Code 219
Culvert Jointless bridge type: Not applicable
(44) Structure Type Appr:
Code 0??
(45) Number of spans in main unit 001
(46) Number of approach spans 0000
(107) Deck Structure Type - Concrete Cast-in-Place Code 1
(108) Wearing Surface / Protective System:
A) Type of wearing surface - Bituminous Code 6
B) Type of membrane - None Code 0
C) Type of deck protection - None Code 0

Age and Service

(27) Year Built 1850
(106) Year Reconstructed 1900
(42) Type of Service: On - Highway
Under - Waterway Code 15
(28) Lanes: On Structure 02 Under structure 00
(29) Average Daily Traffic 004400
(30) Year of ADT 2014 (109) Truck ADT 05 %
(19) Bypass, detour length 004 KM

Geometric Data

(48) Length of maximum span 0003.1M
(49) Structure Length 00003.1M
(50) Curb or sidewalk: Left 01.0 M Right 00.0M
(51) Bridge Roadway Width Curb to Curb 008.0M
(52) Deck Width Out to Out 012.1M
(32) Approach Roadway Width (w/shoulders) 000.0M
(33) Bridge Median - Code ?
(34) Skew 17 DEG (35) Structure Flared N
(10) Inventory Route MIN Vert Clear 99.99M
(47) Inventory Route Total Horiz Clear 12.1M
(53) Min Vert Clear Over Bridge Rdwy 99.99M
(54) Min Vert Underclear ref N 00.00M
(55) Min Lat Underclear RT ref N 00.0M
(56) Min Lat Underclear LT 99.9M

Navigation Data

(38) Navigation Control - No navigation control on waterway Code 0
(111) Pier Protection Code 1
(39) Navigation Vertical Clearance 000.0M
(116) Vert-lift Bridge Nav Min Vert Clear M
(40) Navigation Horizontal Clearance 0000.0M

Classification

	Code
(112) NBIS Bridge Length	N
(104) Highway System	N
(26) Functional Class - Urban Minor Arterial	16
(100) Defense Highway	0
(101) Parallel Structure	N
(102) Direction of Traffic - 2-way traffic	2
(103) Temporary Structure	N
(105) Federal Lands Highways	2
(110) Designated National Network	N
(20) Toll - On free road	3
(21) Maintain - City/Municipal Highway A	04
(22) Owner - City/Municipal Highway A	04
(37) Historical Significance undetermined	

Condition

	Code
(58) Deck	N
(59) Superstructure	N
(60) Substructure	N
(61) Channel & Channel Protection	2
(62) Culverts	2

Load Rating and Posting

	Code
(31) Design Load - Other/Unknown	0
(63) Operating Rating Method - Allowable Stress (AS)	2
(64) Operating Rating	00.0
(65) Inventory Rating Method - Allowable Stress (AS)	2
(66) Inventory Rating	00.0
(70) Bridge Posting	0
(41) Structure - Open	A

Appraisal

	Code
(67) Structural Evaluation	2
(68) Deck Geometry	3
(69) Underclearances, vert. and horiz.	N
(71) Waterway adequacy	
(72) Approach Roadway Alignment	
(36) Traffic Safety Features	
(113) Scour Critical Bridges	6

Inspections

(90) Inspection Date 09/03/14 (91) Frequency 24 MO
(92) Critical Feature Inspection: (93) CFI DATE

(A) Fracture Critical Detail	N	00	MO A)	00/00/00
(B) Underwater Inspection	N	00	MO B)	00/00/00
(C) Other Special Inspection	Y	03	MO C)	09/03/14
(*) Other Inspection ()	N	00	MO *)	00/00/00
(*) Closed Bridge	N	00	MO *)	00/00/00
(*) UW Special Inspection	N	00	MO *)	00/00/00
(*) Damage Inspection			MO *)	00/00/00

Rating Loads

Report Date 00/00/00	H20	Type 3	Type 3S2	Type HS
Operating	0.0	0.0	0.0	0.0
Inventory	0.0	0.0	0.0	0.0

Field Posting

Status Posting Date 00/00/00

	2 Axle	3 Axle	5 Axle
Actual			
Recommended			

Missing Signs N

Misc.

Bridge Name
N Anti-missile fence N Acrow Panel N Jointless Bridge
Freeze/Thaw N : Not Applicable

Accessibility (Needed/Used)

N / N Liftbucket	N / N Rigging	N / N Other
N / N Ladder	N / N Staging	
N / N Boat	N / N Traffic Control	
Y / Y Wader	N / N RR Flagperson	Inspection Hours: 006
N / N Inspector 50	N / N Police	