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# SITE OBSERVATION REPORT

DATE: April 16, 2016
Revised April 18, 2016

TO: Kelly Wood

FROM: Michael Pyszka

SUBJECT: Inverness Force Main Site Visit

CC: Tom Nielsen
Rick Hermes
File

PROJECT NUMBER: 276-2177-032

PROJECT NAME: Inverness 30-Inch Force Main Repair

This observation report is intended to summarize the conditions noted during the site visit performed by Michael Pyszka on Tuesday April 12, 2016, and provide recommendations based on the observed conditions. Access to the underside of the bridge was via three separate rolling scaffoldings provided by the general contractor per contract specifications. Pipe support beams have been labeled with #1 as the first beam on the south end of the bridge nearest the treatment plant. **Due to the damage noted on the girder to support beam connection at support beam #5, it is strongly recommended that any work involving loading of the existing pipe support beams be delayed until all connections can be assessed and any needed repairs performed.**

## Updated April 18, 2016

Based on conditions noted during the April 12 site visit, a second visit was conducted on Friday April 15, 2016 following the removal of an additional 30 feet of insulation on the north end. The purpose of the second visit was to examine the exterior of the 30-inch pipe and provide recommendations on the limits of the Fibrwrap repair. Conditions noted and recommendations follow the photos from the initial site visit.

## CONDITIONS NOTED

### Pipe Insulation

The pipe insulation had been removed from approximately Sta. 22+12 to Sta. 23+35 per the contract documents. There was insulation partially remaining where the pipe passes through Bent 2 (Sta. 23+10, Photo 1) and some of the concrete diaphragms between Bent 1 and Bent 2.

### 30-Inch CCP

The exterior of the 30-inch CCP pipe was examined at the exposed areas. Longitudinal cracking and evidence of seepage was observed at approximately the 9:00 and 3:00 positions (Photos 2 & 3), along with cracking on the bottom at the 6:00 position. Sounding with a hammer revealed several areas that are delaminated or beginning to spall away from the exterior pipe spiral reinforcement. The worst area appeared to be between pipe supports #7 and #9 on the south side of bent 2.

On the west side of the pipe between supports #8 and #9, a 2" diameter hole discovered after insulation was removed was enlarged to 4" by the contractor to view inside the pipe (Photo 4). The interior concrete and metal lining has disintegrated and the exterior spiral reinforcement is visible (Photo 5).

Between pipe supports #7 and #8 there is a flanged connection on the 30-inch CCP (Photo 6). Exterior damage is also evident south of support #7, but the level of damage decreases as the pipe gets closer to the south end of the bridge. On the north end there were signs of leaking on the roller supports where the pipe insulation was still intact.

### Pipe Shields and Roller Supports

The pipe shields on supports #4 and #6 have rotated approximately 90 degrees, and as such the rollers are free to spin and are currently not supporting any weight of the 30-inch CCP pipe (Photo 7).

### Pipe Support Beam to Girder connections

Several pipe support beams have rotated out of position, with support #1 rotating the most (Photos 8 & 9). Several bolts at the girder to support beam connections do not have full bearing of the bolt head or nut shoulder. One of the bolts observed was less than hand tight and able to wiggle back and forth. Several of the girder to support beam connection brackets are exhibit signs of rotation and vertical displacement. The weld on the girder to support beam connection bracket on the west end of support beam #5 has failed and is showing excessive vertical displacement (Photo 10).

### Bent 1 Diaphragm

The concrete diaphragm between the bridge girders at the sound end of the bridge (bent 1) has extensive cracking and dislodged concrete under and adjacent to the girders (Photo 11). Steel reinforcement is visible and has surface rust (Photos 12 & 13).

## RECOMMENDATIONS

### Pipe Insulation

- Remove approximately an additional 30 feet of pipe insulation to the north in order to determine the extent of damage and north end limits for the external pipe repair.
- Remove all insulation where the pipe passes through the intermediate concrete diaphragms and the diaphragm at bent 2.

### 30-Inch CCP Exterior Repair

- Begin the exterior pipe repair just north of the roller on support beam #5 at approximate Sta. 22+59. The repair does not need to go under the roller and can start within 2 inches of the pipe shield.
- The north extents of the exterior pipe repair should be determined after the additional insulation is removed.
- Confirm with Fibrwrap that the repair will function as intended and provide the required strength for CIPP installation in the areas where the existing CCP is cracked and delaminating.
- Confirm with Fibrwrap that the repair material will perform as intended at flanged connections. The submittal did not contain any details or language about how the repair was to be installed at these locations.

### Pipe Shields and Roller Supports

- Pipe shields should be inspected at all roller support locations to determine if they have shifted, and to confirm that the roller is supporting the pipe under the shield.

### Pipe Support Beam to Girder connections

- All pipe support connections should be investigated for damage, including but not limited to rotation, vertical displacement, weld failure, and connection bolt diameter discrepancies.
- **Any and all work involving loading of the existing pipe support beams should be delayed until all connections can be assessed and any needed repairs performed.**

### Bent 1 Diaphragm

- The cracking under and near the girders should be further investigated to determine the extent of the cracking and potential repairs.

## OBSERVATION PHOTOS

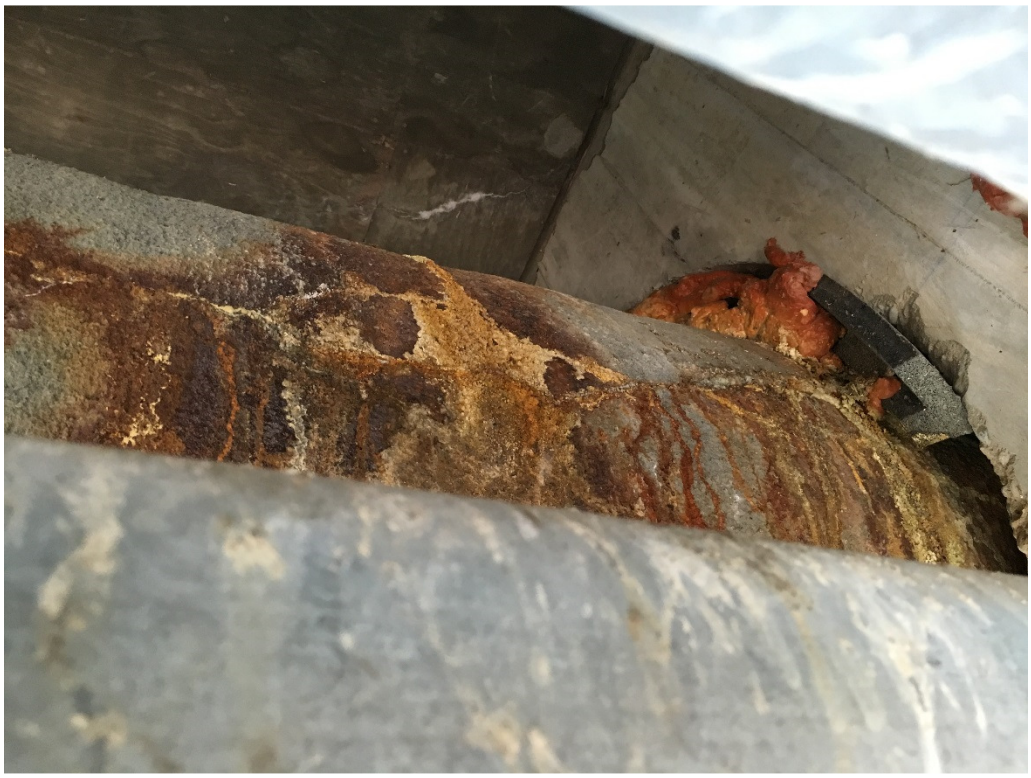

Photo 1 – Insulation and spray foam around CCP at bent 2.

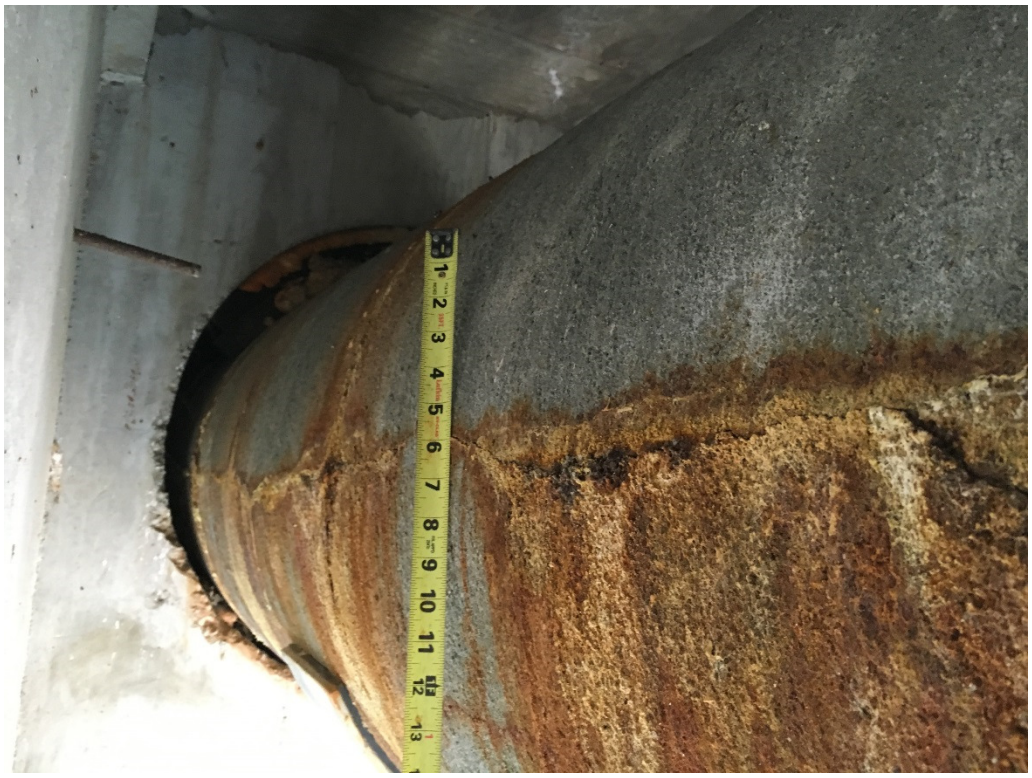

Photo 2 – Horizontal cracking on west side of CCP near bent 2.

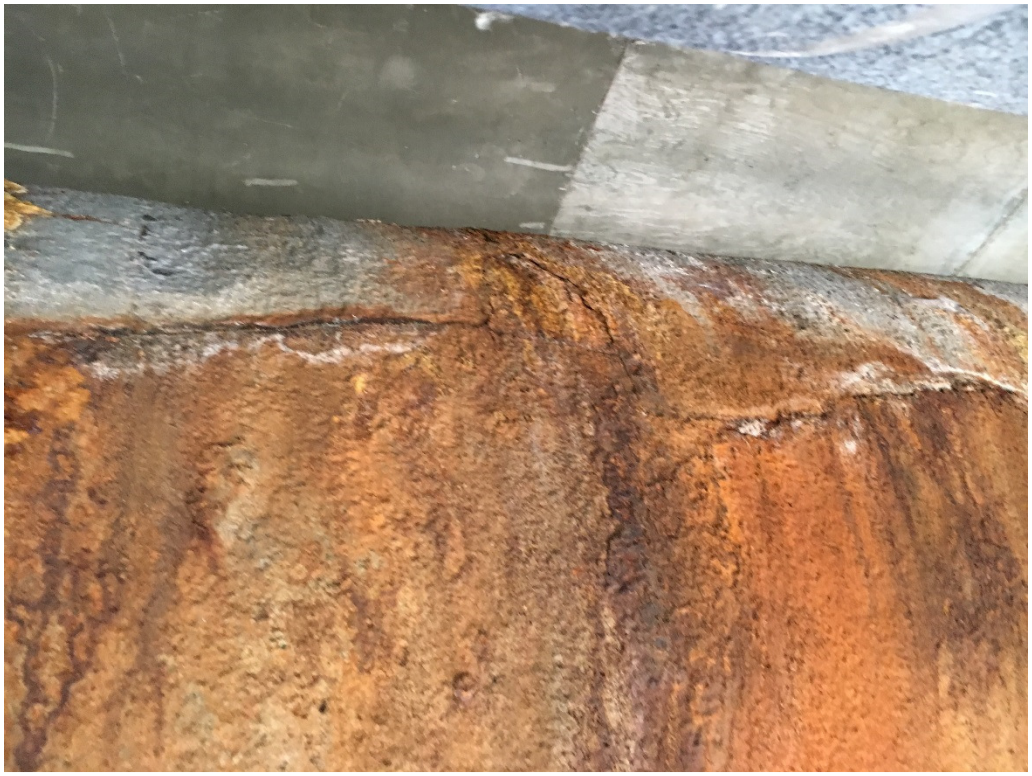

Photo 3 – Horizontal cracking and areas of concrete beginning to delaminate on the east side of CCP near bent 2

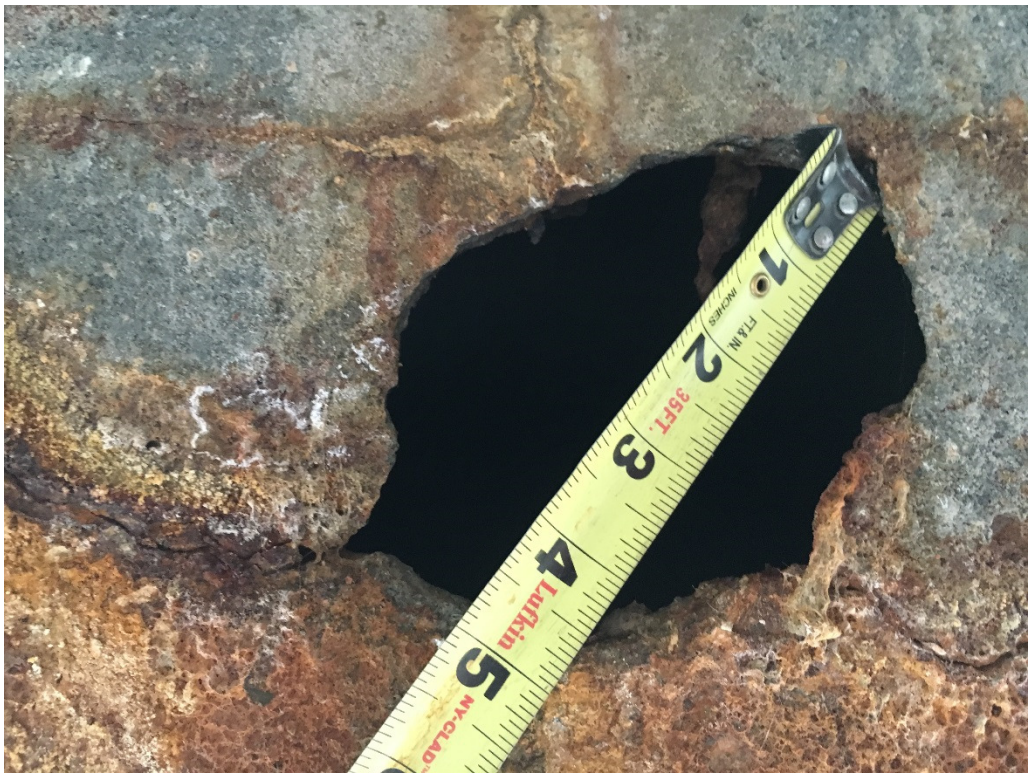

Photo 4 – Enlarged hole on west side of CCP between roller supports #8 and #9.

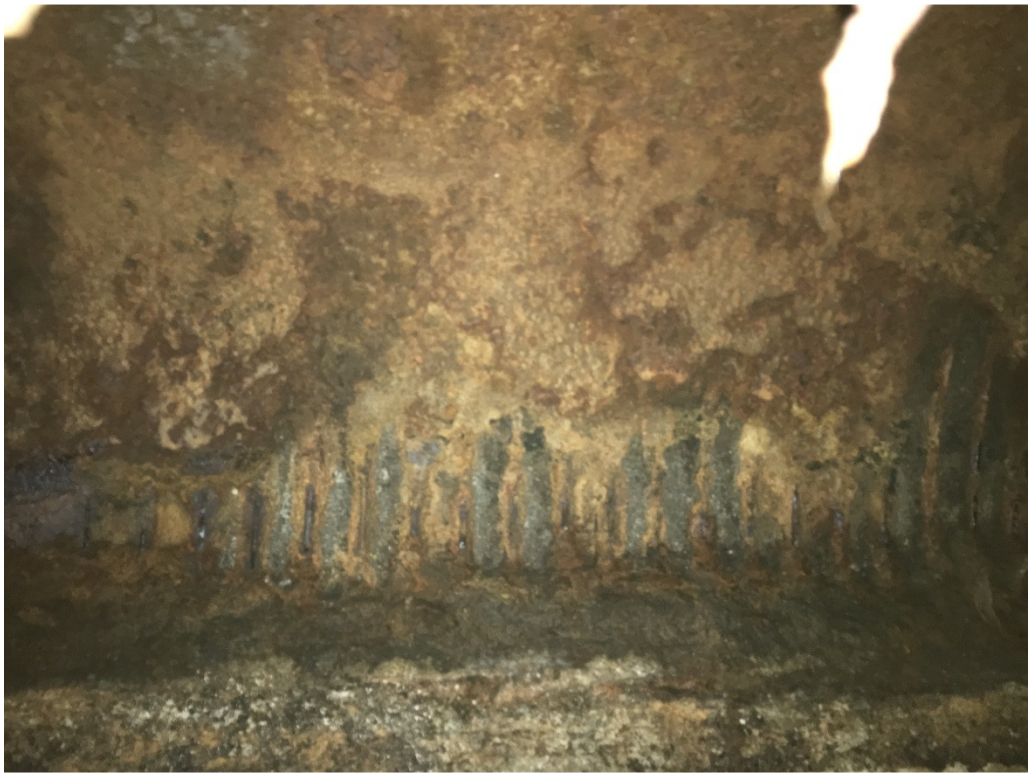
Photo 5 – Exposed exterior spiral reinforcement.

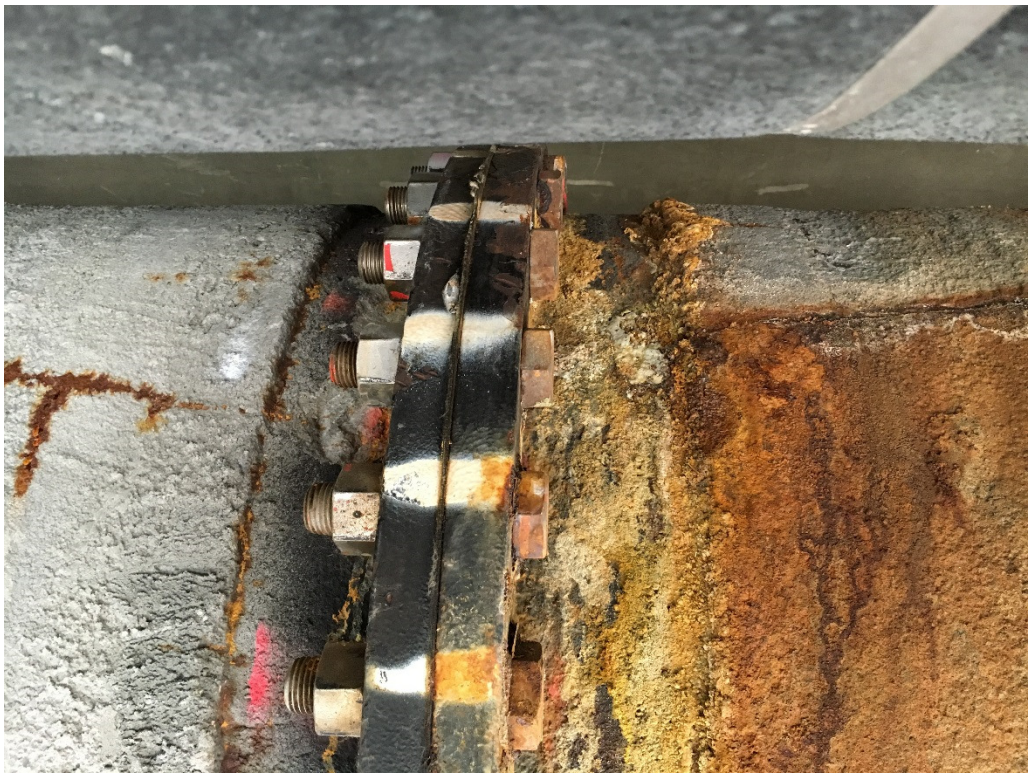

Photo 6 – Flanged connection between support #7 and #8.

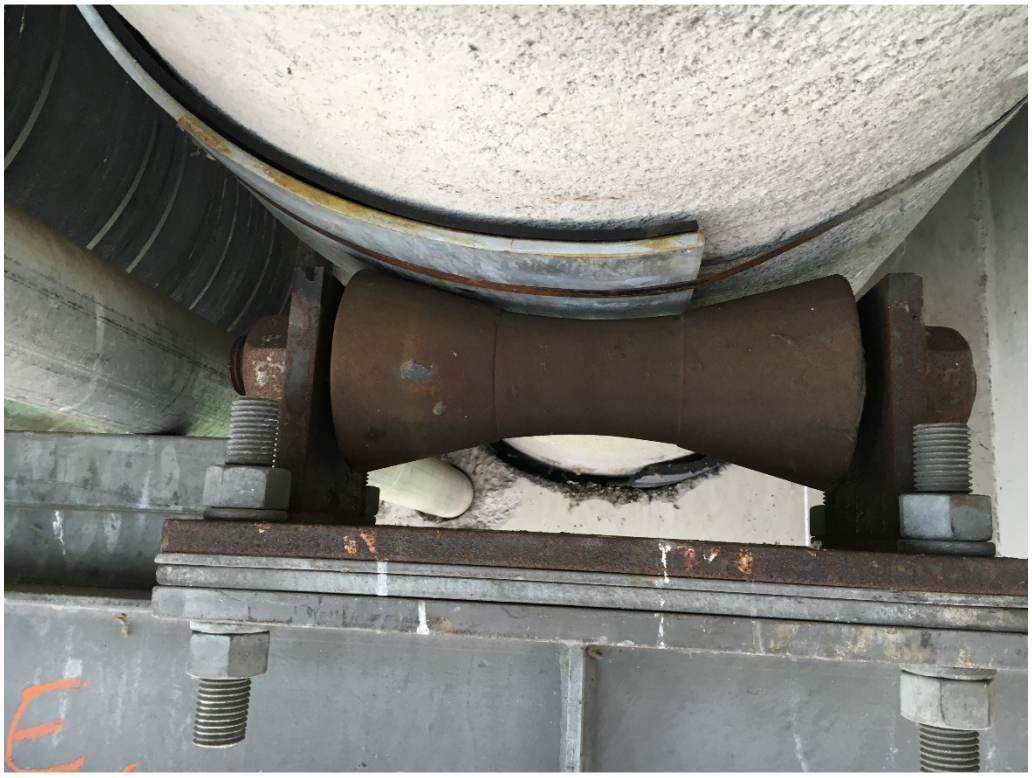

Photo 7 – Rotated pipe shield at support #4.

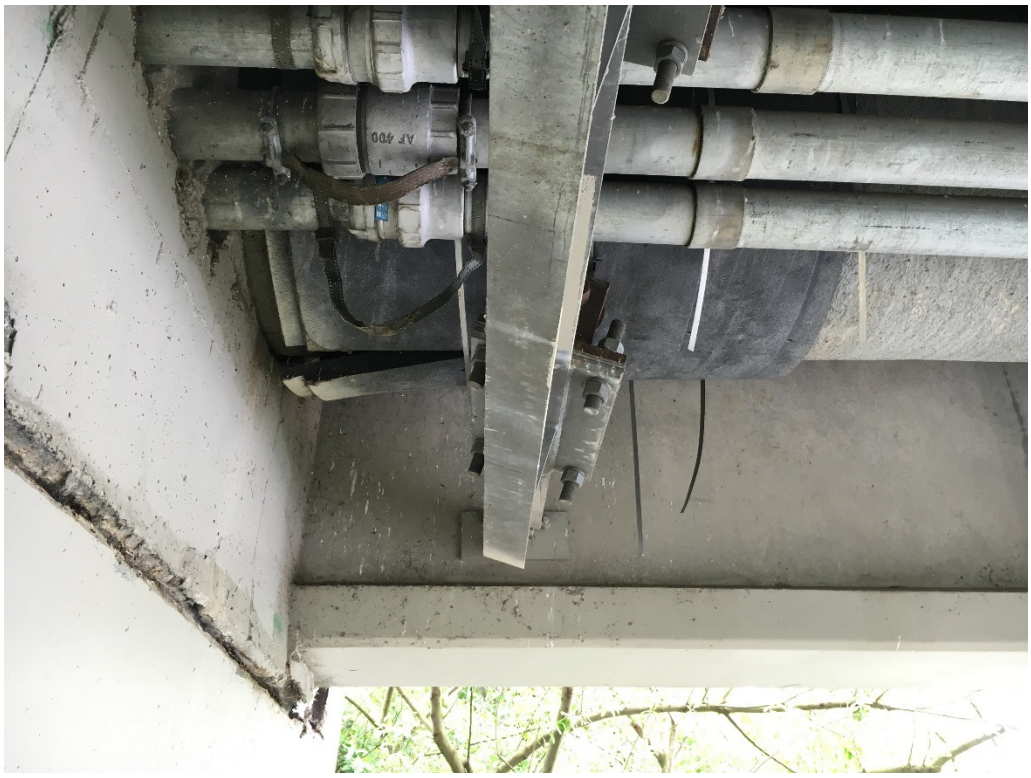

Photo 8 – Rotated pipe support beam at roller #1

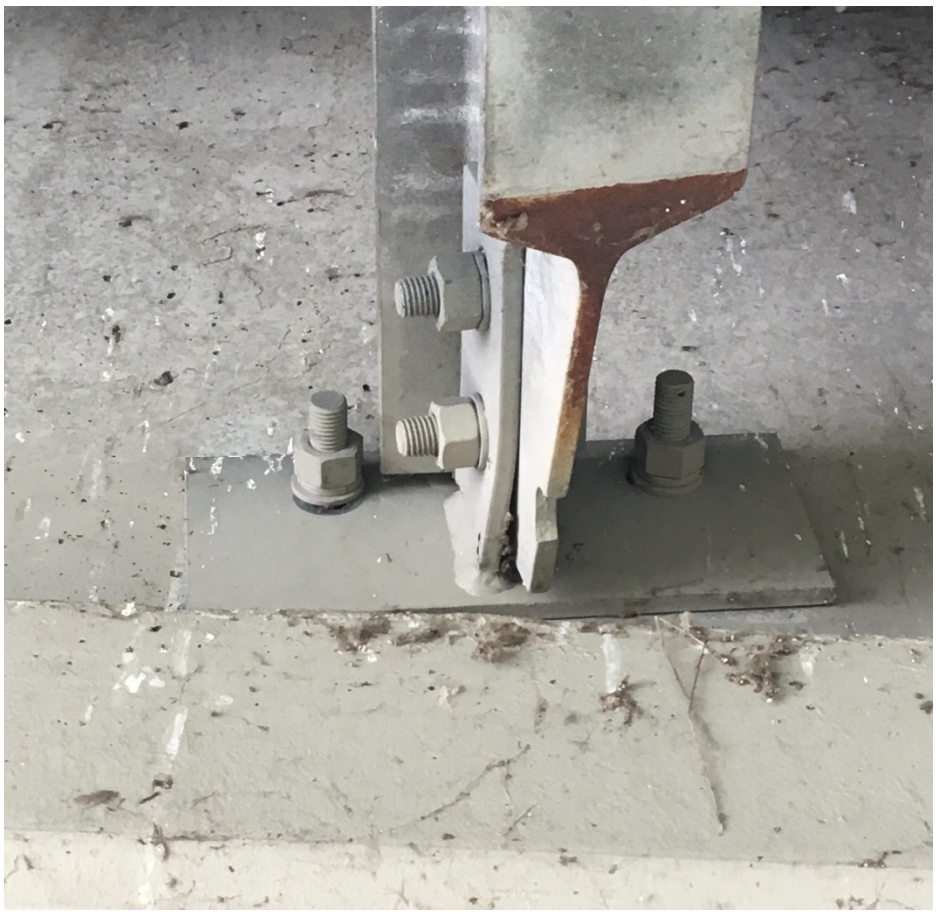

Photo 9 – Rotated girder to support beam connection plate at

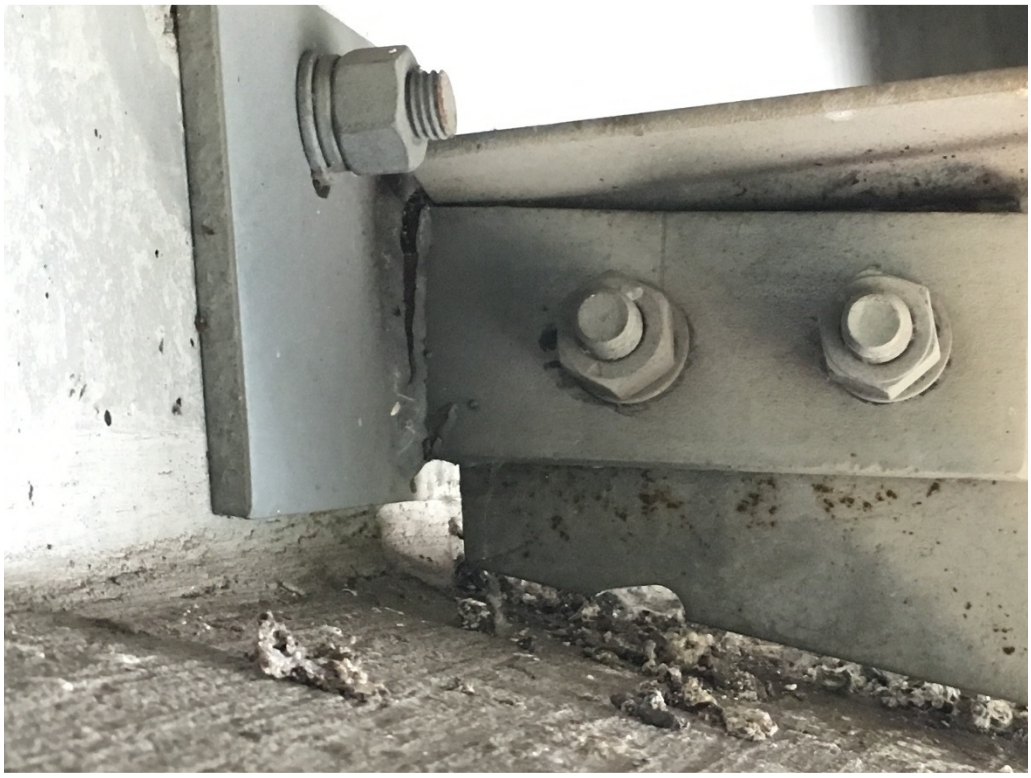

Photo 10 – Failed weld on support beam #5

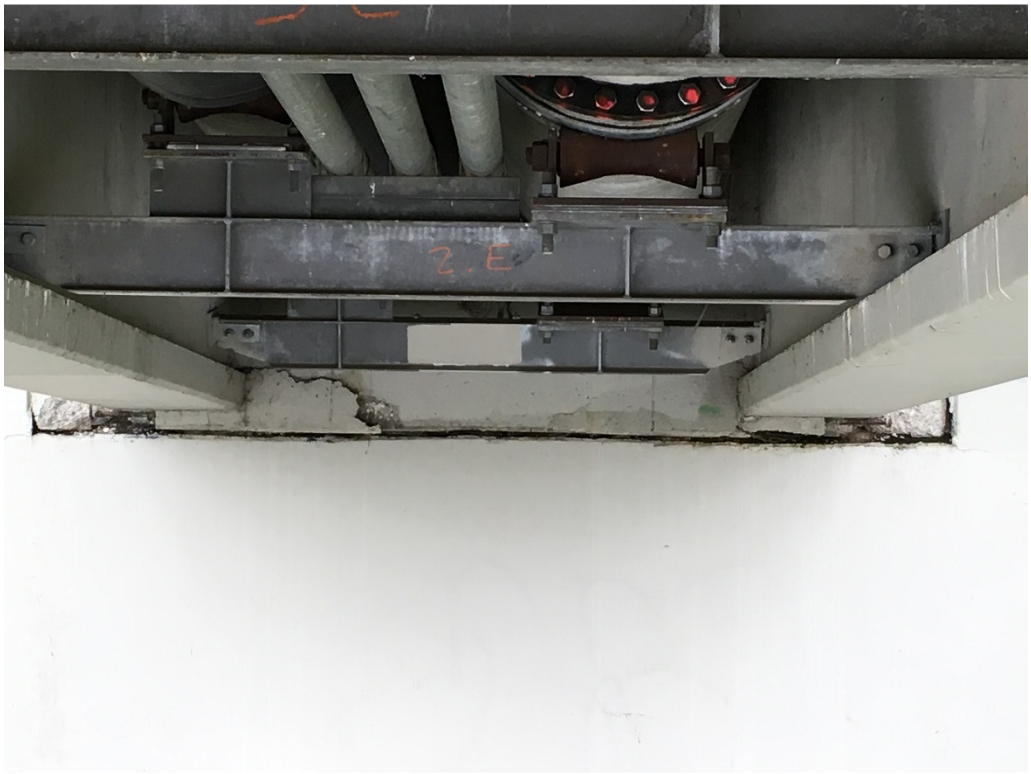


Photo 11 – Cracked concrete under girders at bent 1.

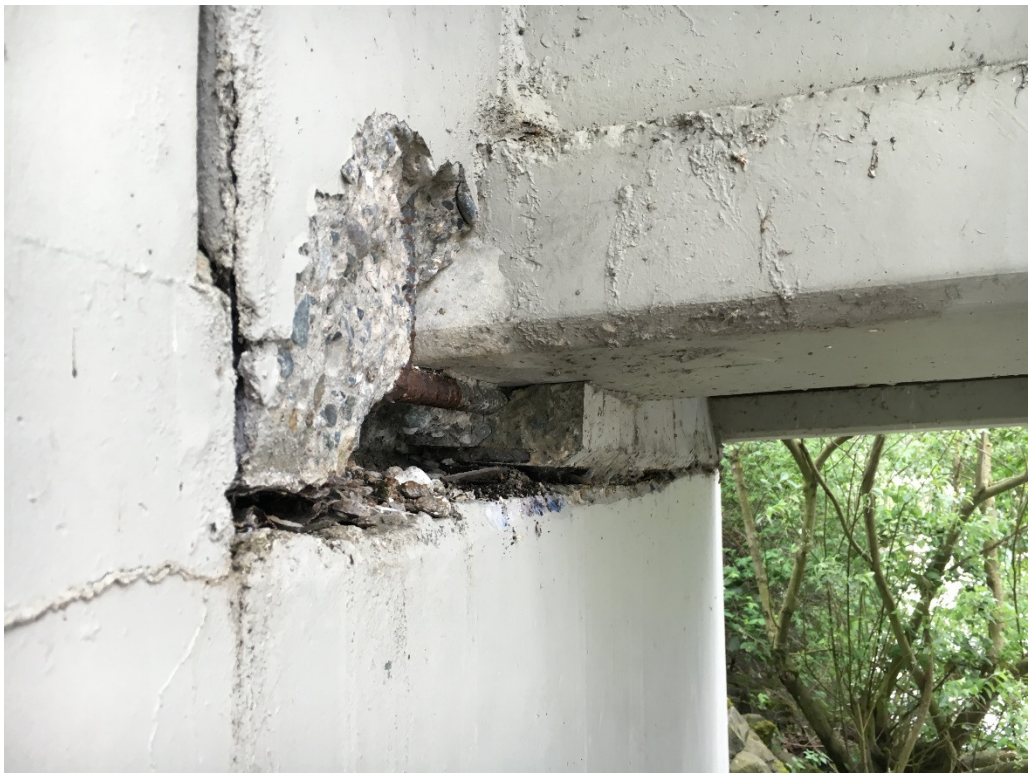

Photo 12 – Cracked concrete under east girder at bent 1.

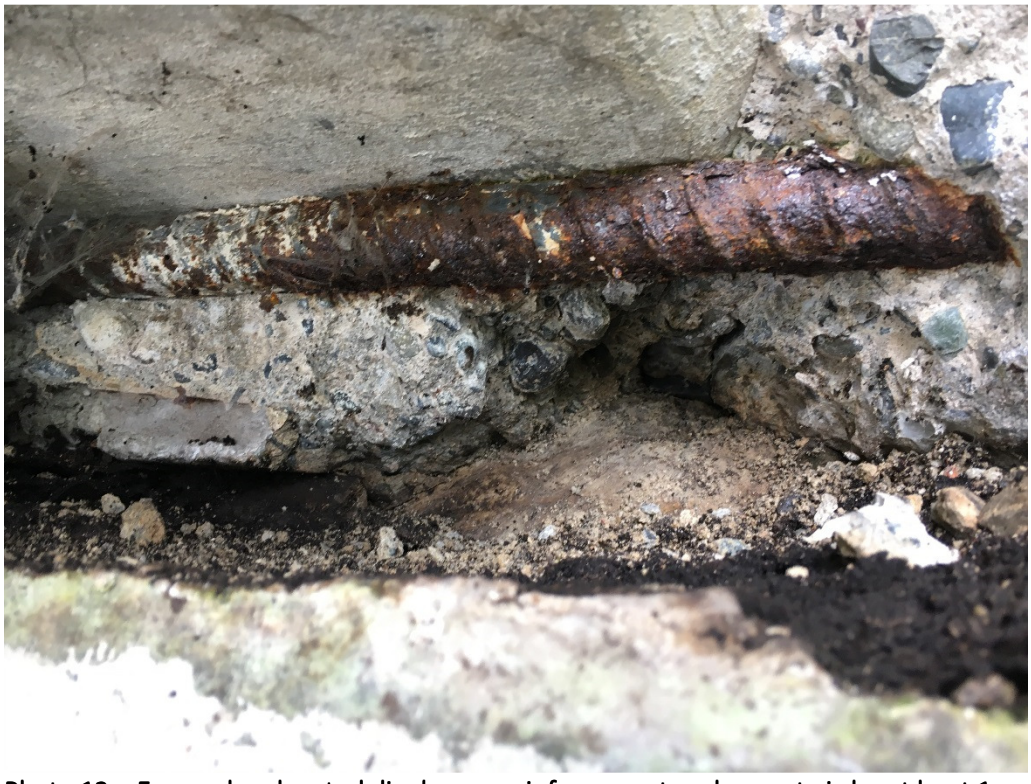

Photo 13 – Exposed and rusted diaphragm reinforcement under west girder at bent 1.

## CONDITIONS NOTED – April 15, 2016 site visit

### Pipe Insulation

The pipe insulation had been removed from approximately Sta. 22+35 to Sta. 23+65 per recommendations from the April 12th site visit. The limits of insulation that has been removed are approximately Sta. 22+12 to Sta. 23.65, or roughly 153 feet in total.

### 30-Inch CCP

The exterior of the 30-inch CCP pipe was examined at the exposed areas. Longitudinal cracking and minor evidence of seepage was observed at approximately the 3:00 position on the west side of the pipe (Photo 14). Additional transverse hoop cracks with little or no staining were evident along bottom half of the pipe (Photo 15). Sounding with a hammer indicated very little, if any delamination near the cracks.

There is a Harnessed Mechanical Coupling at Sta. 23+58 with an approximate 2" by 3" hole on the north end of the pipe within the coupling, at 2:00 on the east side (Photo 16). The pipe on the north side of the coupling does not exhibit any exterior signs of leaking or cracking. Noticeable staining and cracking begins on the south side of the coupling and extends south through bent 2 to the area previously determined as needing exterior repair.

Where the 30-inch CIP passes through bent 2, the pipe is not centered in the hole in the concrete diaphragm between the girders. The pipe is not resting on the concrete, but minimum clearance at the bottom is estimated to be less than 1/4" (Photo 17).

### Pipe Shields and Roller Supports

The pipe shields appear to be in place per original design, however, the pipe roller support on support beam # 13 has minimal contact with the right side of the roller (Photo 18).

### Pipe Support Beam to Girder connections

Several pipe support beams have slightly rotated out of position, and several bolts at the girder to support beam connections do not have full bearing of the bolt head or nut shoulder. One of the bolts observed was less than hand tight and able to wiggle back and forth.

## RECOMMENDATIONS

### 30-Inch CCP Exterior Repair

- Terminate the exterior pipe repair just south of the Harnessed Mechanical Coupling near support beam #14. The revised limits of the exterior pipe repair are from approximate Sta. 22+58 to Sta. 23+55, or roughly 97 feet in total.
- Given the reduced clearance at bent 2 where the CIP passes through the concrete diaphragm, external repair of the pipe with Fibrwrap will be difficult. The contractor discussed submitting alternate methods to the repair/ support the pipe at this location, one of which was to grout the void between the pipe and concrete diaphragm. Any grout or method used to fill the void and support the pipe should include a bond break around the pipe to allow for thermal expansion and contraction of the pipe.
- For all holes greater than 2 inches in diameter, a two part epoxy should be used for repair. A stay-in-place form will likely be required on the pipe interior, and should be constructed as to not obstruct the

CIPP interior repair. Documentation should be obtained from Fibrwrap to confirm that the repair materials are compatible.

- Confirm with Fibrwrap that the repair will function as intended and provide the required strength for CIPP installation in the areas where the existing CCP is cracked and delaminating, and at flanged connections. The submittal did not contain any details or language about how the repair was to be installed at these locations. The following questions for Fibrwrap were provided separately from this report:
    - Will the surface preparation methods submitted be able to effectively and adequately clean and prepare the existing pipe surface sufficiently to obtain the required adhesive strength?
    - The existing CIP pipe has longitudinal cracking at the 9:00 and 2:00 locations between the support rollers, which are spaced at 12 feet apart. Additionally, portions of the existing concrete pipe near the cracks exhibit signs of delamination when sounded with a hammer. Is the proposed repair of a single hoop wrap and a single longitudinal wrap sufficient to provide the strength required for CIPP installation, water cure, and long term service loads?
    - At multiple locations there are flanged connections of the existing CIP pipe, including one that is approximately centered between the roller supports. Given the deteriorated condition of the CIP pipe, and the assumption that the Fibrwrap repair will not be continuous over the flanged connection, will the Fibrwrap repair perform as intended to provide the strength required for the CIPP installation, water cure, and long term service loads? The typical repair sections provided by Fyfe in submittal 12.01 do not contain any details of the repair at the flanged CIP connections.

### Pipe Shields and Roller Supports

- Pipe shields should be inspected at all roller support locations to determine if they have shifted, and to confirm that the roller is supporting the pipe under the shield.

### Pipe Support Beam to Girder connections

- All pipe support connections should be investigated for damage, including but not limited to rotation, vertical displacement, weld failure, and connection bolt diameter discrepancies.
- **Any and all work involving loading of the existing pipe support beams should be delayed until all connections can be assessed and any needed repairs performed.**

OBSERVATION PHOTOS – April 15, 2016 site visit

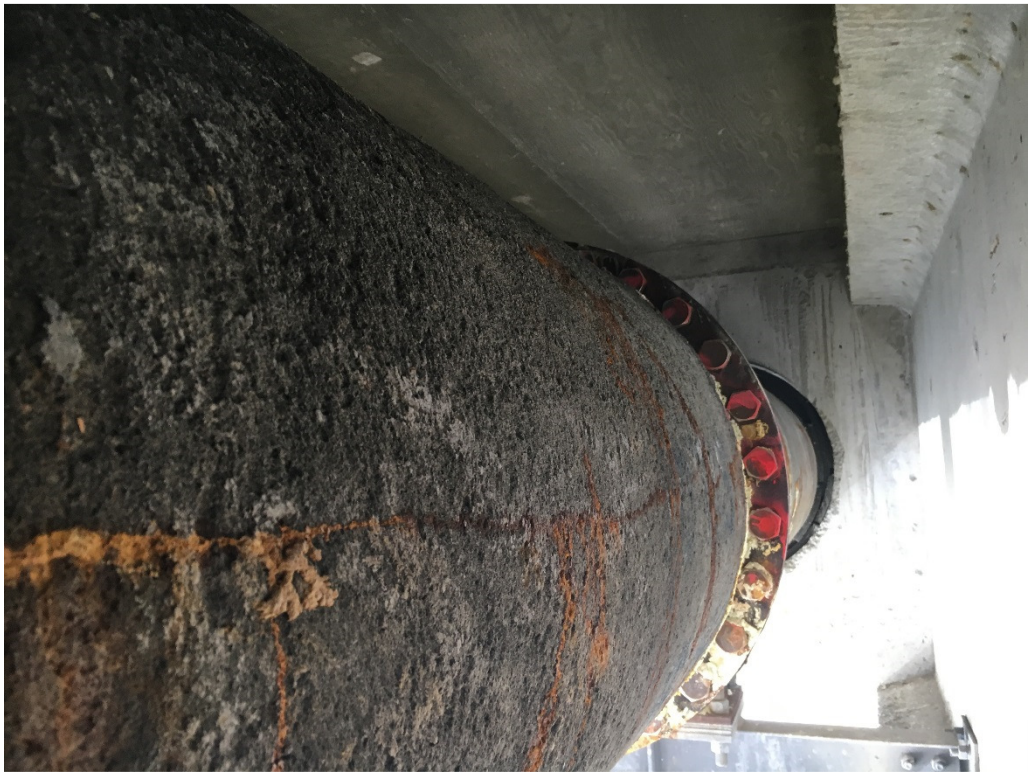

Photo 14 – Longitudinal cracking and minor staining on the west side of the pipe at approximate Sta. 23+50.

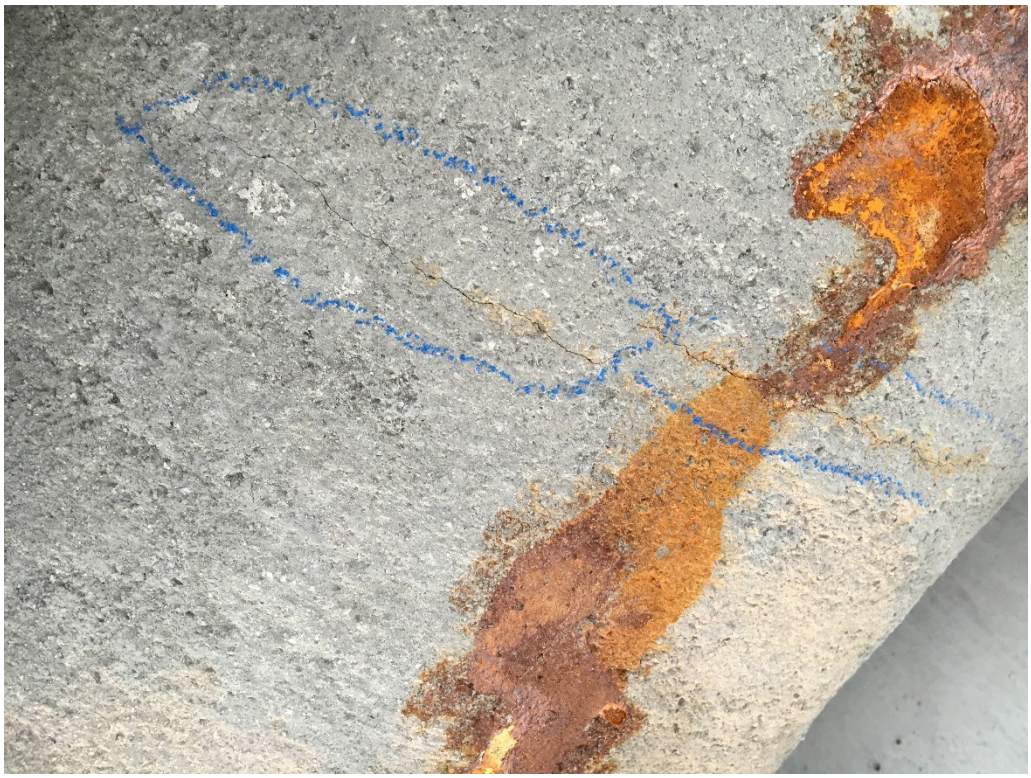

Photo 15 – Hoop cracking on the bottom of the pipe at approximate Sta. 23.50.

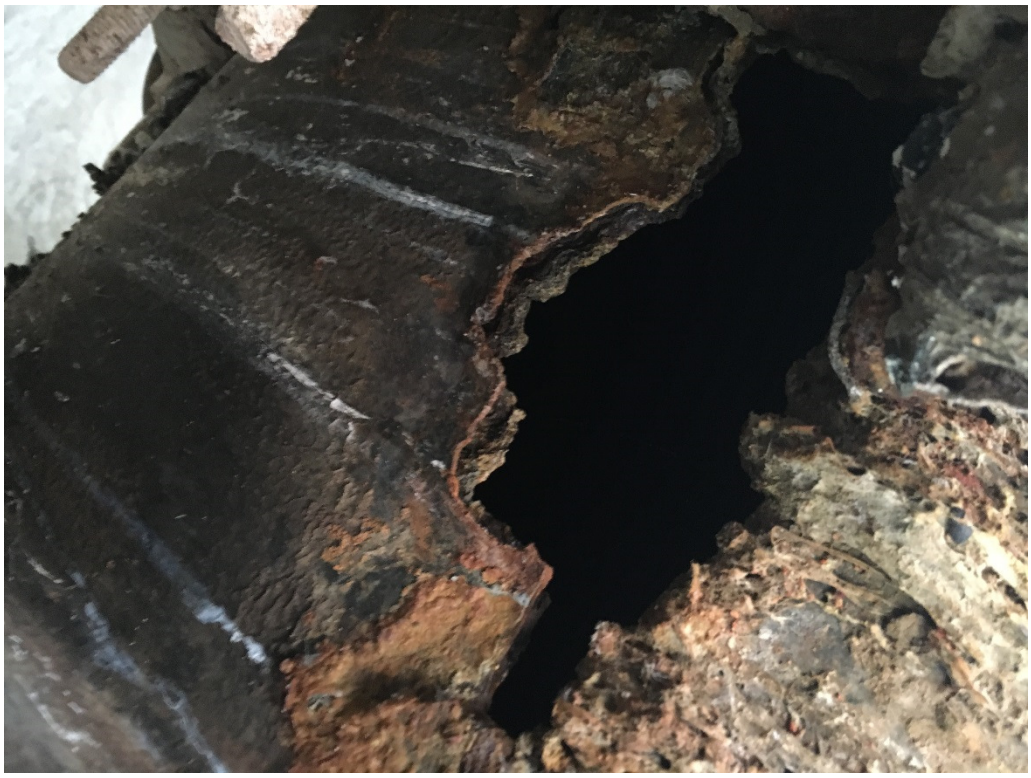

Photo 16 – 2” by 3” hole in east side of Harnessed Mechanical Coupling at Sta. 23+58.

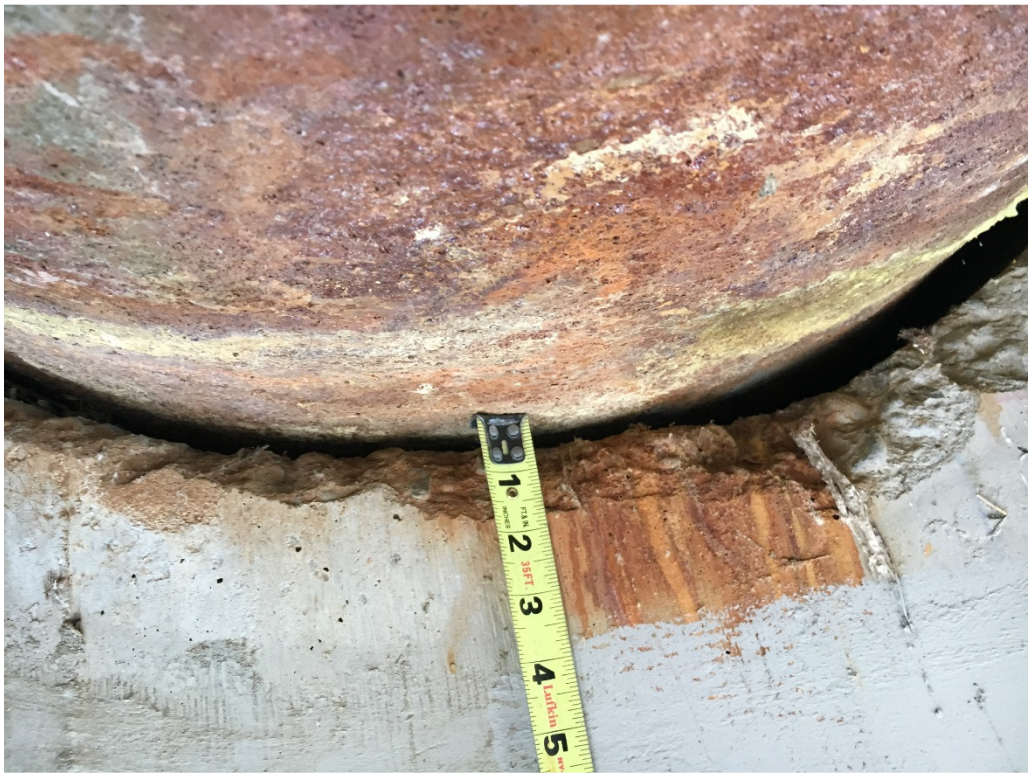


Photo 17 – Reduced clearance at bent 2 where 30-inch CIP passes through concrete diaphragm.

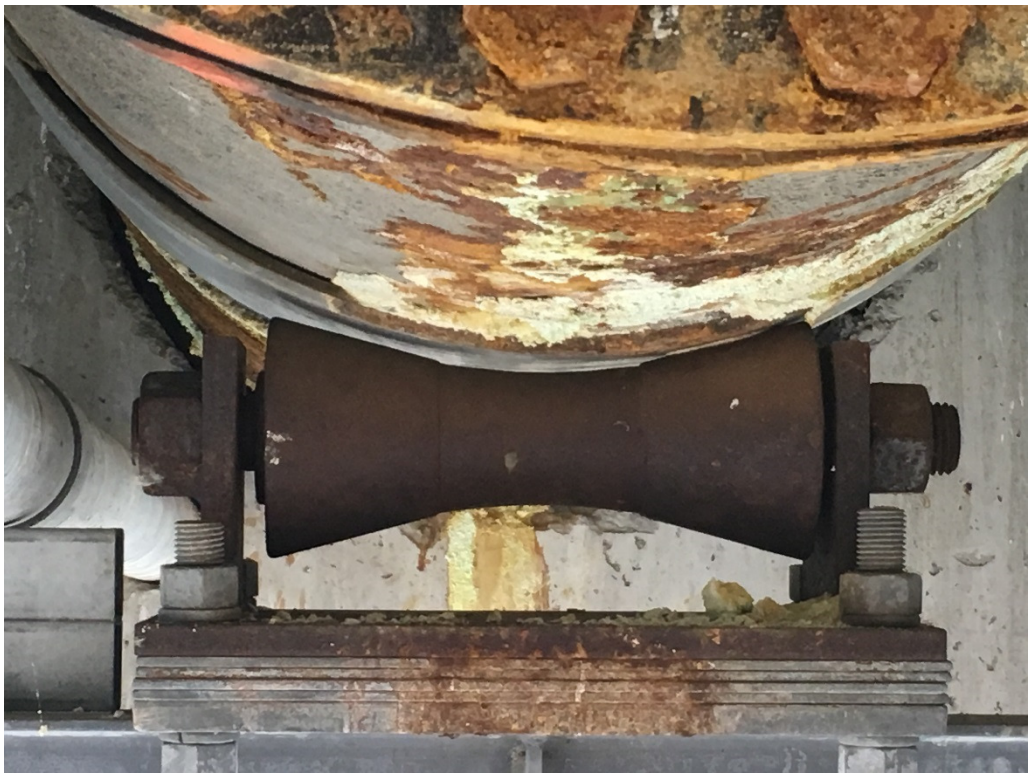

Photo 18 – Roller support at beam #13 with roller only in contact on the west side of the pipe shield.

**ATTACHMENT B**

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# MEMORANDUM

## Scope Increase and Project Delay

**DATE:** May 26, 2016

**TO:** Mark Hutchinson, Blair Bean, Scott Gibson, Bill Ryan, Gary Irwin, Christa Overby and Susan Aldrich

**FROM:** Pete Hesford, CM

**RE:** **Inverness Force Main**
**Project Number E10629**

Background

During recent Contractual reviews of the Inverness project by the Engineer of Record (EOR), some significant structural issues were noted: The southern bridge abutment had extensive concrete spalling and exposed rebar and the pipe support beams supporting the parallel sewer pipes appear to not have been installed correctly. In many locations the structural sufficiency of these pipe supports appears to be compromised due to broken welds, loose bolts, rotated beams, and brackets installed on one side only of the supporting beam. The EOR drafted a Structural Observation Report (attached) that strongly recommends no work on the pipe or bridge until a review and corrective work has been completed for the approximate forty pipe supports along the length of the bridge.

Another factor in the construction of this project is the South American Cliff Dwelling Swallows, protected by the Migratory Bird Act, that have renested along the eastern escarpment of the bridge. Nests were removed and the eastern escarpment maintained clear of nests by BES biologists during the removal of insulation, inspection of pipe, and structural reinforcement of the pipe exterior phase, but this was only for the southern half of the bridge where the pipe had deteriorated. The swallows historically have vacated the Northwest by September 1st.

What do we do with Titan's Contract

- Structural concerns identified in the Structural Observation Report must be addressed prior to further work on the pipe repair portion of the Contract.
- These structural deficiencies affect both the 30-inch line to be repaired and the parallel 20-inch line currently conveying flows.
- The Inverness system has no redundancy.
- In order to mitigate delays to the current Contract we either terminate Titan's Contract for an estimated cost of $35,000 and rebid the project after the entire repair scope is defined, delay their work until after both the nesting season and the structural repairs are completed; for a contractor submitted cost of $25,000. Or as a third option, Titan agreed that should they be awarded the structural repair work through a change order, they would reduce their delay fee by $10,000. See cost tabulation below.

How would we structure a Contract for Structural Repairs

- Add the work by Change Order to existing Titan Contract
- Declare an emergency and Contract the repairs with another contractor

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Where does the Project Funding come from

- If we proceed with current contract, put it in a Change Order as a 150% adjustment to the Construction Budget
- Create another Contract and fund it separately

Costs

Titan has provided the following approximate costs:

- Current Contract Value $590,000
- Work completed to date $250,000
- Estimated cost to terminate the Contract $35,000
- Contractor submitted cost to suspend the Contract $25,000
- Contractor submitted cost to suspend the Contract if awarded Change Order to repair the pipe supports $15,000
- Rough Order of Magnitude (ROM) to install a pipe support beam $5,700 each
- ROM to repair the southern bridge abutment $15,000
- Total Not To Exceed (NTE) ROM for all structural repairs $250,000 (estimate from contractor assumes new structural design similar to previous design concept)

Recommendation

Based on cost and risk associated with delaying the repairs to the force main and structural supports, the recommendation is to suspend Titan's 30-Inch Force Main Repair Contract for four months, until the birds leave and the EOR has designed a repair detail for the pipe supports. Titan would then return to perform both the structural repair work identified by the EOR as well as complete their base contract work to repair the 30-inch pipe. Management would need to support the significant contract cost increase and the extension of the contract time to facilitate the completion of the additional necessary project scope.

Copies: Michael Lombardi, Chris Yapp, Kelly Wood, Dan Hebert, Paul Suto, Const. Eng. File, TRIM Folder

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# SITE OBSERVATION REPORT

DATE: July 15, 2016

TO: Kelly Wood

FROM: Michael Pyszka

SUBJECT: Inverness Force Main Site Visit

CC: Tom Nielsen
Rick Hermes
File

PROJECT NUMBER: 276-2177-032

PROJECT NAME: Inverness 30-Inch Force Main Repair

This observation report summarize s the conditions noted during the site visit performed by Michael Pyszka on Thursday July 14, 2016. The intent of the site visit was to confirm the as-constructed configuration of the pipe support brackets on the north end of the bridge, prior to beginning design of a retrofit bracket. Additionally, bolt hole dimensions and locations were measured on the existing pipe support beams. Access to the underside of the bridge was from the bank using a short extension ladder on both the north and south ends. Binoculars were used from the bank and the edge of the slough on the north side.

## CONDITIONS NOTED

The pipe support beams and brackets on the north end of the bridge appear to have been modified from the original design, the same as the support beams and brackets on the south end. Rotation of the support beams was observed, as well as minor deformation of brackets. Looking at the support beams over the river through the binoculars, it appears that most, if not all of the pipe support beams have rotated. Given the distance, the amount of rotation was not discernable.

The roller supports on two adjacent beams (possibly a third as well) were observed to not be in direct contact with the 30-inch CCP. It was hard to tell with the pipe insulation in the way, but the 30-inch CCP appeared to have very little clearance as it passed through the nearest concrete diaphragm at the north end. This is consistent with the conditions noted at the south end.

## RECOMMENDATIONS

The modification of the pipe support beams and brackets from the original design appears to be consistent across the entire bridge. Our recommendation is to proceed with the design of a replacement bracket that works with the existing support beams. The existing beams will not be replaced unless additional damage is observed during construction. A draft of the bracket will be prepared and submitted for review by BES and the Contractor, on or before Friday July 29, 2016. The bracket design will be finalized after the bird nesting season is complete and the Contractor has installed scaffolding, allowing access to the support beams on the north end of the bridge.