



Delaware Department of
Transportation

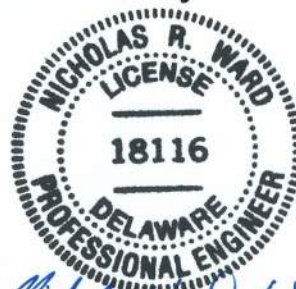
**Underwater Inspection of
Interstate 95 over Christina River
Bridge No. 1-744-059
April 5 and 6, 2016**

Prepared by:



121 Continental Drive, Suite 207
Newark, DE 19713
(302) 655 - 4451
www.pennoni.com

Submitted by:



Nicholas Ward 6.14.2016

N. Ward, P.E.
Delaware P.E. No. 18116
KCI Project No. T201607001



Bridge No. 1-744-059
Interstate 95 over Christina River

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**Underwater Inspection
Bridge No. 1-744-059
Interstate 95 over Christina River**

SIGNIFICANT FINDINGS SUMMARY

A routine underwater inspection of Bridge No. 1-744-059 was performed on April 5 and 6, 2016. The Underwater substructure units were generally in fair condition. The reinforced concrete pier stems typically exhibit scaling up to 1-inch deep. Most of the west and east faces of the West and East Pier Stems exhibit areas of moderate scaling up to 3-inches deep with exposed corroded steel reinforcement with moderate section loss. The west face of the West Stem of Pier 5 exhibits up to 4-inch deep scaling with exposed steel reinforcement with up to 90% section loss to the horizontal reinforcement. The top of the footing is exposed at Pier 2. Steel sheet piling is present at Piers 1 through 5; the sheet piling typically protrudes up to 3-feet from the mudline. In accordance with the National Bridge Inspection Standards, DeIDOT Underwater Bridge Inspection Guidelines, and based on the inspection findings it is recommended that the submerged substructure units of Bridge No. 1-744-059 remain on a routine underwater inspection interval of 24 months.

1.0 INTRODUCTION

1.1 Purpose and Scope

DeIDOT Bridge No. 1-744-059 carries Interstate 95 over the Christina River in New Castle County, Delaware. On April 5 and 6, 2016, Pennoni performed a routine underwater inspection at the bridge to verify the condition of all substructure units from the high water mark to the channel bottom. This report includes a description of the structure, the method of investigation, and a detailed description of the conditions noted. In addition, this report contains a condition assessment of the bridge components evaluated and presents recommendations for follow-up actions as needed. River depth soundings were recorded along the substructure units, along the centerline of the bridge, along each fascia, and at cross sections of the channel at 50 and 100 feet upstream and downstream of the bridge.

1.2 General Description of the Structure

DeIDOT Bridge No. 1-744-059 is a seven span bridge over the Christina River. The bridge is supported on two abutments and six piers. The North and South Abutments are each constructed of a reinforced concrete pile cap supported by cast in place concrete piles and are situated out of the water. Piers 1 through 6 each consist of three reinforced concrete hammerhead style pier stems supported by individual footings founded on steel HP12x74 piles of various length. Refer to Appendix A for a location map of the bridge and Photographs 1 and 2 in Appendix B for overall views of the bridge. Refer to Figure 1 in Appendix C for a sketch of the bridge site.

1.3 Method of Investigation

A dive team consisting of commercially trained divers, led by a Delaware-registered Professional Engineer, conducted the underwater investigation. The team members and their duties for this inspection were as follows: Nicholas Ward, PE - Team Leader and Dive Supervisor; Joseph Challburg – Tender, Martin Anderson – Dive Inspector/Tender and Andrew Fulton – Dive Inspector/Tender. The inspection was conducted using commercial surface supplied air diving equipment. During the inspection, the diver worked out of a 27-foot dive boat where the Dive

Supervisor recorded the inspection notes. Access to the bridge was obtained via a public boat launch 1/2-miles west of the bridge.

The underwater investigation generally consisted of a Level I visual inspection of 100 percent of the accessible substructure surfaces from the high water mark to the channel bottom. A Level II visual/tactile inspection, which included removing marine growth at the waterline, mid-depth and channel bottom, was performed at various locations to facilitate an evaluation of the underlying surfaces and provide an overall condition of the structure. Particular attention was given to observed areas of excessive deterioration or apparent distress, and the condition of previous repairs was noted.

A cursory assessment of the waterway and channel bottom conditions in the vicinity of the bridge was also performed. The type of channel bottom material was noted, as well as the location and extent of observed scour, riprap, or debris. The location of the waterline with respect to a fixed reference on the bridge was noted at the time of inspection.

2.0 EXISTING CONDITIONS

At the time the soundings were recorded on April 5, 2016, the waterline reference was measured from the southwest corner of Pier 6 from the bottom of the cap at the stem and measured to be 24.1-feet. Depth soundings indicated that the maximum water depth at the bridge structure was 16.3-feet at the quarter point in Span 5 along the west fascia. The river is tidally influenced and has a tidal swing of approximately 6 feet. At the time of inspection there was up to 1-foot of visibility and a water velocity of up to 2.0-feet per second. Refer to Figure 1 in Appendix C for a Sounding Plan of the bridge.

The reinforced concrete stems at Piers 2 through 5 typically exhibit scaling 2 1/2' H x up to 1-inch deep throughout the tidal zone. Around the piers there is typically steel sheet piling that protrudes from the mudline up to 3-feet high; the sheet piling typically exhibits minor to moderate surface corrosion. The top of the footing is exposed at Pier 2. The exposure of the top of the footing at Piers 4 and 5 previously noted was covered with hard packed sand during the 2016 Inspection. Timber debris was observed around the stems of all piers. The channel bottom consisted of sand and silty sand with up to 3-feet of probe rod penetration outside the steel sheet piling and predominately hard packed sand with up to 4-inches of probe rod penetration inside the steel sheet piling.

Overall, Piers 1 and 6 are in satisfactory condition. Piers 1 and 6 stems typically exhibit up to 1/2-inch deep scaling from the mean high waterline to the streambed. At Pier 1 a 6-foot long section of steel H-pile is on the channel bottom just north of the steel sheet pile at the East Stem. Refer to Figures 2 and 7, respectively in Appendix C for detailed inspection notes of Piers 1 and 6.

Overall, Pier 2 was in fair condition. The west face of the West Stem exhibits a 6' H x full-width (3'-6") x 3" D area of scaling with exposed corroded steel reinforcement (7 vertical and 3 horizontal steel bars) with 20% section loss on the vertical bars and up to 60% section loss on the horizontal bars, starting 2 feet-6 inches above the mudline. The east face of the West Stem exhibits a 2' H x full-width x 1 1/2" D area of scaling with exposed corroded steel reinforcement (3 horizontal steel bars), 1-foot above the mudline that extends 3-feet onto the north face. The west face of the East Stem exhibits scaling up to 4' H x full-width x up to 2 1/2" D with exposed corroded steel reinforcement (11 vertical and 2 horizontal steel bars) with up to 30% section loss, 6-feet above the

mudline that extends 6-inches on both the north and south faces. The East Stem exhibits 2' H x up to 1 1/2-inch deep scaling/poorly consolidated concrete at the mudline on all faces. The top of the footing is exposed along the north and south faces of the Center Stem inside the steel sheet piling. A 6-foot long section of a steel H-pile is on the channel bottom along the north face of the exposed steel sheet pile at the Center Stem and a 3-foot long section of steel H-pile is at the southwest corner of the steel sheet piling. A 2 to 3-foot concrete overpour exists along the north face of the steel sheet pile from the west quarter point to the northeast corner at the East Stem. Refer to Figure 3 in Appendix C for detailed inspection notes of Pier 2.

Overall, Pier 3 was in fair condition. The stems exhibit a 2' H x 1 1/2" D area of scaling/poorly consolidated concrete at the mudline on all faces. The west face of the West Stem exhibits a 6' H x full-width x 3" D area of scaling with exposed corroded steel reinforcement (6 vertical and 2 horizontal steel bars) with up to 20% section loss. The west face of the East Stem exhibits a 2'-6" H x full-width x 3" D area of scaling with exposed corroded steel reinforcement (2 vertical and 2 horizontal steel bars) with up to 25% section loss, at the waterline. The previously noted 10' L x 1' D scour depression that extended 3-feet north of the north face of the West Stem; a 3' L x 1' D scour depression that extended 3-feet out from the west face of the Center Stem; and a 3' L x FW x 1' D scour depression that extended 3-feet away from the north face of the East Stem were not observed during the 2016 Inspection; however, around the pier stems there is a minor, up to 6-inches deep, streambed change. There is a 14' H x up to 1/16" W vertical crack on the east face of the Center Stem that terminates 4 feet below the waterline. Refer to Figure 4 in Appendix C for detailed inspection notes of Pier 3.

Overall, Pier 4 was in satisfactory condition. The west face of the West Stem exhibits 5' H x full-width x 4" D scaling with exposed corroded steel reinforcement (1 vertical and 1 horizontal steel bar), at the waterline that extends 1-foot on the north and south faces. The east face of the West Stem exhibits 1'-4" H x full-width x 4" D scaling with exposed corroded steel reinforcement (with one horizontal steel bar) at the waterline. At the center of the west face of the West Stem is a vertical crack up to 30' H x up to 1/16" W that terminates 5-feet below the waterline. The east face of the East Stem exhibits 1'-6" H x full-width x 4" D scaling with exposed corroded steel reinforcement (1 vertical and 2 horizontal steel bars), starting 3-feet above the mudline. The west face of the East Stem exhibits 3' H x full-width x 4" D scaling with exposed corroded steel reinforcement (5 vertical and 4 horizontal steel bars), starting 3-feet above the mudline. Steel debris, up to 4-feet long, is on the channel bottom at the west face of the East Stem. Refer to Figure 5 in Appendix C for detailed inspection notes of Pier 4.

Overall, Pier 5 was in fair condition. The west face of the West Stem exhibits 3' H x full-width x 4" D scaling with exposed corroded steel reinforcement (4 horizontal and 8 vertical steel bars) with up to 90% section loss to the horizontal reinforcement, 4-feet from the mudline that extends 4-feet long onto the north face. The West Stem exhibits 2 1/2' H x up to 2" D scaling along the south, east and north faces with an exposed horizontal steel bar and a vertical steel bar at the southeast chamfer, 3-feet above the mudline. There is map cracking and a 1/32-inch wide vertical crack extending 15-feet up from the band of scaling on the west face of the West Stem. The west face of the East Stem exhibits 3' H x full-width x 3" D scaling with exposed corroded steel reinforcement (3 vertical and 2 horizontal steel bars), 6-feet above the mudline that extends 5-feet long on the north face with one exposed horizontal steel reinforcement bar. Refer to Photographs 4 and 5 in Appendix B for scaling defect. Refer to Figure 6 in Appendix C for detailed inspection notes of Pier 5.

Overall, Pier 6 was in satisfactory condition. The stem exhibits a band of up to 1/2-inch deep scale from the mean high waterline to the mudline. The channel bottom in the vicinity of the pier consists primarily of gravel and concrete debris with riprap placed between each stem. Refer to Figure 7 in Appendix C for detailed inspection notes of Pier 6.

The north embankment consisted of small cobbles up to 4 inches in diameter with minor vegetation. The South Embankment consisted of minor vegetation. Refer to Photographs 9 and 10 in Appendix B for channel views. Refer to Figure 1 in Appendix C for detailed inspection results of the embankments.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 Evaluation and Assessments

Overall, the submerged substructure units of Structure No.1-744-059 are in fair condition. A comparison of the soundings recorded during the previous inspection on April 3, 2014 and the soundings taken during this inspection revealed minor scour along the west fascia of the structure. The footing exposure at Pier 2 is not of concern at this time given that the bottom of the footing was embedded below the current channel bottom, restrained within the steel sheet pile walls, and the footing is supported by piles.

The timber debris accumulations do not affect the channel flow, and as a result, do not require removal at this time. If the debris accumulations increase in size or density, it may be necessary to remove the debris to limit further debris accumulation, and reduce the likelihood of general channel bottom and localized scour.

3.2 Recommended NBI Condition Ratings

Substructure Code (Item 60)	Channel and Channel Protection Code (Item 61)	Underwater Inspection Code (Item 92B) (Months)
5	6	24

The recommended NBI Rating for Item 60 (Substructure) is a 5. This rating is recommended due to the extent of the scaling on the pier stems along with the exposed steel reinforcement with section loss.

The current NBI Rating for Item 61 (Channel and Channel Protection) is a 6. This rating is recommended due the exposed footing at Pier 2 and previously noted exposed footings at Piers 4 and 5.

3.3 Recommendations

The bands of scaling and associated concrete deterioration at Piers 2 through 5 should be repaired. In lieu of traditional concrete patching repairs, which may be short-lived, consideration should be given to installing a fiberglass jacket system (or similar method) around each pier stem to provide a longer-life repair.

The channel bottom configuration should continue to be closely monitored during future underwater inspections to ensure that the footing exposure at Pier 2 remains minimal and the footings at Piers 4 and 5 do not get exposed due to scour as previously noted.

In accordance with the National Bridge Inspection Standards, DelDOT Underwater Bridge Inspection Guidelines, and based on the inspection findings it is recommended that the submerged substructure units of Bridge No. 1-744-059 remain on a routine underwater inspection interval of 24 months. It is also recommended that soundings be recorded at the substructure units during the biennial inspections and during or immediately following any significant high water event to check if significant localized scour is occurring. If the biennial inspection soundings determine that significant localized scour is occurring, an underwater inspection interval less than 24 months may be warranted.

APPENDIX A – LOCATION MAP

Bridge No. 1-744-059
Interstate 95 over Christina River



DELAWARE DEPARTMENT OF TRANSPORTATION		
INTERSTATE 95 over CHRISTINA RIVER BRIDGE NO. 1-744-059		
LOCATION MAP		
CREATED BY: ATF	121 Continental Drive, Suite 207 Newark, DE 19713 www.pennoni.com	DATE: 4/06/2016
CHECKED BY: NRW		SCALE: N.T.S.
PROJECT NO.: T201607001		Appendix A



APPENDIX B – PHOTOGRAPHS

Bridge No. 1-744-059
Interstate 95 over Christina River



Photograph 1. Overall View of the East Elevation, Looking West.



Photograph 2. Overall View of the West Elevation, Looking East.

Bridge No. 1-744-059
Interstate 95 over Christina River



Photograph 3. Typical Configuration of Pier (Pier 1 shown), Looking Southeast.



Photograph 4. Pier 5, west face of West Stem, Looking East.
Note: 3' H x full-width x up to 4" D scale with exposed steel reinforcement.

Bridge No. 1-744-059
Interstate 95 over Christina River



Photograph 5. Pier 5, west face of West Stem, Looking East.
Note: Exposed steel reinforcement with section loss.



Photograph 6. South Abutment, Looking South.
Note: Previous area of erosion has been filled with riprap.

Bridge No. 1-744-059
Interstate 95 over Christina River



Photograph 7. Typical View of Embankment (Southwest Shown)



Photograph 8. Typical View of Embankment (Northeast Shown)

Bridge No. 1-744-059
Interstate 95 over Christina River

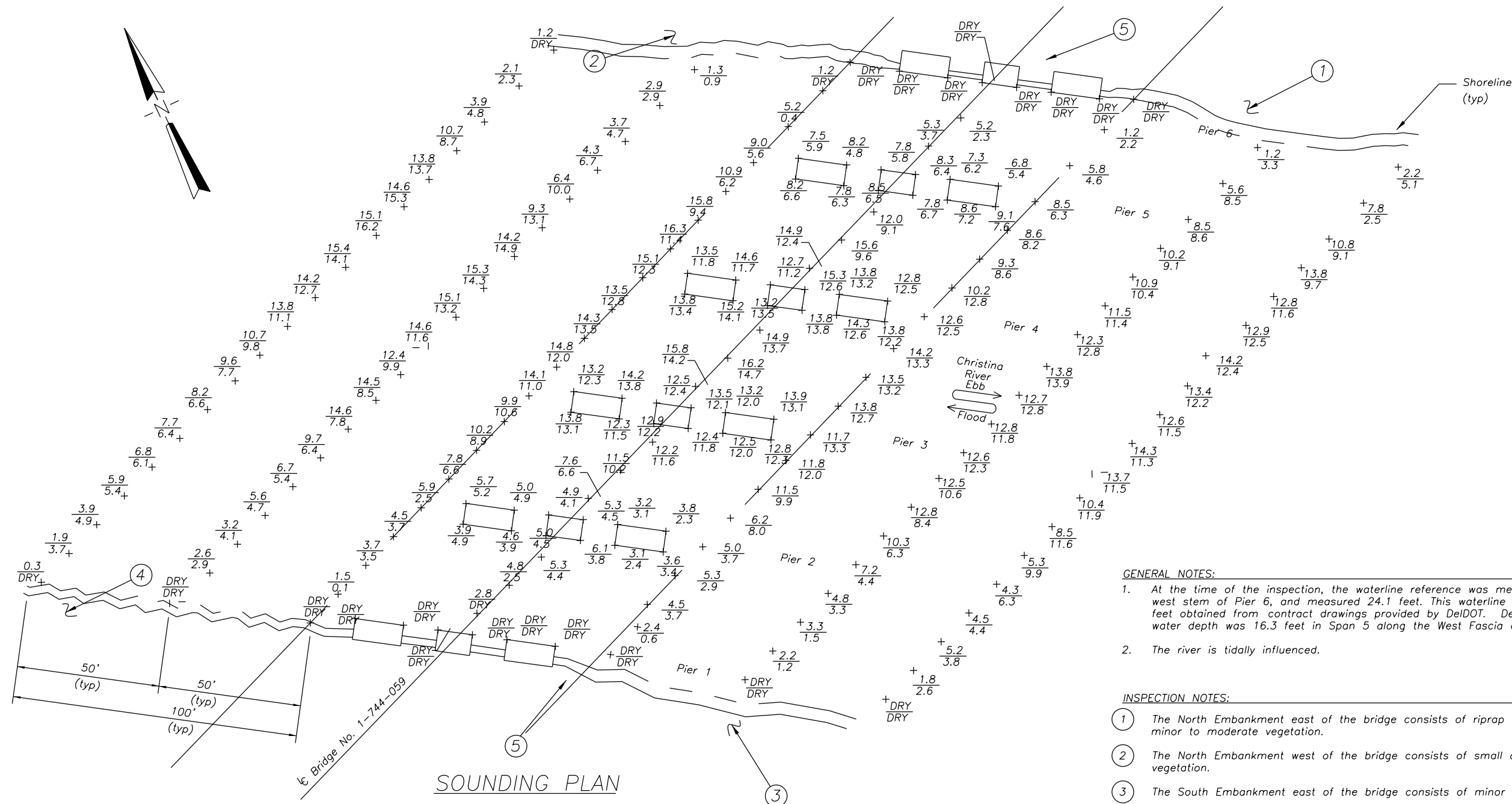


Photograph 9. Tidal View (Christina River), Looking West.



Photograph 10. Tidal View (Christina River), Looking East.

APPENDIX C – FIGURES



GENERAL NOTES:

- At the time of the inspection, the waterline reference was measured from the southeast corner of the west stem of Pier 6, and measured 24.1 feet. This waterline corresponds to an actual elevation of 0.84 feet obtained from contract drawings provided by DeIDOT. Depth soundings indicated that the maximum water depth was 16.3 feet in Span 5 along the West Fascia at the quarter point.
- The river is tidally influenced.

INSPECTION NOTES:

- The North Embankment east of the bridge consists of riprap measuring 6 to 12-inches in diameter with minor to moderate vegetation.
- The North Embankment west of the bridge consists of small cobbles up to 4-inches in diameter with minor vegetation.
- The South Embankment east of the bridge consists of minor vegetation.
- The South Embankment west of the bridge consists of riprap measuring 6 to 12-inches in diameter.
- The embankments under the bridge consist of riprap measuring 6 to 12-inches in diameter from the mean high waterline to the mean low waterline.

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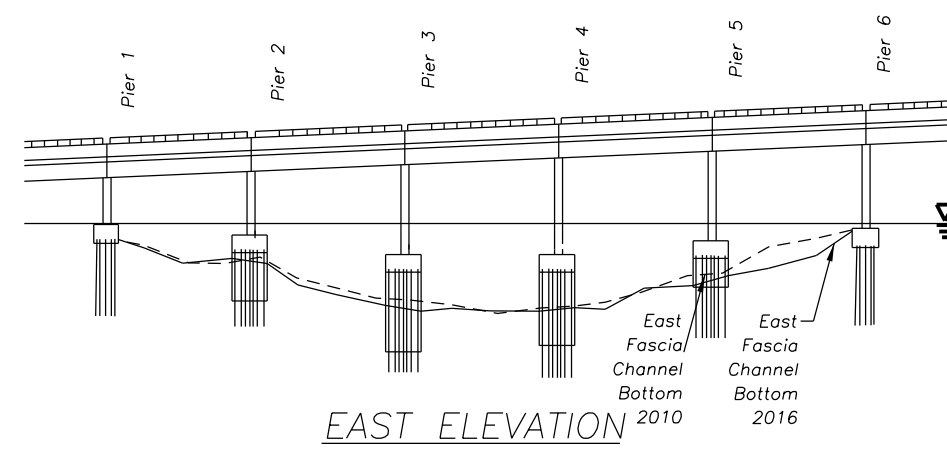
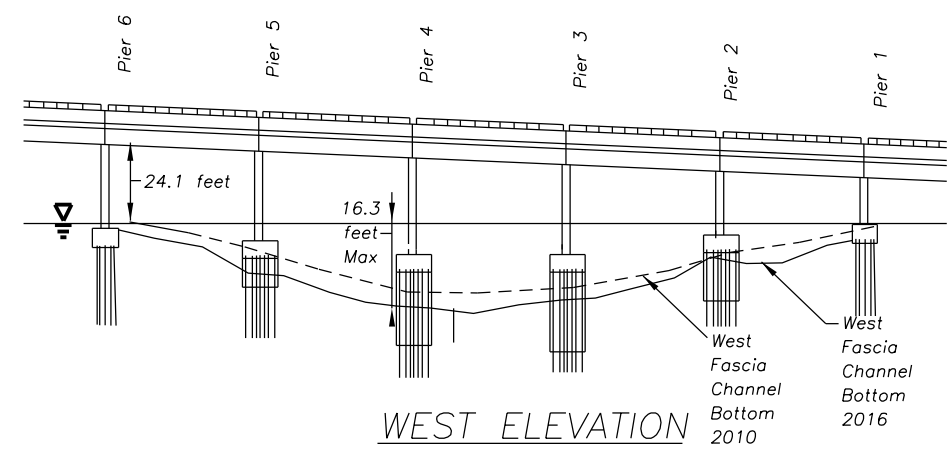
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- X.X 2010 BASE YEAR SOUNDINGS (ADJUSTED)
- (X) Inspection note number

**DELAWARE
DEPARTMENT OF TRANSPORTATION**

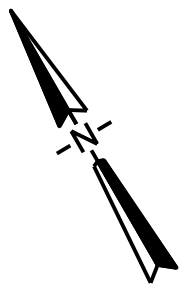
INTERSTATE 95 OVER CHRISTINA RIVER
BRIDGE NO. 1-744-059

SOUNDING PLAN

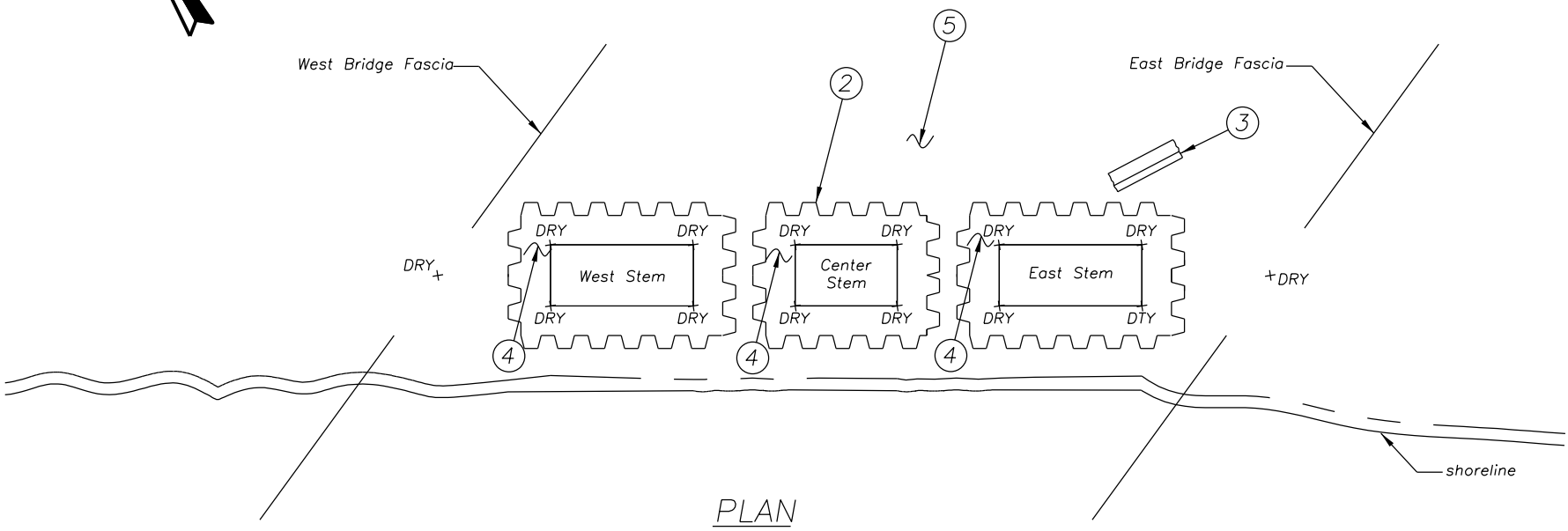
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JOB NO.: KCIT1601		FIGURE NO.: 1	



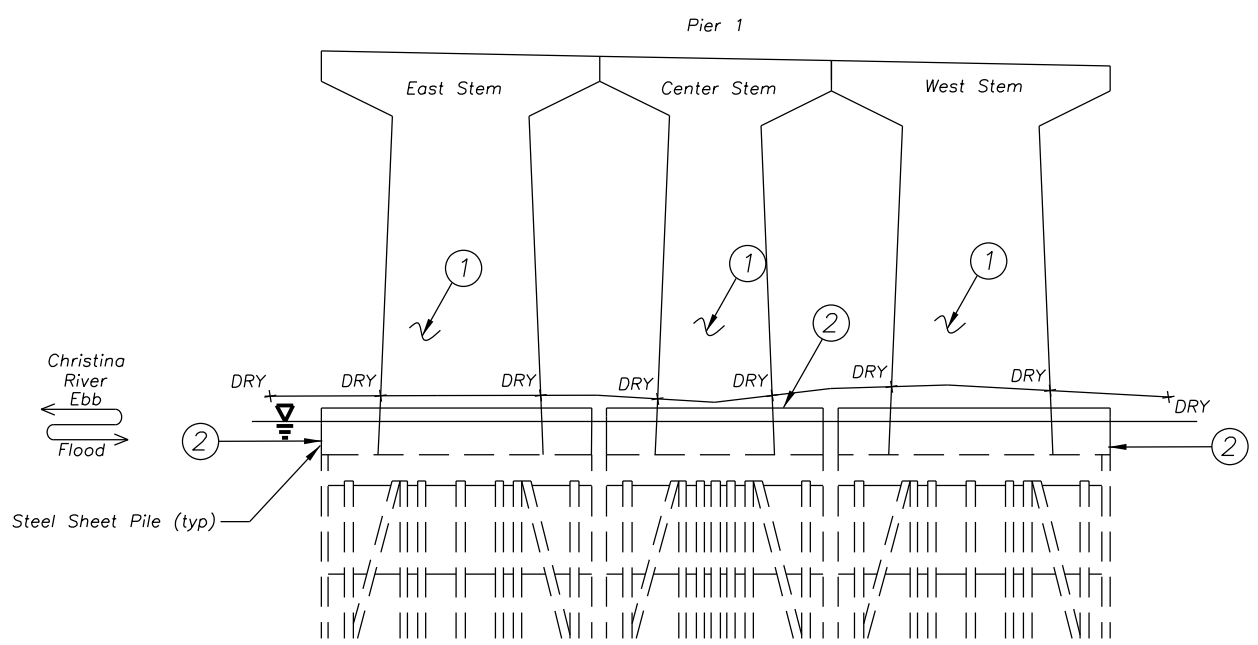
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Christina River
Flood
Ebb



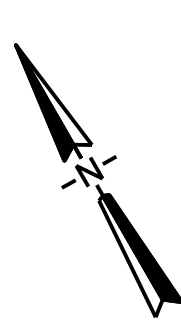
- INSPECTION NOTES:**
- ① The concrete surfaces of all Pier 1 Stems exhibit up to 1/2-inch deep scaling from the mean high waterline to the channel bottom.
 - ② Steel sheet pile is approximately 4.5-feet off the north face of all pier stems and extends to the centerline of the east and west faces of all pier stems. The steel sheet pile extends out of the channel bottom approximately 1.2-feet. The sheeting is in good condition with minor surface corrosion.
 - ③ Section of steel H-pile, 6-feet long, is north of the steel sheet piling at the East Stem.
 - ④ Within the steel sheet pile, gravel with up to 2-inches of probe rod penetration existed.
 - ⑤ The channel bottom outside the steel sheet pile consists of sandy silt with up to 3-feet of probe rod penetration.



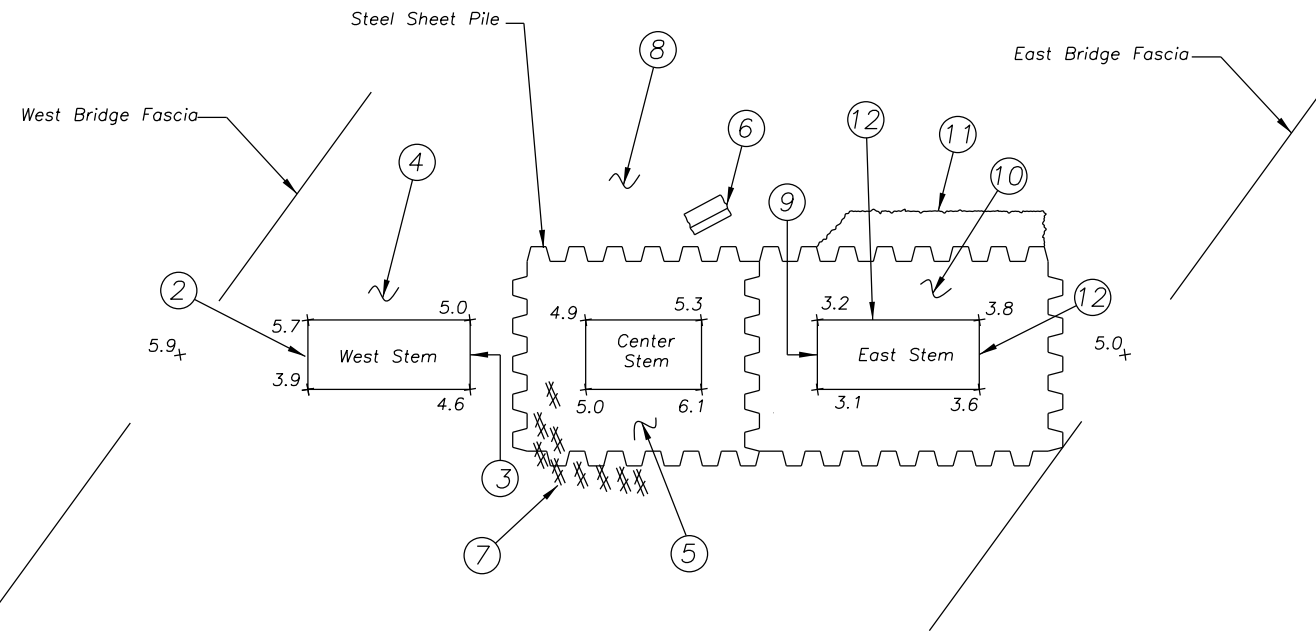
NORTH ELEVATION

- LEGEND:**
- ✕ X.X Indicates water depth at the time of inspection in feet
 - # Inspection note number

DELAWARE DEPARTMENT OF TRANSPORTATION		
INTERSTATE 95 OVER CHRISTINA RIVER BRIDGE NO. 1-744-059		
PIER 1 INSPECTION DETAILS		
DRAWN BY: ATF		DATE: 4/06/16
CHECKED BY: NRW		SCALE: N.T.S.
JOB NO.: KCIT1601		FIGURE NO.: 2
		121 Continental Drive Suite 207 Newark, DE 19713 www.pennoni.com



Christina River
Ebb
Flood

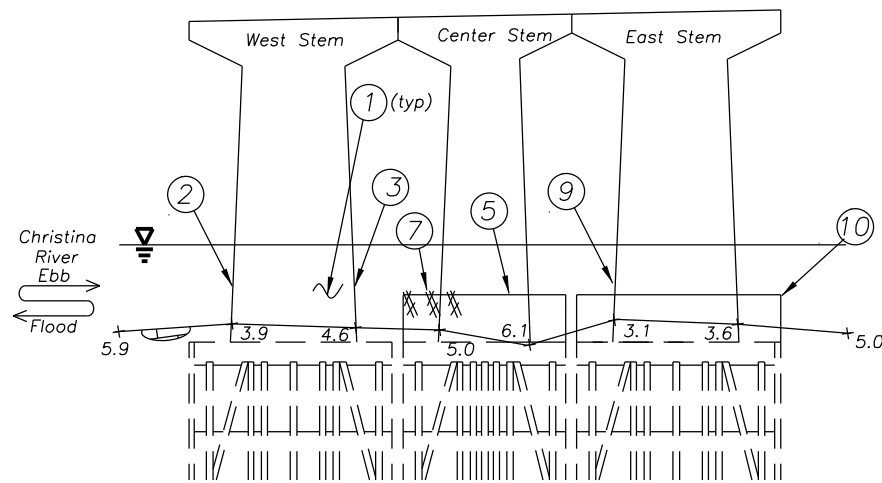


PLAN

INSPECTION NOTES:

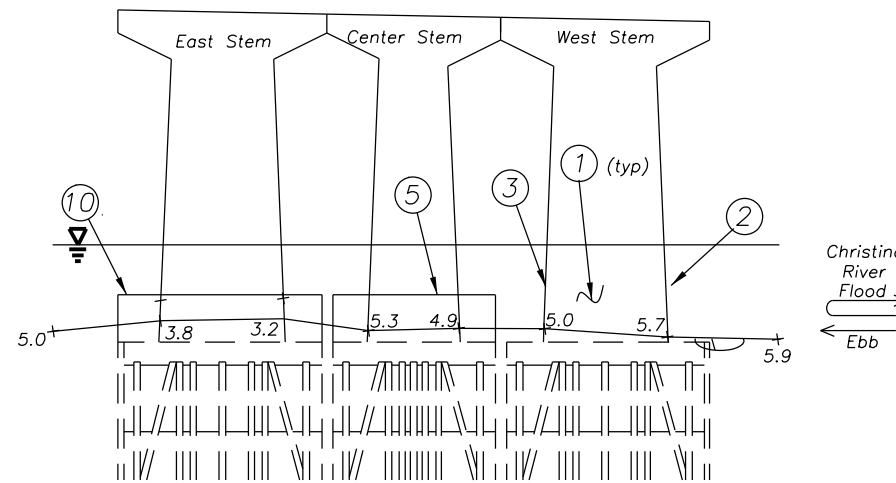
- ① The concrete surfaces of all Pier 2 Stems exhibit a band of 2'-6" H x up to 1-inch scaling in the tidal zone.
- ② Scaling on the west nose of the West Stem, measuring 6' H x full-width x 3" D with exposed corroded steel reinforcement (7 vertical and 3 horizontal steel bars) with 20% section loss on the vertical steel bars and up to 60% section loss on the horizontal steel bars, starting 2.5-feet above the mudline.
- ③ Scaling on the east nose of the West Stem, measuring 2' H x full-width x 1 1/2" D with exposed corroded steel reinforcement (3 horizontal steel bars), 1-foot above the mudline that extends 3-feet onto the north face.
- ④ The channel bottom in the vicinity of the West Stem consists of gravel with up to 1-inch of probe rod penetration.
- ⑤ Steel sheet pile was exposed around the Center Stem, the top of the steel sheet pile was 2 to 3-feet from the mudline. The top of the footing was exposed along the north and south faces of the Center Stem inside the steel sheet pile. Within the steel sheet pile along the east and west faces of the Center Stem, sandy gravel with up to 4-inch probe rod penetration exists.
- ⑥ A section of a steel H-pile, 6-feet long, is on the channel bottom along the north face of the exposed steel sheet pile at the Center Stem.
- ⑦ Minor timber debris is present at the west nose of the Center Stem and extends 6-feet east, down the south face of the steel sheet pile.
- ⑧ The channel bottom outside the steel sheet pile consists of sand with up to 4-inches probe rod penetration.
- ⑨ An area of scaling is present on the west nose of the East Stem, measuring 4' H x full-width x 2 1/2" D with exposed corroded steel reinforcement (11 vertical and 2 horizontal rebars) with up to 30% section loss, 6-feet above the mudline that extends 6-inches onto the north and south faces.
- ⑩ Steel sheet pile is exposed around the entire East Stem with the top of the steel sheet pile located 2 to 2.5-feet from the mudline. Within the steel sheet pile, there is gravel with 0-inches of probe rod penetration covering the footing. At the west nose there was a 3-foot long section of steel H-pile on the gravel.
- ⑪ Concrete overpour exists along the north face of the steel sheet pile from the west quarter point to the northeast corner at the East Stem. The overpour extends 2 to 3-feet out from the north face of the steel sheet pile with 6 to 18-inches of vertical exposure.
- ⑫ There is scaling/poorly consolidated concrete in the East Stem on all faces measuring 2' H x 1 1/2" D at the mudline.

Pier 2



SOUTH ELEVATION

Pier 2



NORTH ELEVATION

LEGEND:

- x X.X Indicates water depth at the time of inspection in feet
- # Inspection note number
- X Timber debris

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INTERSTATE 95 OVER CHRISTINA RIVER
BRIDGE NO. 1-744-059

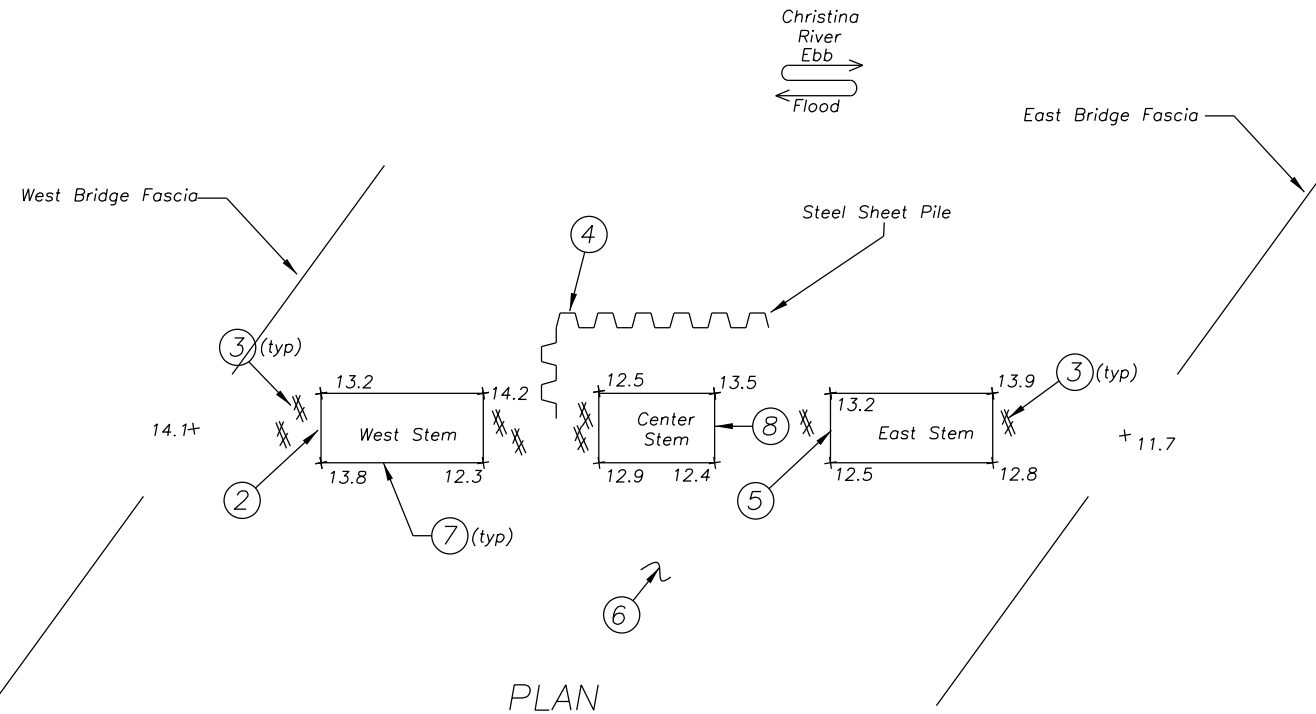
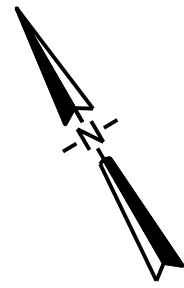
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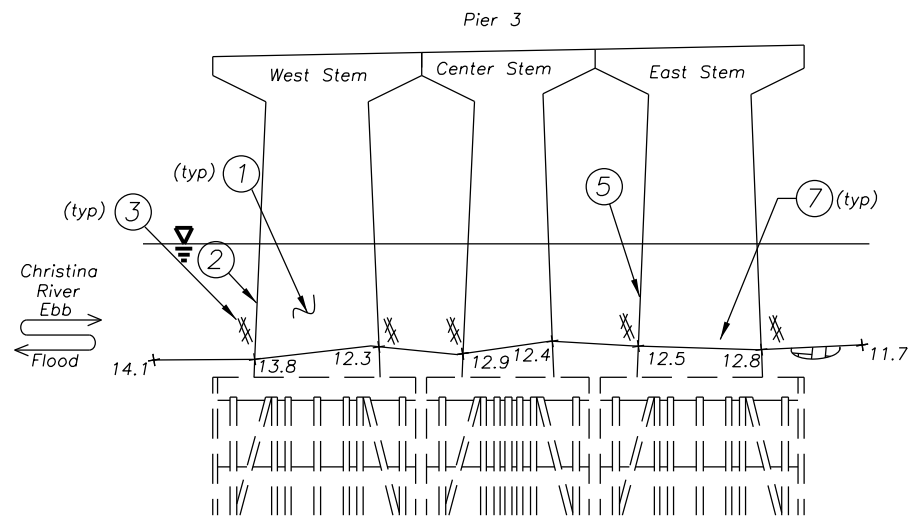
121 Continental Drive
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DATE: 4/06/2016
SCALE: N.T.S.
FIGURE NO.: 3

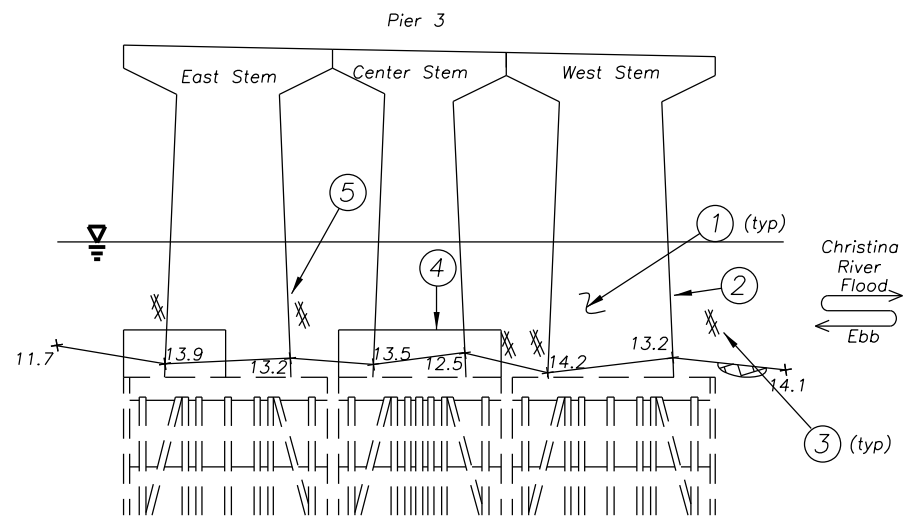


INSPECTION NOTES:

- ① The concrete surfaces of all Pier 3 Stems exhibits a band of 2'-6" H x up to 1" D scaling within the tidal zone.
- ② Area of scaling on the west nose of the West Stem measuring 6' H x full-width x 3" D with exposed corroded steel reinforcement (6 vertical and 2 horizontal steel bars) with 20% section loss.
- ③ Minor accumulations of timber debris measuring up to 12-inches in diameter exists at the east and west faces of the West and East Stems and the west face of the Center Stem, along the streambed.
- ④ Steel sheet pile is exposed 12-feet below the waterline from the northeast corner of the Center Stem, along the north face, and terminated into the channel bottom at the centerline of the west face.
- ⑤ An area of scaling on the west nose of the East Stem measuring 2'-6" H x full-width x 3" D with exposed corroded steel reinforcement (2 vertical and 2 horizontal steel bar) with up to 25% section loss.
- ⑥ The channel bottom in the vicinity of the pier consists of sand and minor gravel with up to 6-inches of probe rod penetration.
- ⑦ There is a band of scaling/poorly consolidated concrete measuring 2' H x 1 1/2" D on all faces of the pier stems at the mudline.
- ⑧ There is a 14' H x up to 1/16" W vertical crack on the east face of the Center Stem, starting at 4 feet below the waterline and extending up.



SOUTH ELEVATION



NORTH ELEVATION

LEGEND:

- ✕ X.X Indicates water depth at the time of inspection in feet
- # Inspection note number
- ⌘ Timber debris

**DELAWARE
DEPARTMENT OF TRANSPORTATION**

INTERSTATE 95 OVER CHRISTINA RIVER
BRIDGE NO. 1-744-059

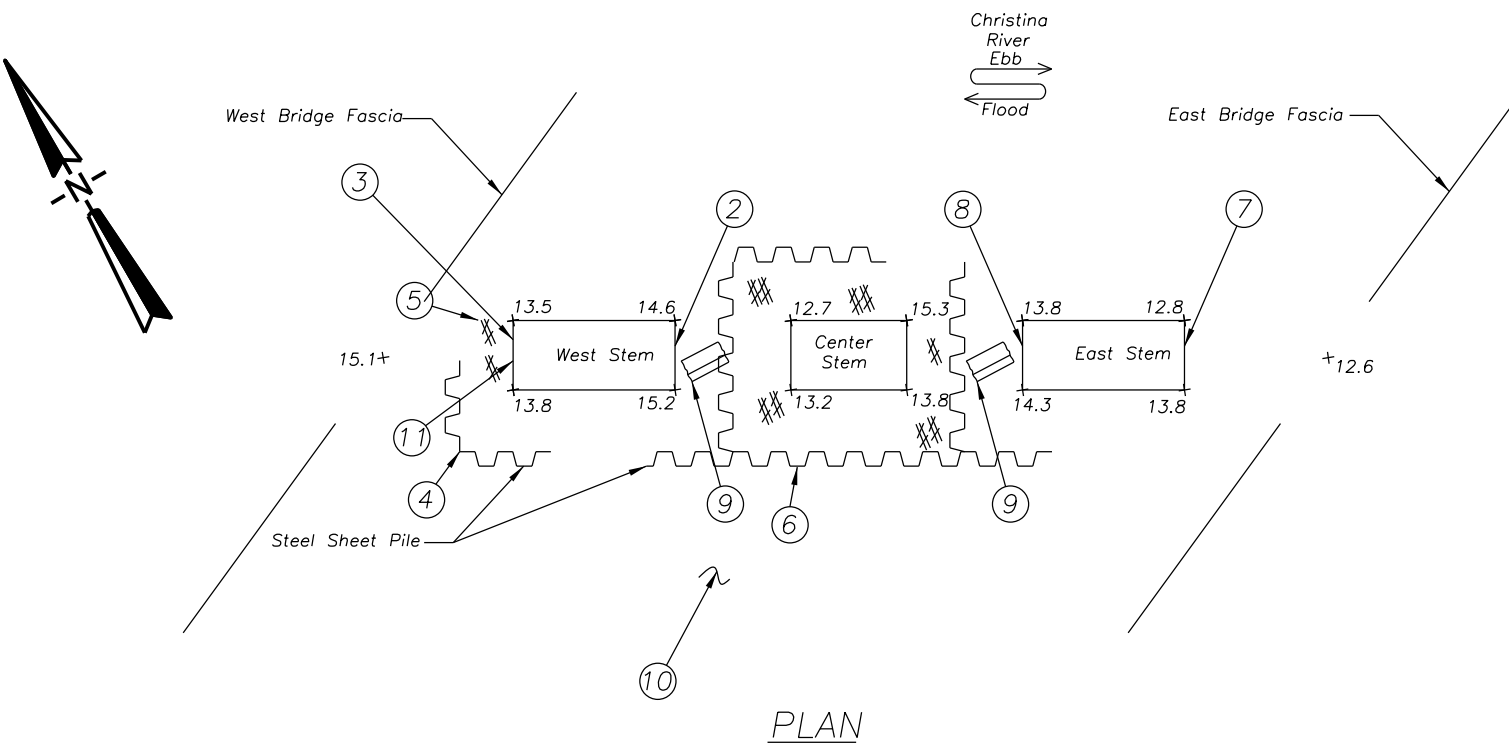
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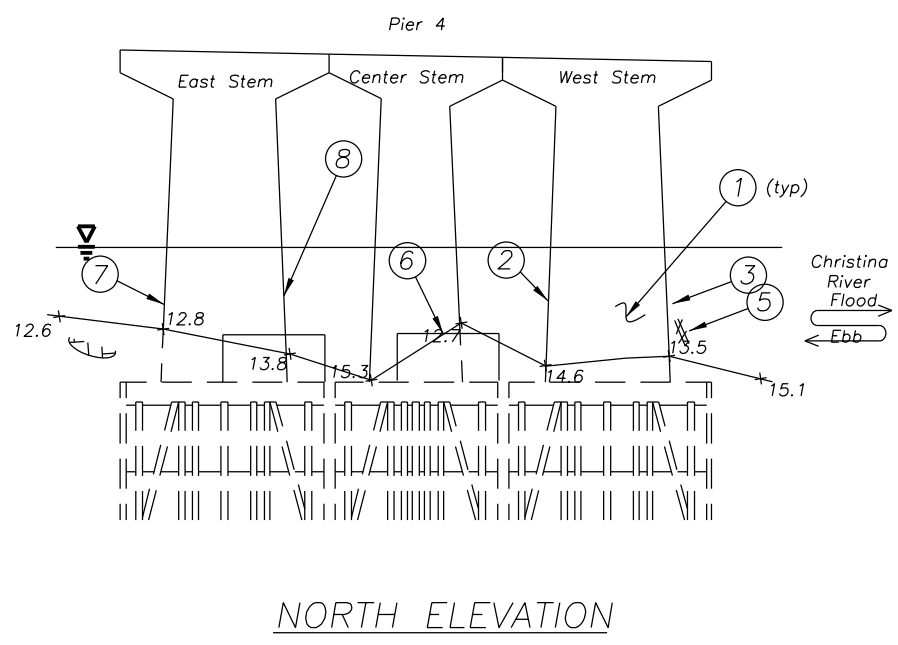
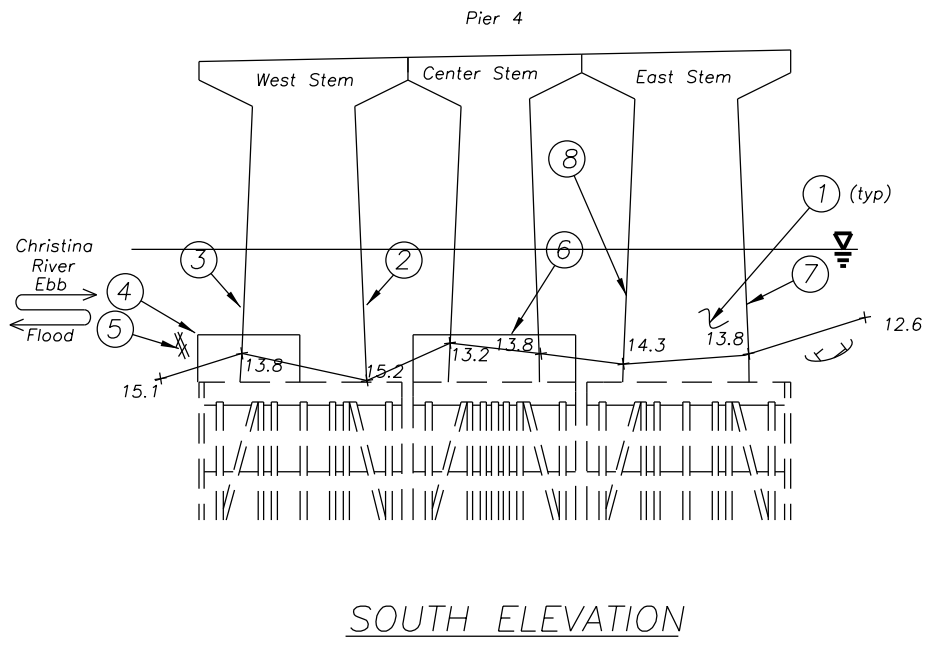


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DATE: 4/06/16
SCALE: N.T.S.
FIGURE NO.: 4

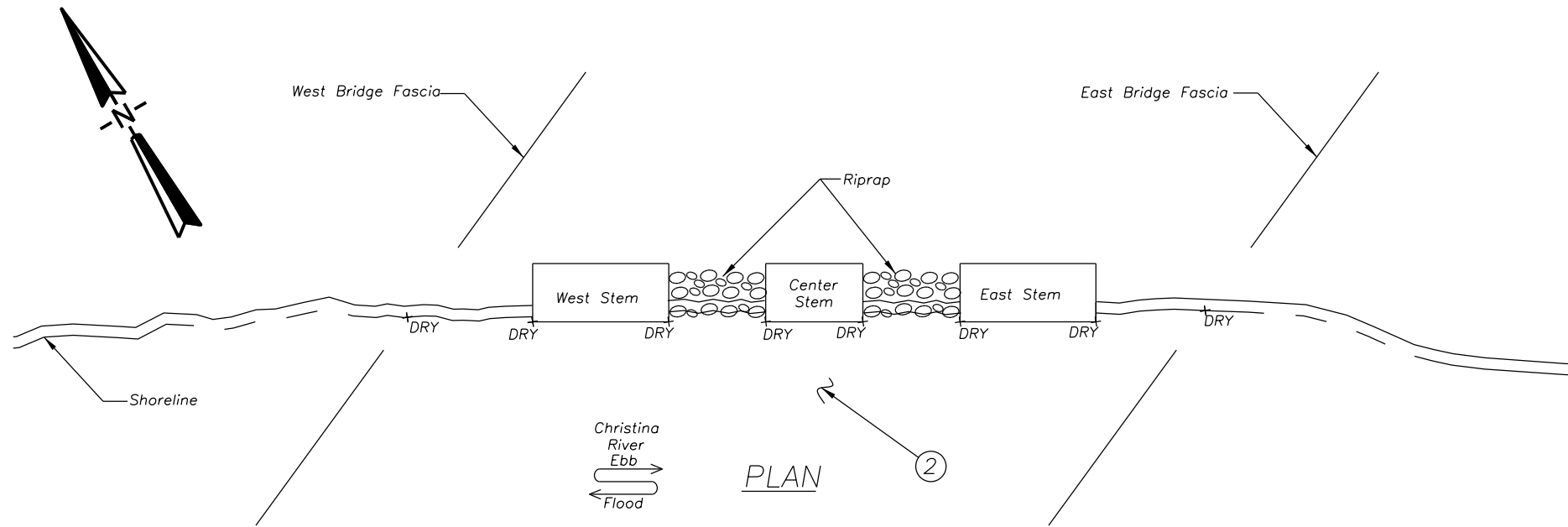


- INSPECTION NOTES:
- ① The concrete surfaces of all Pier 4 Stems exhibits a band of 2'-6" H x up to 1" D scaling in the tidal zone.
 - ② Area of scaling on the east nose of the West Stem measuring 1'-4' H x full-width x 4" D with one exposed corroded horizontal steel reinforcement.
 - ③ Area of scaling on the west nose of the West Stem measuring 5' H x full-width x 4" D with exposed corroded steel reinforcement (1 vertical and 1 horizontal steel bar), that extends 1-foot onto the north and south faces.
 - ④ Steel sheet pile is exposed from the centerline of the west nose of the West Stem extending to the southwest corner of the pier and extended 6-feet east on the south face of the pier. The steel sheet pile extended approximately 3-feet out of the channel bottom.
 - ⑤ Moderate accumulations of timber debris consisting of branches measuring 6 to 12-inches in diameter exists at the west nose of the West Stem.
 - ⑥ Steel sheet pile is exposed at the Center Stem along the south face, east face, west face, and extended 15-feet east along the north face from the northwest corner. The steel sheet pile extended approximately 2-feet out of the channel bottom.
 - ⑦ Scaling on the east face of the East Stem, measuring 1'-6" H x full-width x 4" D with exposed corroded steel reinforcement (1 vertical and 2 horizontal), starting 3-feet above the mudline.
 - ⑧ Scaling on the west face of the East Stem, measuring 3' H x full-width x 4" D with exposed corroded steel reinforcement (5 vertical and 4 horizontal), starting 3-feet above the mudline.
 - ⑨ Steel debris measuring approximately 4-feet long exists on the channel bottom at the west face of the East Stem and the east face of the West Stem.
 - ⑩ The channel bottom in the vicinity of the pier consists of sand and gravel with up to 2-inches of probe rod penetration.
 - ⑪ There is a 30' H x 1/16" W vertical crack starting 5-feet below the waterline, extending up the center of the west face of the West Stem.

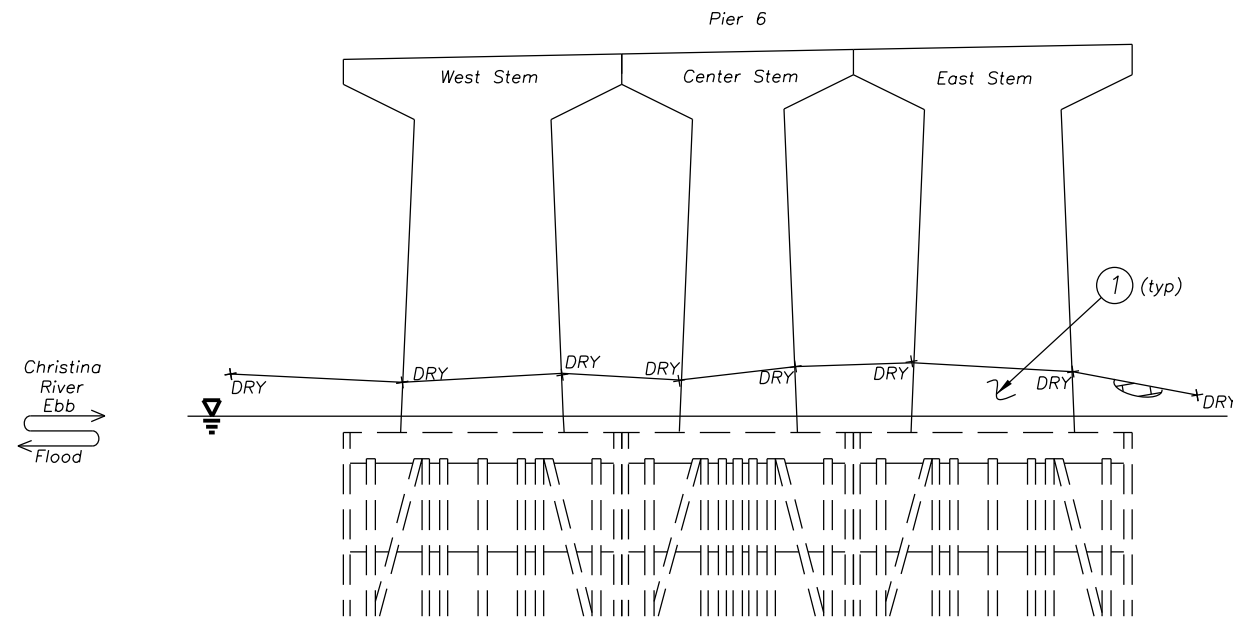


- LEGEND:
- x X.X Indicates water depth at the time of inspection in feet
 - # Inspection note number
 - X Timber debris

DELAWARE DEPARTMENT OF TRANSPORTATION		
INTERSTATE 95 OVER CHRISTINA RIVER BRIDGE NO. 1-744-059		
PIER 4 INSPECTION DETAILS		
DRAWN BY: ATF		121 Continental Drive Suite 207 Newark, DE 19713 www.pennoni.com
CHECKED BY: NRW		DATE: 4/06/16
JOB NO.: KCIT1601		SCALE: N.T.S.
		FIGURE NO.: 5



- INSPECTION NOTES:**
- ① The concrete surfaces of all Pier 6 Stems exhibits a band of up to 1/2-inch deep scaling from the mean high waterline to the mudline.
 - ② The channel bottom in the vicinity of the pier consists of gravel and concrete debris measuring 3 to 8-inches in diameter with riprap between pier stems.



SOUTH ELEVATION

- LEGEND:**
- x X.X Indicates water depth at the time of inspection in feet
 - # Inspection note number

**DELAWARE
DEPARTMENT OF TRANSPORTATION**

INTERSTATE 95 OVER CHRISTINA RIVER
BRIDGE NO. 1-744-059

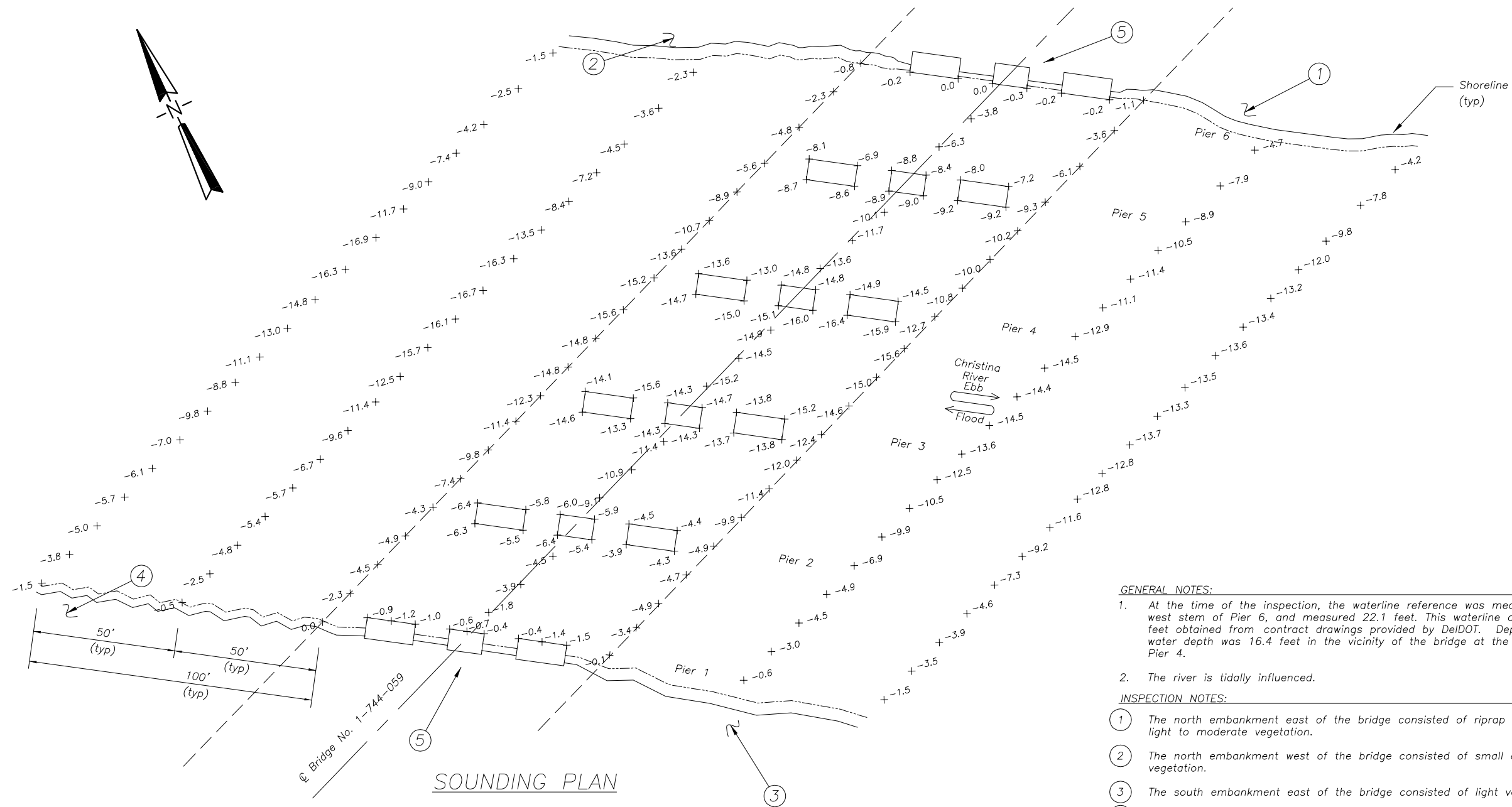
PIER 6 INSPECTION DETAILS

DRAWN BY: ATF
CHECKED BY: NRW
JOB NO.: kcit1601



121 Continental Drive
Suite 207
Newark, DE 19713
www.pennoni.com

DATE: 4/06/16
SCALE: N.T.S.
FIGURE NO.: 7



GENERAL NOTES:

1. At the time of the inspection, the waterline reference was measured from the southeast corner of the west stem of Pier 6, and measured 22.1 feet. This waterline corresponds to an actual elevation of 0.84 feet obtained from contract drawings provided by DelDOT. Depth soundings indicated that the maximum water depth was 16.4 feet in the vicinity of the bridge at the southwest corner of the east stem of Pier 4.

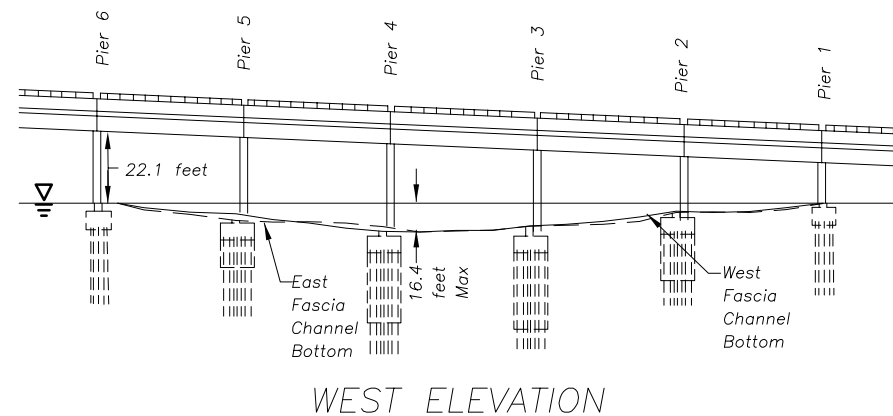
2. The river is tidally influenced.

INSPECTION NOTES:

- ① The north embankment east of the bridge consisted of riprap measuring 6 to 12 inches in diameter with light to moderate vegetation.
- ② The north embankment west of the bridge consisted of small cobble up to 4 inches in diameter with light vegetation.
- ③ The south embankment east of the bridge consisted of light vegetation.
- ④ The south embankment west of the bridge consisted of riprap measuring 6 to 12 inches in diameter.
- ⑤ The embankments under the bridge consisted of riprap measuring 6 to 12 inches in diameter from the mean high waterline to the mean low waterline.

LEGEND:

- ⊕ Indicates water depth at the time of inspection in feet
- ⓧ Inspection note number



WEST ELEVATION

**DELAWARE
DEPARTMENT OF TRANSPORTATION**

INTERSTATE 95 OVER CHRISTINA RIVER
BRIDGE NO. 1-744-059

BASE YEAR SOUNDING PLAN

DRAWN BY: KPC
CHECKED BY: TBW
JOB NO.: 6428



10201 Lee Highway
Suite B
Fairfax, VA 22030
www.collinsengr.com

DATE: 4/21/10
SCALE: N.T.S.
FIGURE NO.: 8

APPENDIX D – ELEMENT RATINGS



Bridge No. 1-744-059
Interstate 95 over Christina River

ELEMENT DATA SUMMARY

ELEM	DESCRIPTION	UNIT	TOTAL	CS1	CS2	CS3	CS4	COMMENTS
210	RC Pier Wall	LF	234	0	158	76	0	See Span Details
1090	Exposed Rebar	lf	8	0	0	8	0	See Span Details
1190	Abrasion/Wear	Lf	226	0	158	68	0	See Span Details

NOTES:

1. The elements and quantities above only reflect the limits of the element from the high water mark to the mudline.



Bridge No. 1-744-059
Interstate 95 over Christina River

SPAN 1 –ELEMENT DATA

ELEM	DESCRIPTION	UNITS	TOTAL	CS1	CS2	CS3	CS4	COMMENTS
210	RC Pier Wall	LF	39	0	39	0	0	Abrasion CS2: (39 LF) The pier typically exhibits up to 1/2-inch deep scaling from them mean high water mark to the channel bottom.
1190	Abrasion/Wear	lf	39	0	39	0	0	

Bridge No. 1-744-059
Interstate 95 over Christina River

SPAN 2 –ELEMENT DATA

ELEM	DESCRIPTION	UNITS	TOTAL	CS1	CS2	CS3	CS4	COMMENTS
210	RC Pier Wall	LF	39	0	24	15	0	<p>Abrasion CS3: (13 LF) The east face of the West Stem exhibits a 2' H x full-width x 1 1/2" D area of scaling with exposed corroded steel reinforcement (3 horizontal steel bars), 1-foot above the mudline that extends 3-feet onto the north face. The East Stem exhibits 2' H x up to 1 1/2-inch deep scaling/poorly consolidated concrete at the mudline on all faces.</p> <p>CS2: (24 LF) The stems exhibit scaling 2'-6" H x up to 1-inch deep throughout the tidal zone. The top of the footing is exposed along the north and south faces of the Center Stem.</p> <p>Exposed Rebar CS3: (2 LF) The west face of the West Stem exhibits a 6' H x full-width (3'-6") x 3" D area of scaling with exposed corroded steel reinforcement (7 vertical and 3 horizontal steel bars) with 20% section loss on the vertical bars and up to 60% section loss on the horizontal bars, starting 2 1/2-feet above the mudline. The west face of the East Stem exhibits scaling up to 4' H x full-width x up to 2 1/2" D with exposed corroded steel reinforcement (11 vertical and 2 horizontal steel bars) with up to 30% section loss, 6-feet above the mudline the extends 6-inches on both the north and south faces.</p>
1090	Exposed Rebar	lf	2	0	0	2	0	
1190	Abrasion/Wear	lf	37	0	24	13	0	

Bridge No. 1-744-059
Interstate 95 over Christina River

SPAN 3 –ELEMENT DATA

ELEM	DESCRIPTION	UNITS	TOTAL	CS1	CS2	CS3	CS4	COMMENTS
210	RC Pier Wall	LF	39	0	0	39	0	<p>Abrasion CS3: (37 LF) The stems exhibit a 2' H x 1 1/2" D area of scaling/poorly consolidated concrete at the mudline on all faces. There is a 14' H x up to 1/16" W vertical crack on the east face of the Center Stem that terminates 4 feet below the waterline.</p> <p>Exposed Rebar CS3: (2 LF) The west face of the West Stem exhibits a 6' H x full-width x 3" D area of scaling with exposed corroded steel reinforcement (6 vertical and 2 horizontal steel bars) with up to 20% section loss, starting at the mudline. The west face of the East Stem exhibits a 2'-6" H x full-width x 3" D area of scaling with exposed corroded steel reinforcement (2 vertical and 2 horizontal steel bars) with up to 25% section loss, at the waterline.</p>
1090	Exposed Rebar	lf	2	0	0	2	0	
1190	Abrasion/Wear	lf	37	0	0	37	0	

Bridge No. 1-744-059
Interstate 95 over Christina River

SPAN 4 –ELEMENT DATA

ELEM	DESCRIPTION	UNITS	TOTAL	CS1	CS2	CS3	CS4	COMMENTS
210	RC Pier Wall	LF	39	0	35	4	0	<p>Abrasion CS3: (4 LF) The west face of the West Stem exhibits 5' H x full-width x 4" D scaling with exposed corroded steel reinforcement (1 vertical and 1 horizontal steel bar), at the waterline that extends 1-foot on the north and south faces. The east face of the West Stem exhibits 1'-4" H x full-width x 4" D scaling with exposed corroded steel reinforcement (with 1 horizontal steel bar) at the waterline. The east face of the East Stem exhibits 1'-6" H x full-width x 4" D scaling with exposed corroded steel reinforcement (1 vertical and 2 horizontal steel bars), starting 3-feet above the mudline. The west face of the East Stem exhibits 3' H x full-width x 4" D scaling with exposed corroded steel reinforcement (5 vertical and 4 horizontal steel bars), starting 3-feet above the mudline.</p> <p>CS2: (35 LF) The stems exhibit scaling 2'-6" H x up to 1-inch deep throughout the tidal zone.</p>
1190	Abrasion/Wear	lf	39	0	35	4	0	

Bridge No. 1-744-059
Interstate 95 over Christina River

SPAN 5 –ELEMENT DATA

ELEM	DESCRIPTION	UNITS	TOTAL	CS1	CS2	CS3	CS4	COMMENTS
210	RC Pier Wall	LF	39	0	21	18	0	<p>Abrasion CS3: (14 LF) The West Stem exhibits 2 1/2' H x up to 2" D scaling along the south, east and north faces with an exposed horizontal steel bar and a vertical steel bar at the southeast chamfer, 3-feet above the mudline. The west face of the East Stem exhibits 3' H x full-width x 3" D scaling with exposed corroded steel reinforcement (3 vertical and 2 horizontal steel bars), 6-feet above the mudline that extends 5-feet long on the north face with one exposed horizontal steel bar.</p> <p>CS2: (21 LF) The stems exhibit scaling 2'-6" H x up to 1-inch deep throughout the tidal zone</p> <p>Exposed Rebar CS3: (4 LF) The west face of the West Stem exhibits 3' H x full-width x 4" D scaling with exposed corroded steel reinforcement (4 horizontal and 8 vertical steel bars) with up to 90% section loss, 4-feet from the mudline that extends 4-feet long onto the north face (Photos 4 and 5).</p>
1090	Exposed Rebar	lf	4	0	0	4	0	
1190	Abrasion/Wear	lf	35	0	21	14	0	



Bridge No. 1-744-059
Interstate 95 over Christina River

SPAN 6 –ELEMENT DATA

ELEM	DESCRIPTION	UNITS	TOTAL	CS1	CS2	CS3	CS4	COMMENTS
210	RC Pier Wall	LF	39	0	39	0	0	Abrasion CS2: (39 LF) The pier typically exhibits up to 1/2-inch deep scaling from the mean high water mark to the channel bottom.
1190	Abrasion/Wear	lf	39	0	39	0	0	