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March 4, 2008

Mr. Evan Lowell, PE
Senior Project Manager
TranSystems | Lichtenstein
11 Huron Drive
Natick, MA 01760-1314

Re: Underwater Inspection of Deer Isle-Sedgwick Bridge
Deer Isle, Maine
Letter Report
Appledore Project No. 5059

Dear Mr. Lowell:

A facility assessment team from Appledore Marine Engineering, Inc. (AMEI) performed an underwater inspection of Piers 4 and 5 of the Deer Isle-Sedgwick Bridge in Deer Isle, Maine on January 21 and 22, 2008. The scope of work included a visual inspection of the two piers from mean low water to the mudline in order to provide an overall assessment of the structures and determine appropriate locations for concrete core extractions. The following report documents our findings, assessments, and recommendations for the pier substructures. We have provided a magnitude cost estimate for repairs based on our general observations.

It was a pleasure working with you on this project and we look forward to working with you again in the future. Should you have any questions or comments concerning the contents of this report, please do not hesitate to contact me.

Regards,

Craig R. Morin, PE
Project Engineer

Lawrence J. Wagner, PE
Principal, NHI UBI #130091

File: (Deer Isle Bridge - Letter Report.doc)

Devin Anderson

SUMMARY

The underwater portions of the substructure units inspected (Piers 4 and 5) were found to be in Fair condition. The concrete in the pylon bases was found to contain voids up to 12 inches deep. The concrete in these locations was soft, contained cracks, and likely has reduced strength. The concrete in the pylons was found to be generally semi-hard and could not be easily broken with a chipping hammer. No concrete was exposed in the footing. No evidence of scour was observed.

INTRODUCTION

In January 2008, Appledore Marine Engineering, Inc. (Appledore) completed an underwater inspection of Piers 4 and 5 at the Deer Isle - Sedgwick Bridge in Deer Isle, Maine. The inspection was performed by a four-man dive team under the direction of a Professional Engineer, and included a visual inspection of the piers from mean low water to the mudline.

Previous underwater dive inspection reports were provided dated between January 2003 and October 1988. Previous reports indicated steel and concrete deterioration of the pier shafts just below the mean low water line.

OBJECTIVE

The objective of this project is to provide a general description and assessment of the underwater condition of Piers 4 and 5 and recommend locations for concrete coring to be performed.

FACILITY DESCRIPTION

The Deer Isle - Sedgwick Bridge was constructed in 1939 over the Eggemoggin Reach. The bridge is 2,505 ft long with two main piers, Piers 4 and 5, as shown in Figure 1. Each of the main piers consists of three sections: a concrete footing within steel sheet piling; a concrete pylon base encased by a metal sheeting, and concrete circular pylons, encased by a metal sheeting, which extend above the water line and support the bridge superstructure. Water depths at Piers 4 and 5 are approximately 55 ft and 65 ft, respectively. Photos 1, 2, and 3 show overall views of the bridge and the main piers.

OBSERVATIONS

Areas of deterioration found during this inspection are illustrated in Figures 2 and 3. Light marine growth and algae was present throughout the underwater portions of each structural element but could be easily removed by hand. Some portions of the pylons contained light barnacles in the tidal zone.

Footings

No observed defects were found on the concrete footings and steel sheet piling. No evidence of scour was observed at the base of the footing. The channel bottom consisted of hard gravel and cobbles.

Pylon Bases

The concrete pylon bases contain areas of moderate deterioration where the metal sheeting has corroded and the concrete is exposed. At these areas, the concrete is soft with exposed aggregate and could be pulverized with a hammer (Photos 4 and 5). At some locations, holes in the metal sheeting resulted in voids in the concrete up to 12 inches deep, or cracks up to 1/2-inch wide as shown in Photos 4 and 5. Several voids were observed in the pylon bases of both piers.

Pylons

The concrete pylons contain areas of minor deterioration where the metal sheeting is deteriorated and the concrete is exposed. At these areas, the concrete is semi-hard but could not be easily broken up with a hammer. At each of the four pylons there is a band of exposed concrete around the circumference of the pylons between El. -2.0 and -5.0 (Photos 6 and 7). This deterioration occurs between the mean low water line and the base of the pylons.

Above the mean low water line and throughout the tidal zone, the metal sheeting is thin and could be punctured with a hammer (Photo 8). The concrete is semi-hard in this area but could not be easily broken up with a hammer.

ASSESSMENTS

Based on our underwater inspection of Piers 4 and 5, the underwater condition of these structures is Fair due to the condition of the concrete in the pylon bases. While the metal sheeting is not considered a structural element of the piers, it has provided protection to the concrete and has preserved the concrete's strength. Exposed areas of concrete in the pylon bases that could be pulverized with a hammer likely have reduced strengths below their initial design values.

RECOMMENDATIONS

It is recommended that:

A. Concrete cores be extracted from the pylons and pylon bases in order to obtain specimens for determining the compressive strength of the concrete. One core should be extracted from the footing in order to determine the general concrete strength at this location. Figure 4 illustrates a concrete coring plan.

B. It is recommended that the voids in the pylon bases be repaired. The cost associated with this repair is shown in Table 1.

TABLE 1

Item No.	Recommended Repairs	Estimated Construction Cost (ECC)
1	Repair voids in pylon bases	$ 200,000
	Subtotal	**$ 200,000**
	Engineering fees: Inspections, Design, Permitting, and Construction Admin.	$ 50,000
	TOTAL * say	**$ 250,000**

C. If the results of concrete coring and compression testing determine that the strength of the concrete pylons is reduced, then it is also recommended that structural repairs be implemented to the four pylons at a cost shown in Table 2.

TABLE 2

Item No.	Recommended Repairs	Estimated Construction Cost (ECC)
1	Repair voids in pylon bases	$ 200,000
2	Implement structural repairs to pylons (4 total)	$ 1,000,000
	Subtotal	**$ 1,200,000**
	Engineering fees: Inspections, Design, Permitting, and Constr. Admin.	$ 200,000
	TOTAL * say	**$ 1,400,000**

* Notes:

1. Costs are in 2008 dollars and include: Contingency, Mobilization, and Contractor Overhead and Profit.
2. Recommended Repair items only include those elements inspected during this underwater inspection, and therefore do not include repairs for superstructure or utilities.

D. The submerged portions of the structure should be reinspected in five years.

PHOTOGRAPHS

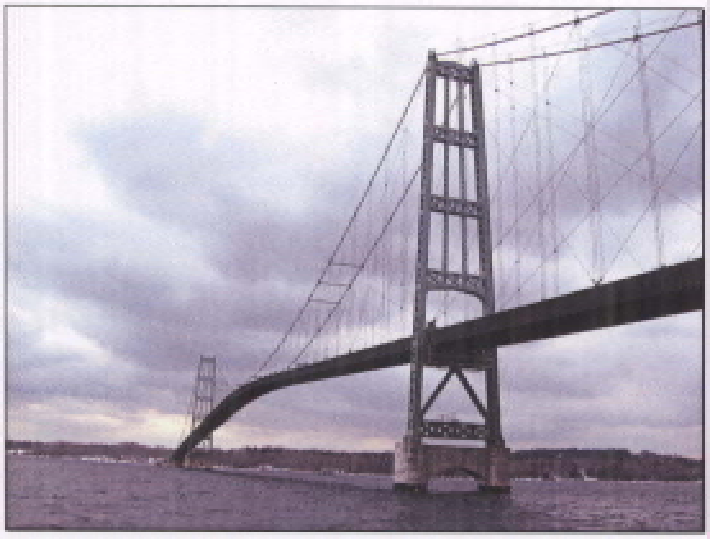


Photo 1:
Overall view of Deer Isle - Sedgwick Bridge.

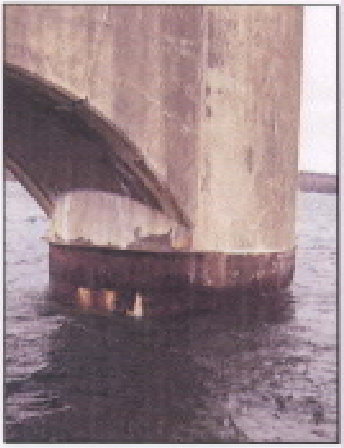


Photo 2:
Pylons of Pier 5.

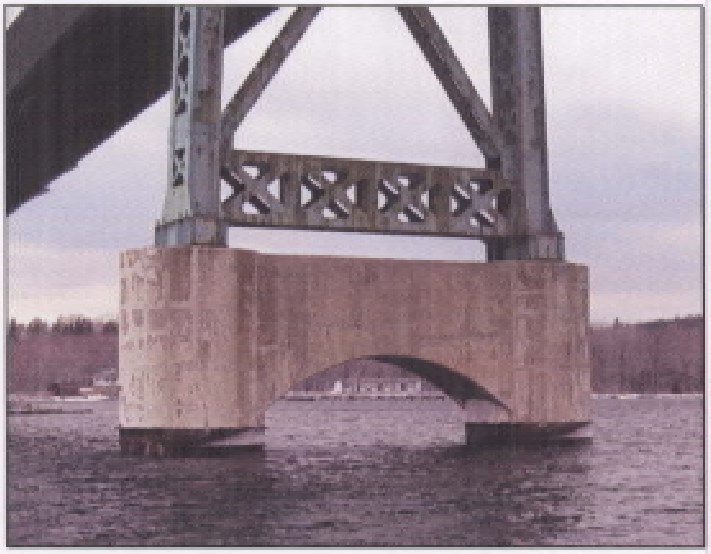


Photo 3:
Overall view of Pier 4.

Photo 4:

Void in the eastern face of the pylon base at the northeast corner of Pier 5. Void is 2' wide by 1' high by 12" deep. Note the void extends through the soft concrete and continues to the northern face.

Photo 5:

Horizontal crack in the soft concrete on the southern side of the pylon base at Pier 4.

Photo 6:

Typical underwater condition of the exposed concrete at the pylons between EL. -2.0 and EL. -5.0. Note white areas where semi-hard concrete was sounded with a chipping hammer.

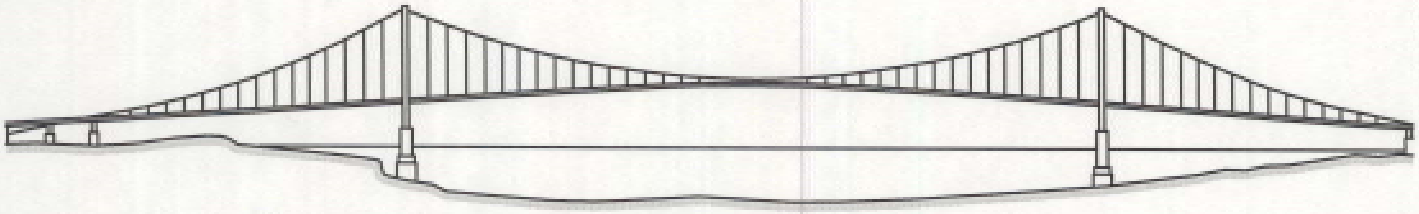
Photo 7:

Typical underwater condition of the exposed concrete at the pylons between EL. -2.0 and EL. -5.0 (MLLW). Note exposed concrete aggregate.

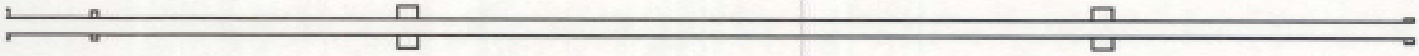
Photo 8:

Typical underwater condition of the metal sheeting covering the pylons. Note the thinness of the sheeting material. The concrete is semi-hard at these exposed areas within the tidal zone. Note hammer markings in the concrete.

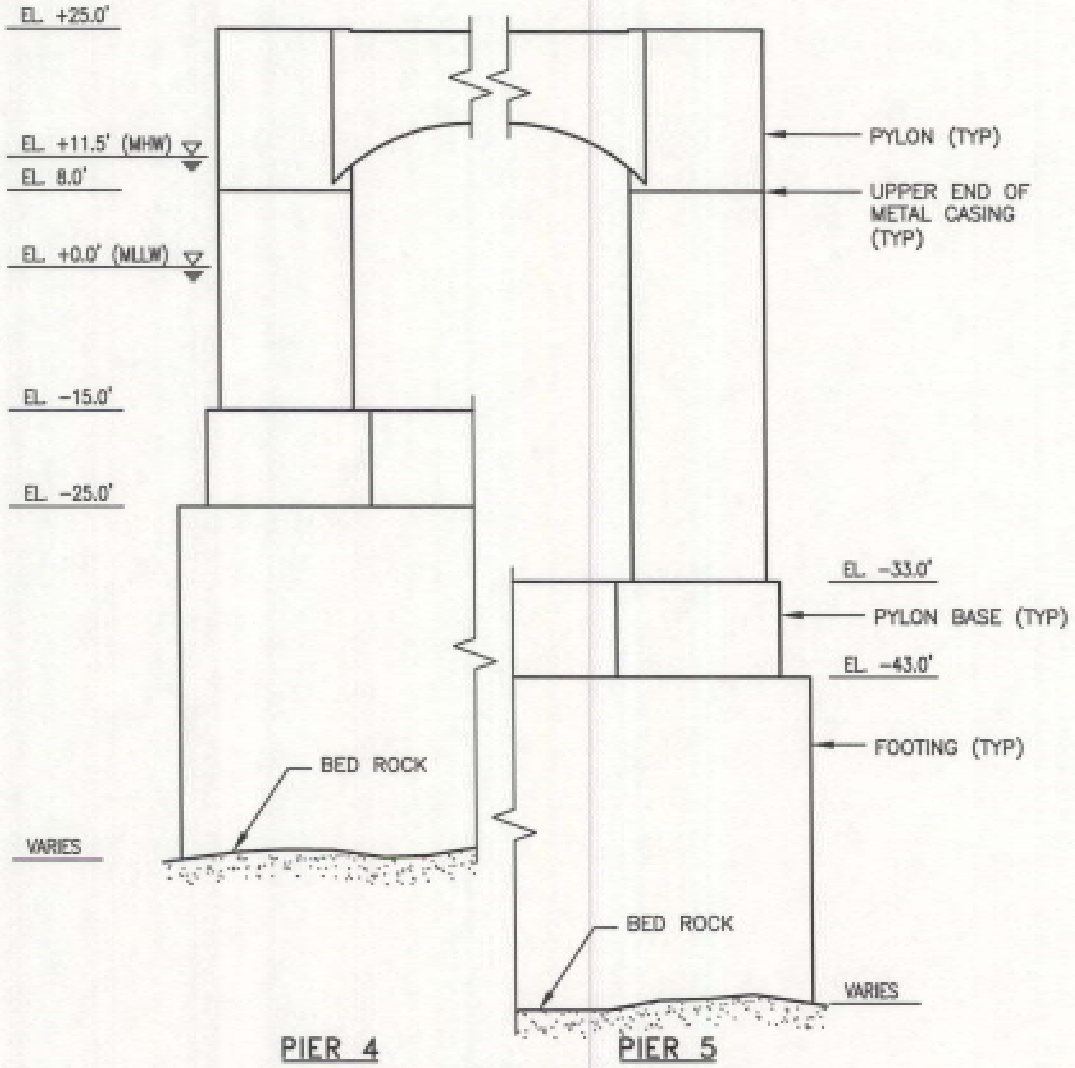
FIGURES



ELEVATION
SCALE: 1" = 300'-0"



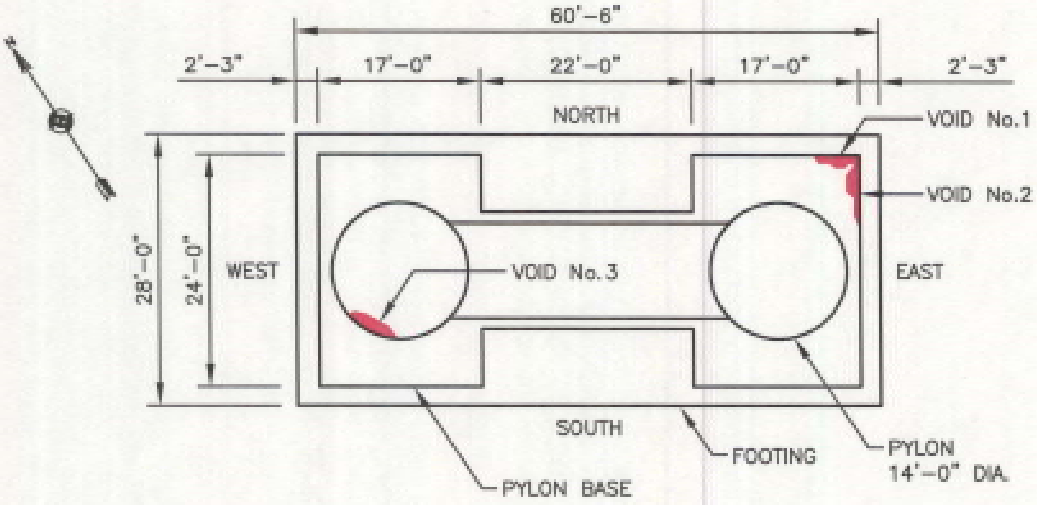
PLAN
SCALE: 1" = 300'-0"



PIER 4 PIER 5

PIER ELEVATION
SCALE: 1" = 20'-0"

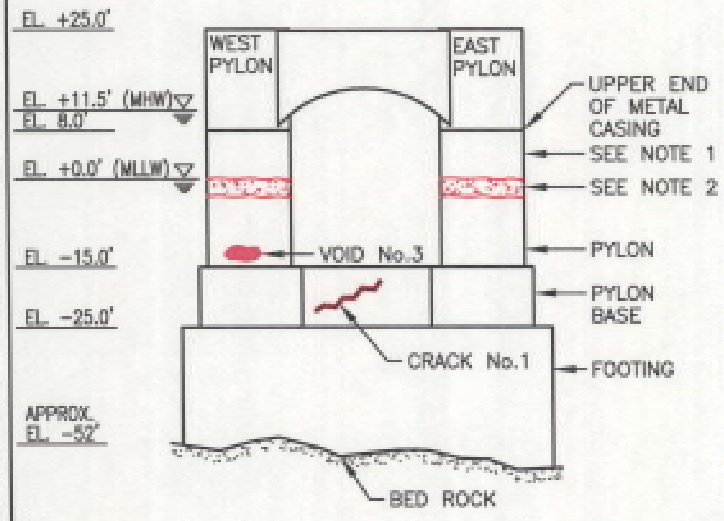
GRAPHIC SCALE AS NOTED	DATE MARCH 2008	APPLEDORE MARINE ENGINEERING, INC. PORTSMOUTH, N.H.	TranSystems TranSystems|Lichtenstein 11 Huron Drive Natick, MA 01760-1314	
			DEER ISLE - SEDGWICK BRIDGE DEER ISLE, ME GENERAL PLAN AND ELEVATION	FIG. NO. 1



PLAN

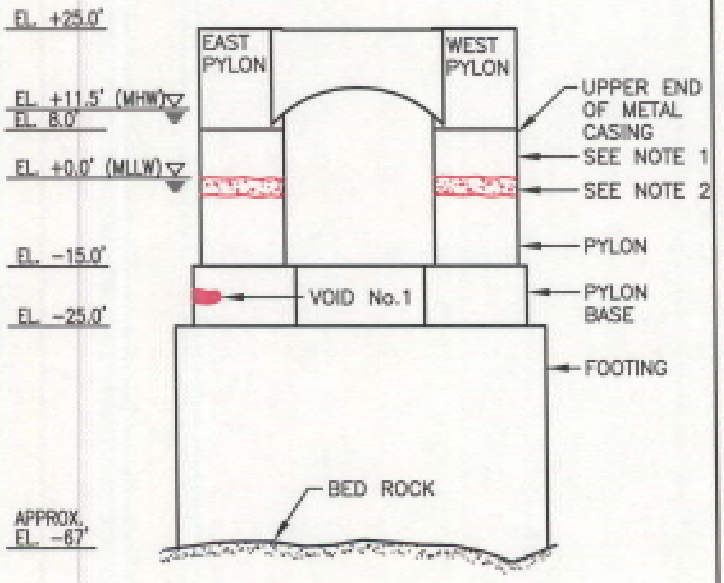
SCALE: 1" = 20'-0"

OBSERVED DETERIORATION	
VOID No.1	4'W x 2'H x 1'D
VOID No.2	4'W x 2'H x 1'D
VOID No.3	2'W x 1'H x 3"D
CRACK No.1	6"L x 1/2"H



PIER 4 SOUTH ELEVATION

SCALE: 1/32" = 1'-0"



PIER 4 NORTH ELEVATION

SCALE: 1/32" = 1'-0"

NOTES:
1. CORROSION OF METAL CASING IN TIDAL ZONE
2. SEMI-HARD AREA OF EXPOSED CONCRETE

GRAPHIC SCALE AS NOTED	DATE MARCH 2008	APPLEDORE MARINE ENGINEERING, INC. PORTSMOUTH, N.H.	TranSystems TranSystems|Lichtenstein 11 Huron Drive Natick, MA 01760-1314	DEER ISLE – SEDGWICK BRIDGE DEER ISLE, ME PIER 4 OBSERVATIONS FIG. NO. 2

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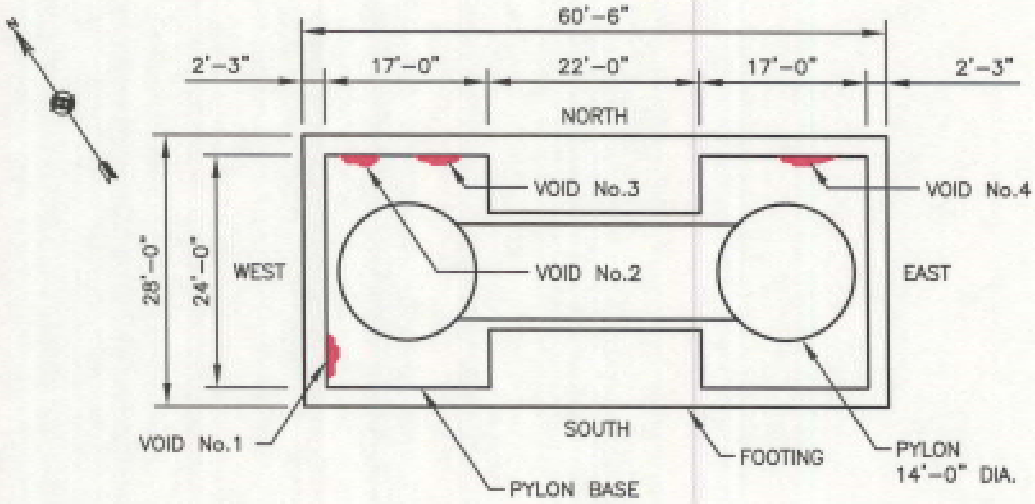
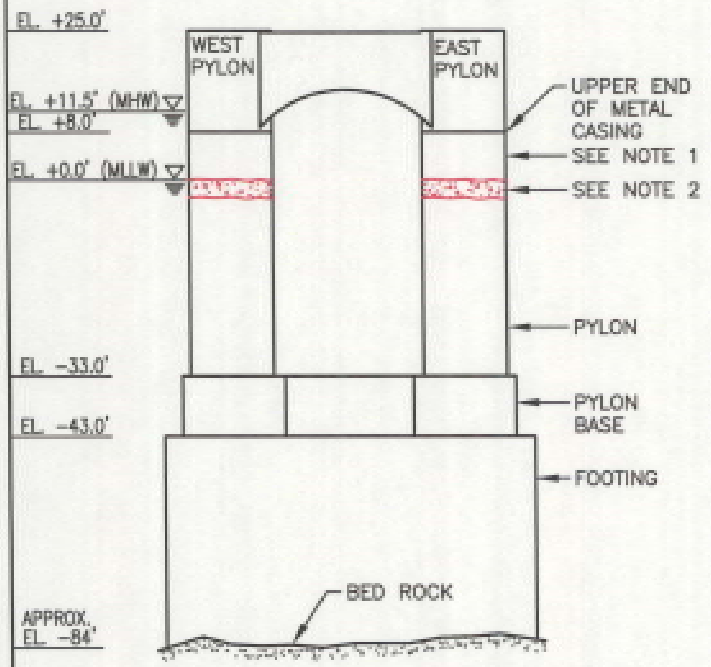
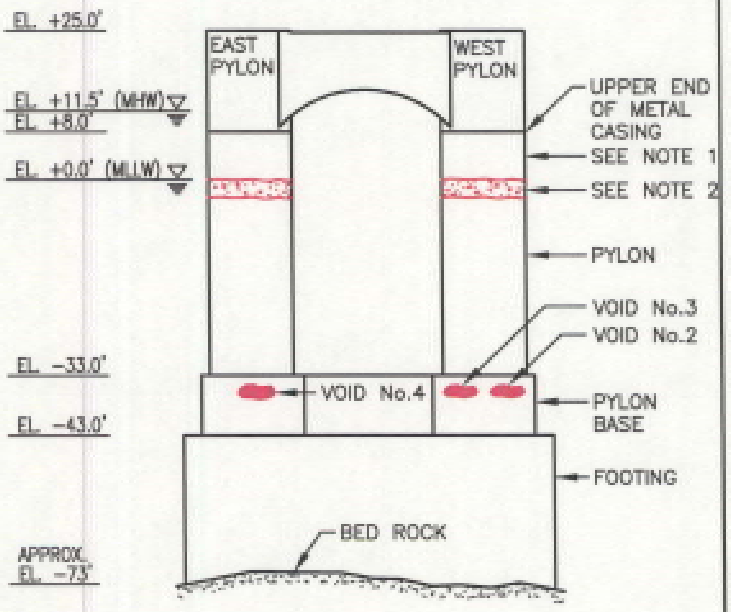


PLAN
SCALE: 1" = 20'-0"

OBSERVED DETERIORATION	
VOID No.1	2'W x 2'H x 8"D
VOID No.2	4'W x 2'H x 4"D
VOID No.3	2'W x 1'H x 4"D
VOID No.4	3'W x 3'H x 4"D



PIER 5 SOUTH ELEVATION
SCALE: 1/32" = 1'-0"



PIER 5 NORTH ELEVATION
SCALE: 1/32" = 1'-0"

NOTES:
1. CORROSION OF METAL CASING IN TIDAL ZONE
2. SEMI-HARD AREA OF EXPOSED CONCRETE

GRAPHIC SCALE AS NOTED	DATE MARCH 2008	APPLEDORE MARINE ENGINEERING, INC. PORTSMOUTH, N.H.	TranSystems TranSystems|Lichtenstein 11 Huron Drive Natick, MA 01760-1314	DEER ISLE – SEDGWICK BRIDGE DEER ISLE, ME PIER 5 OBSERVATIONS FIG. NO. 3

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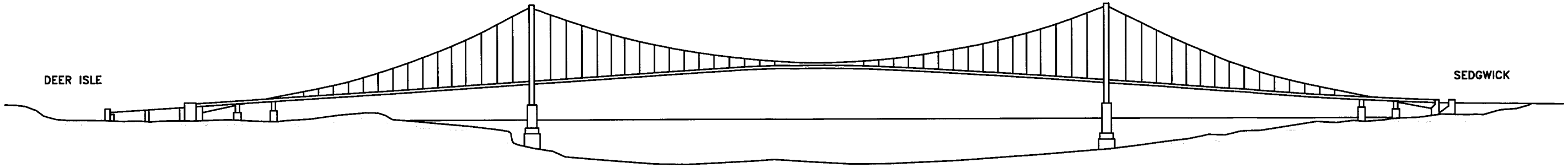
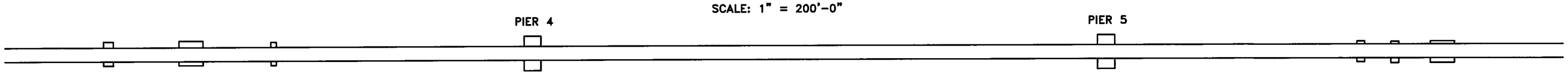
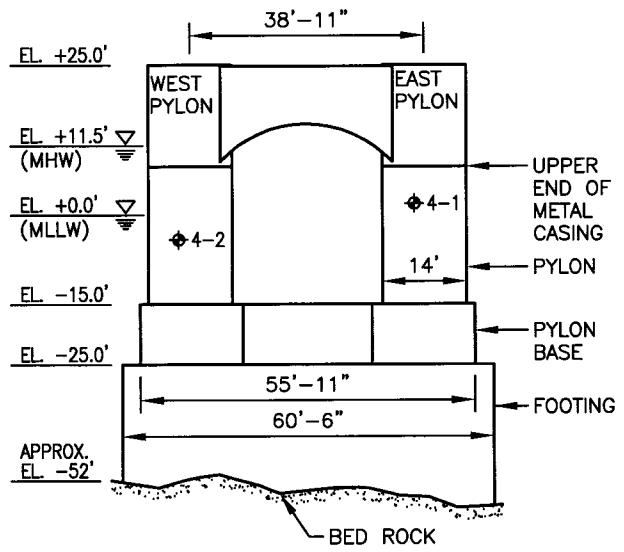


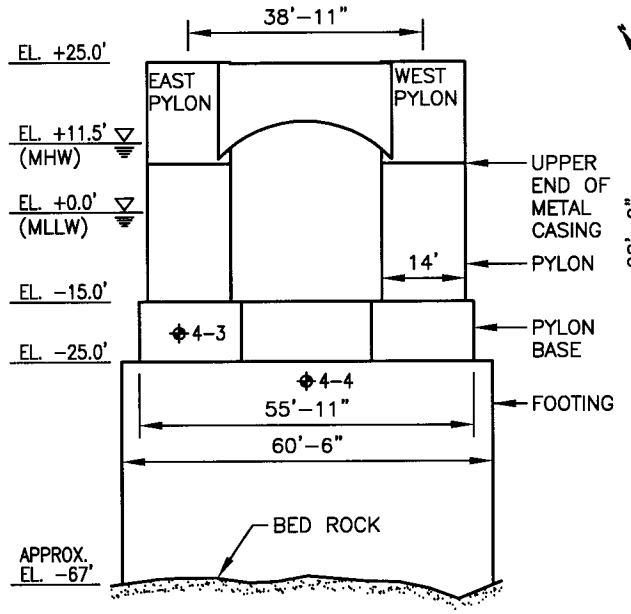
ELEVATION
SCALE: 1" = 200'-0"



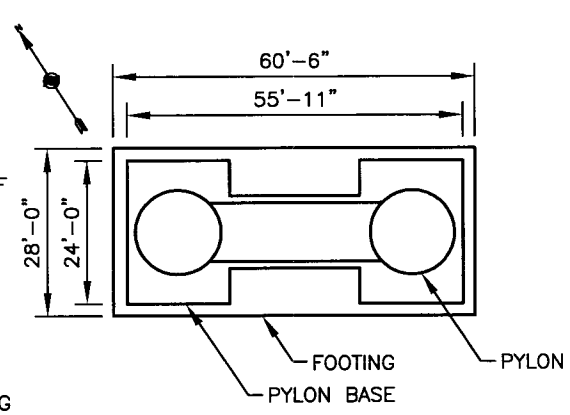
PLAN
SCALE: 1" = 200'-0"



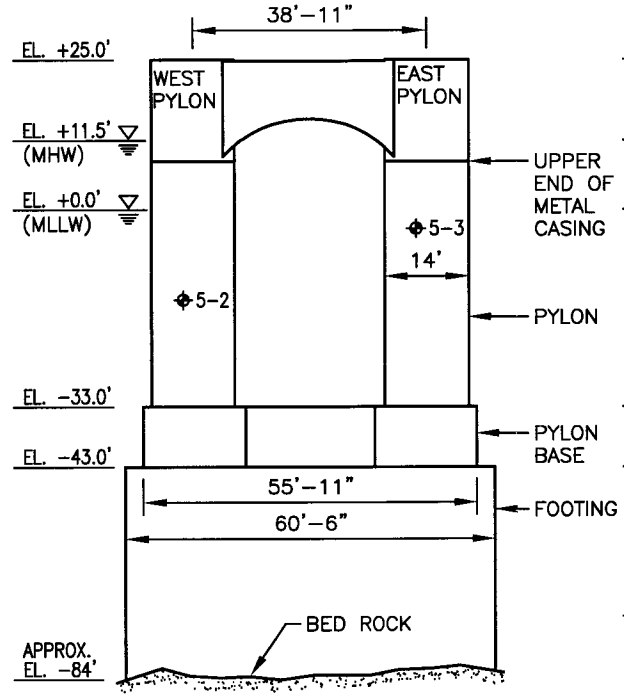
PIER 4 SOUTH ELEVATION
SCALE: 1/32" = 1'-0"



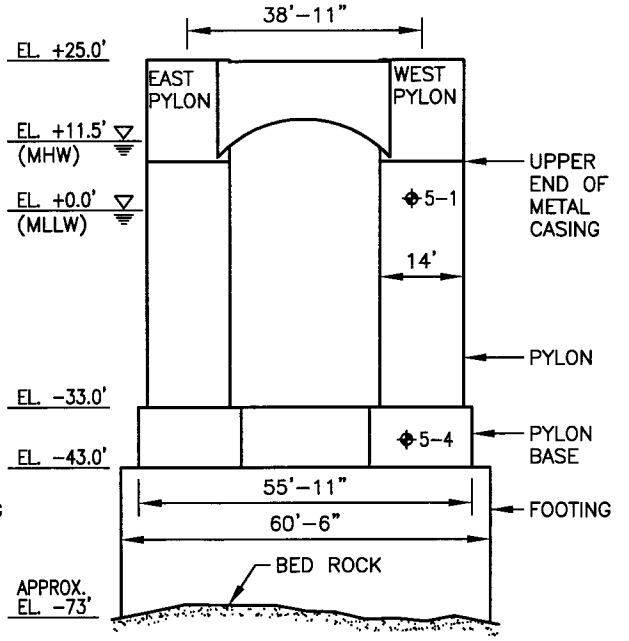
PIER 4 NORTH ELEVATION
SCALE: 1/32" = 1'-0"



TYPICAL PIER PLAN
SCALE: 1/32" = 1'-0"



PIER 5 SOUTH ELEVATION
SCALE: 1/32" = 1'-0"



PIER 5 NORTH ELEVATION
SCALE: 1/32" = 1'-0"

NOTES:
1. CONCRETE CORES SHALL BE 3" DIA. BY 12" LONG.
2. LABEL ALL CORES AND PLACE IN SEPARATE CONTAINERS.
3. ONCE CORES ARE OBTAINED, FILL THE CORED HOLES WITH A NON-STRUCTURAL EPOXY GROUT.

CONCRETE CORE SCHEDULE

CORE I.D.	PIER	ELEMENT	EL. (MLLW)
⌖ 4-1	4	EAST PYLON	+2.0'
⌖ 4-2	4	WEST PYLON	-4.0'
⌖ 4-3	4	EAST PYLON BASE	-20.0'
⌖ 4-4	4	FOOTING	-28.0'
⌖ 5-1	5	WEST PYLON	+2.0'
⌖ 5-2	5	WEST PYLON	-15.0'
⌖ 5-3	5	EAST PYLON	-4.0'
⌖ 5-4	5	WEST PYLON BASE	-38.0'

GRAPHIC SCALE

AS NOTED

DATE
MARCH 2008

APPLEDORE MARINE ENGINEERING, INC.
PORTSMOUTH, N.H.

TranSystems
TranSystems|Lichtenstein
11 Huron Drive
Natick, MA 01760-1314

DEER ISLE - SEDGWICK BRIDGE

CORING PLAN

FIG. NO. 4

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CONDITION RATING DESCRIPTIONS

CONDITION RATING DESCRIPTIONS

Rating	Description
Good	No visible damage, or only minor damage is noted. Structural elements may show very minor deterioration, but no overstressing is observed. No repairs are required.
Satisfactory	Limited minor to moderate defects or deterioration are observed, but no overstressing is observed. No repairs are required.
Fair	All primary structural elements are sound, but minor to moderate defects or deterioration is observed. Localized areas of moderate to advanced deterioration may be present but do not significantly reduce the load-bearing capacity of the structure. Repairs are recommended, but the priority of the recommended repairs is low.
Poor	Advanced deterioration or overstressing is observed on widespread portions of the structure, but does not significantly reduce the load-bearing capacity of the structure. Repairs may need to be carried out with moderate urgency.
Serious	Advanced deterioration, overstressing, or breakage may have significantly affected the load-bearing capacity of primary structural components. Local failures are possible and loading restrictions may be necessary. Repairs may need to be carried out on a high-priority basis with urgency.
Critical	Very advanced deterioration, overstressing, or breakage has resulted in localized failure(s) of primary structural components. More widespread failures are possible or likely to occur, and load restrictions should be implemented as necessary. Repairs may need to be carried out on a very high priority basis with strong urgency.

From: *Underwater Investigations, Standard Practice Manual*, ASCE, 2001.