Structural Assessment Memo

Main Street Pier
Existing Concrete Slab and Foundations
Daytona Beach, Florida

Prepared for:

City of Daytona Beach

August 2019

Prepared by:

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Structural Assessment Memorandum
City of Daytona Beach Main Street Pier

1. Purpose

The purpose of this Structural Assessment Memo is to describe and evaluate the general condition assessments of observed, accessible, and unconcealed existing structural systems of the City of Daytona Beach Main Street Pier. A site investigation was performed by GRAEF team members on July 16, 2019 to visually observe accessible and unconcealed existing structural deficiencies for imminent life safety issues.

2. Existing Conditions

The structural assessment of the pier for this report only consists of the following pier elements:

- Former space needle cradle/bowl concrete support and adjacent concrete beams (wings).
- Former chairlift concrete pier support between Bents 3 and 4.
- Concrete U-beam (vault) and slab between Bents 3 and 4.
- Concrete beams and slab between Bents 2 through 4.
- Steel channel beams with transverse steel channels/plates at end for connection of timber bent cap to concrete beam between Bents 2 through 4.
- Steel angle ledger supporting concrete slab at former chairlift concrete pier support between Bents 3 and 4.
- Former chairlift concrete pier support between Bents 14 and 15.

Due to the proximity to the corrosive environment of the Pier and constant saltwater spray, all of the concrete structural elements exhibit minor to severe deterioration that ranges from minor efflorescence and bleeding of the corroding reinforcing steel to major spalling of concrete and loss of original reinforcing capacity, and all of the steel structural elements exhibit minor to severe corrosion that ranges from minor pitting of the steel angle ledger to heavy scaling and section loss of the steel channel beams. A visual and sounding condition survey was performed to identify cracks, spalls, delaminations, and corrosion at the structural elements. A full strength capacity assessment was not performed due to the limited availability of as-built drawings. The Pier elements observed were found to have the following:

- Former space needle cradle/bowl concrete support and adjacent concrete beams (wings) – No deficiencies of the bowl and cylindrical concrete wall were noted (see Photo 1). The adjacent concrete beams (wings) have major corrosion and the loss reinforcing at the bottom of beams (full length) along with concrete spalling (see Photo 2).
- Former chairlift concrete pier support between Bents 3 and 4 – Some minor cracks are present on the south face as well as delaminations on the bottom (see Photo 3).
- Concrete U-beam (vault) and slab between Bents 3 and 4 – Several cracks, delaminations, and spalling occur at both the north and south faces as well as the bottom (see Photo 4).
- Concrete beams and slab between Bents 2 through 4 – Several cracks, delaminations, and spalling occur at both the slab and beams (see Photo 5).
- Steel channel beams with transverse steel channels/plates at end for connection of timber bent cap to concrete beam between Bents 2 through 4 – Steel members exhibit major corrosion and section loss. The connection of one of the channels to a concrete beam was also compromised (see Photo 6).
- Steel angle ledger supporting concrete slab at former chairlift concrete pier support between Bents 3 and 4 – Steel members exhibit minor corrosion and section loss at most places with the exception of the interior of the existing U-shaped concrete beam where heavy corrosion was noted (see Photo 7).
- Former chairlift concrete pier support between Bents 14 and 15 – Several cracks and delaminations were found on the three faces of the pier cap and pier above. Severe deterioration of the bottom of the cap was noted with the exposed bottom layer of reinforcing exposed and a large delamination on the north side of the bottom (see Photos 8 and 9).

Although we were not observing the condition of the existing timber elements, one additional deficiency that was noted was that a shim was missing between the top of an existing timber pile and the bottom of the existing timber bent cap at south end of Bent 4 (see Photo 10). The structural deficiencies are further identified in the exhibits at the end of this report

3. Recommendations

For the scope of the project, both short-term and long-term recommendations have been provided to address the deficiencies of the Pier structural elements. It is recommended that the short-term recommendations be implemented for a duration of 12 months or less. After 12 months, it is recommended that the long-term recommendations be implemented.

Short-Term Recommendations:

- Remove all delaminated concrete.
- Blast clean all former delaminated surfaces and existing spalled surfaces and coat with a corrosion inhibitor such as Sika FerroGard 903 or equal.
- Inject all cracks that are greater than 0.01 inches in width with an epoxy such as Sikadur - 35 Hi-Mod LV or equal.
- Repair the connection between the steel channel beam with transverse steel plate at end and the 8"x18" concrete beam where an existing anchor is exposed. This will require shoring of the existing 8"x18" concrete beam and the adjacent 8"x48" concrete beam, concrete repair of the concrete beam end, and reinstallation of the anchors. The following procedures should be followed:
    - Install temporary shoring.
    - Remove existing through bolts in existing steel plate.
    - Remove section of deteriorated existing concrete beam to sound material by chipping with light duty pneumatic or electric concrete chipper. Blast clean existing concrete surfaces that will be in contact with freshly placed repair material and clean to remove loose material and dust immediately prior to application of repair material. Provide ¾" clearance around all existing reinforcing steel when exposed.
    - Coat the prepared concrete surface with an epoxy bonding agent such as MasterEmaco P 124 or equal and apply in accordance with the manufacturer's recommendations. Form and fill prepared area with high-strength, non-metallic, non-shrink grout such as MasterEmaco S 440 Cl or equal, and mix and apply in accordance with the manufacturer's recommendations. Firmly consolidate the grout mix in the area to be repaired. Restore surfaces and edges to the original dimension and shape of the repaired item.
    - Reinstall existing through bolts through existing steel plate and repaired concrete beam.
    - Remove temporary shoring.
- Install timber shim where missing between the top of an existing timber pile and the bottom of the existing timber bent cap at south end of Bent 4.

It is noted that the corrosion inhibitor repairs identified for all former delaminated surfaces and existing spalled surfaces will likely be unsightly as exposed reinforcing bars will remain visible. If the aesthetics of the recommended short-term repairs is a concern, in lieu of blast cleaning concrete surfaces and coating with a corrosion inhibitor, a concrete patch repair could be performed at all delaminations and spalls that would include removing deteriorated concrete to a depth behind the existing steel reinforcing bar, blast cleaning, dowel installation (if necessary), steel rebar replacement (if necessary), coating the surface with an epoxy bonding agent, and restoring with a non-metallic, non-shrink grout mix.

Long-Term Recommendations:

- Remove existing concrete beams (wings) adjacent to the former space needle cradle/bowl concrete support. Replace with timber framing.
- Repair former chairlift concrete pier support between Bents 3 and 4 with epoxy crack injection and concrete patch repair.
- Remove existing concrete U-beam (vault) and slab between Bents 3 and 4. Replace with galvanized steel beam connected to former chairlift concrete pier support and former space needle cradle/bowl concrete support. This new beam will support new timber framing and decking.
- Remove existing concrete beams and slab between Bents 2 through 4. Replace with timber framing and decking.
- Remove existing steel channel beam with transverse steel plate at end for connection of timber bent cap to concrete beam between Bents 2 through 4.
- Remove steel angle ledger supporting concrete slab at former chairlift concrete pier support between Bents 3 and 4.
- Repair former chairlift concrete pier support between Bents 14 and 15 with epoxy crack injection and concrete patch repair.
- Install timber shim where missing between the top of an existing timber pile and the bottom of the existing timber bent cap at south end of Bent 4.

Coordination with the Florida Fish and Wildlife Conservation Commission will be necessary to address any sea turtle impacts to the project's construction and maintained throughout the duration of the project.

Photo 1
Former Space Needle Cradle/Bowl Concrete Support, Looking Northwest
No Deficiencies Were Noted at the Cylindrical Concrete Support

Photo 2
Existing 8”x48” Concrete Beam (Wing), Looking South
Note Missing Steel Reinforcing Bar

Photo 3
Former Chairlift Concrete Pier Support Between Bents 3 and 4, Looking Up and North
Note Delaminated Area Identified with "H" on Bottom

Photo 4
Existing Concrete U-Beam (Vault), Looking West
Note Spalled and Delaminated Areas with Exposed Steel Reinforcing Bars

Photo 5
Existing 8”x18” Concrete Beam and Slab, Looking Up and North
Note Spalled Areas with Exposed Steel Reinforcing Bars

Photo 6
Existing Steel Channel Beam with Transverse Steel Connection Plate at End, Looking Up and East
Note Corrosion as well as Exposed Steel Reinforcing Bars and Anchor at Concrete Beam

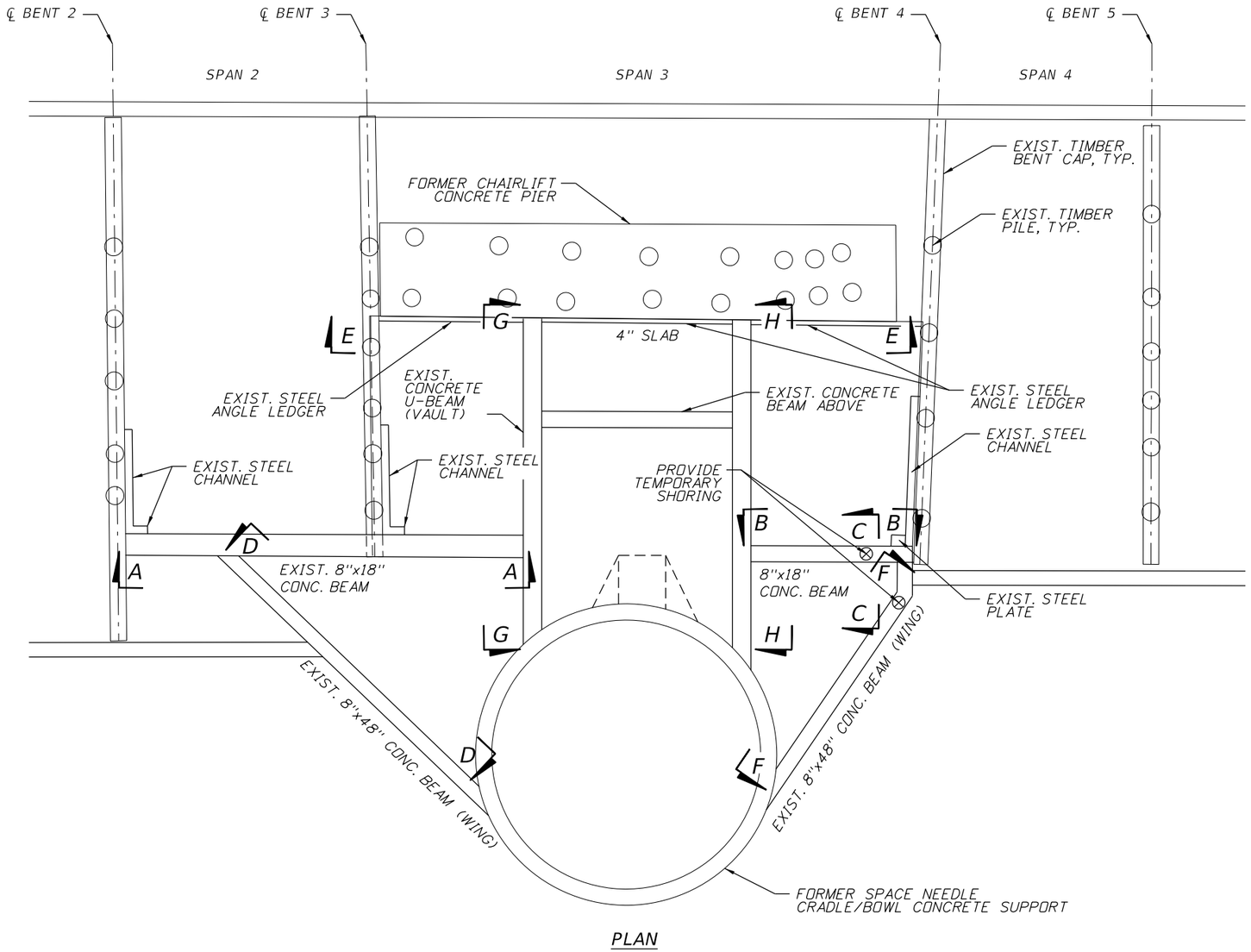
Photo 7
Existing Steel Angle Ledger, Looking Up and North
Note Severe Corrosion of Angle on Right Side

Photo 8
Former Chairlift Concrete Pier Support Between Bents 14 and 15, Looking Up and West
Note Spalled and Delaminated Areas with Exposed Steel Reinforcing Bars

Photo 9
Former Chairlift Concrete Pier Support Between Bents 14 and 15, Looking East
Note Cracking at the South End

Photo 10
Existing Timber Bent 4 South End, Looking Southeast
Note Missing Shim Between Existing Timber Pile and Cap

APPENDIX



PLAN

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

GRAEF
2300 Maitland Center Parkway
Suite 210
Maitland, FL 32751
407 / 659-6500
Certificate of Authorization #4270

EOR: Scott D. Hinrichs, PE #67810

DRAWN BY:	SRK
CHECKED BY:	VLG
DESIGNED BY:	VLG
CHECKED BY:	SDH

THE CITY OF DAYTONA BEACH

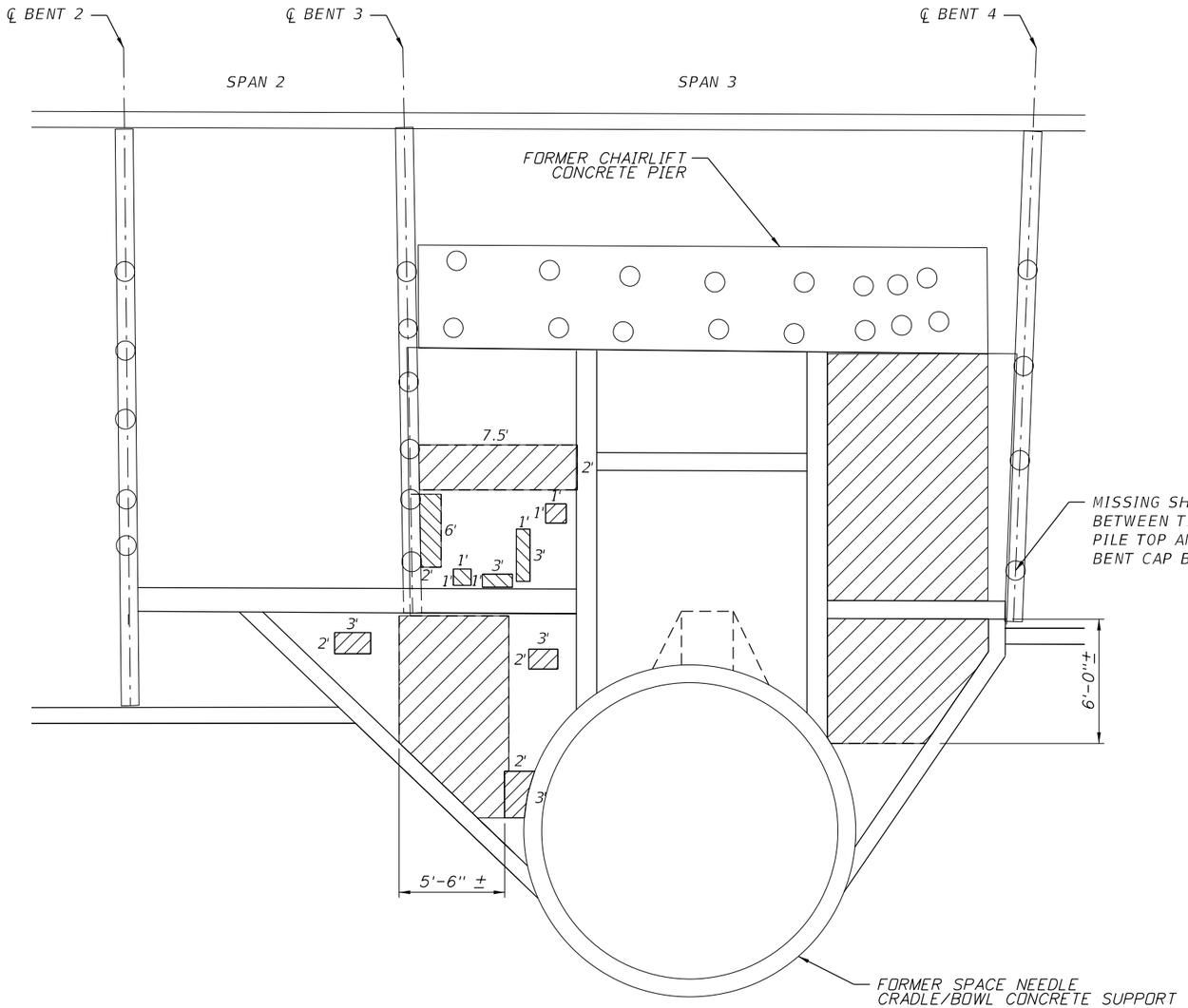
ROAD NO.	COUNTY	CDB PROJECT NUMBER
MAIN ST	VOLUSIA	

SHEET TITLE: PLAN - BENT 2 TO BENT 5

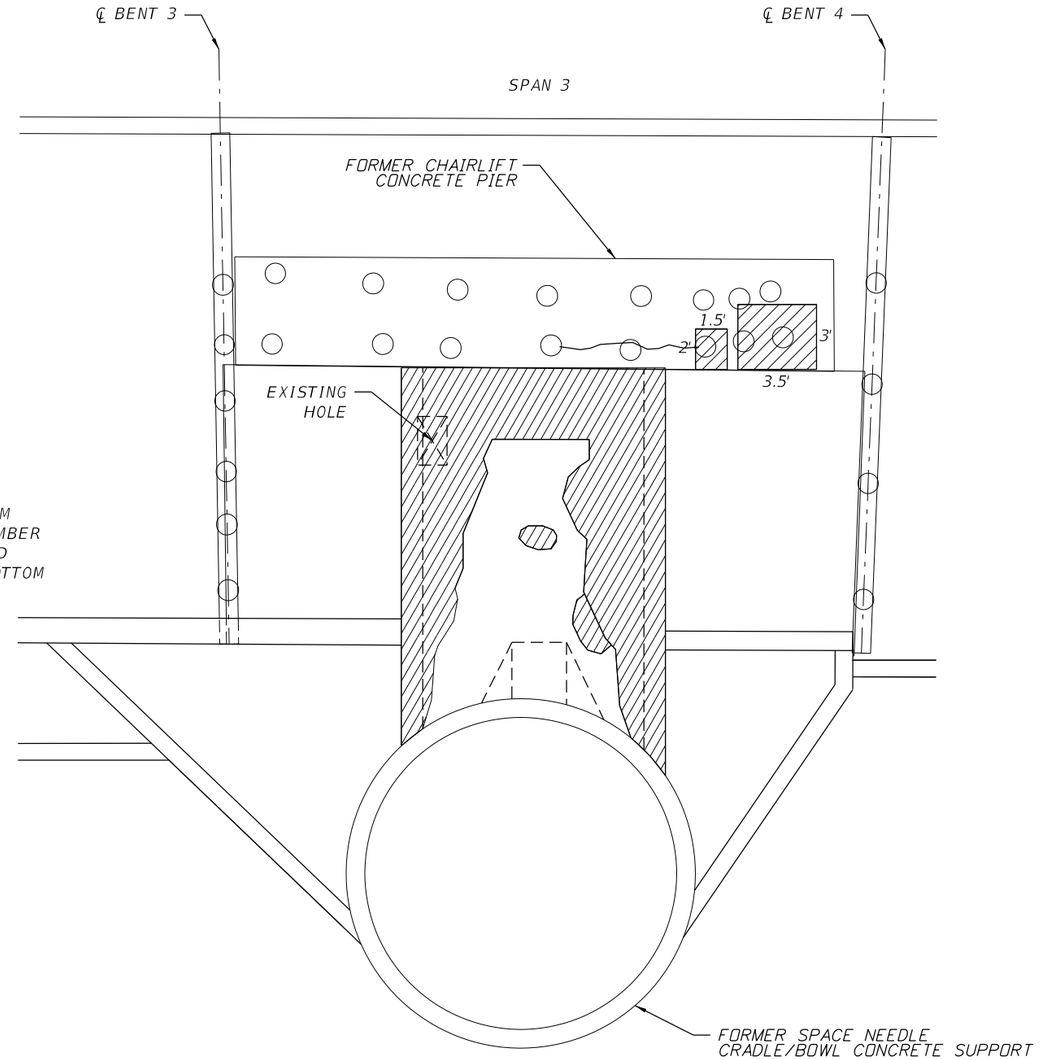
REF. DWG. NO.:

PROJECT NAME: DAYTONA BEACH MAIN STREET PIER EVALUATION

SHEET NO.: 1



CONCRETE SLAB BOTTOM DETERIORATION PLAN



FORMER CHAIRLIFT CONCRETE PIER AND CONCRETE U-BEAM (VAULT) BOTTOM DETERIORATION PLAN

LEGEND

CONCRETE SPALL/DELAMINATION

CRACK > 0.01" WIDE

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THE CITY OF DAYTONA BEACH

ROAD NO.	COUNTY	CDB PROJECT NUMBER
MAIN ST	VOLUSIA	

SHEET TITLE: PLAN - BOTTOM DETERIORATION, BENT 2 TO BENT 5

REF. DWG. NO.:

PROJECT NAME: DAYTONA BEACH MAIN STREET PIER EVALUATION

SHEET NO.: 2

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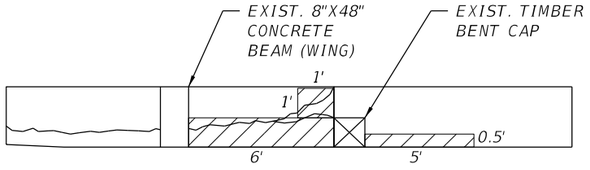
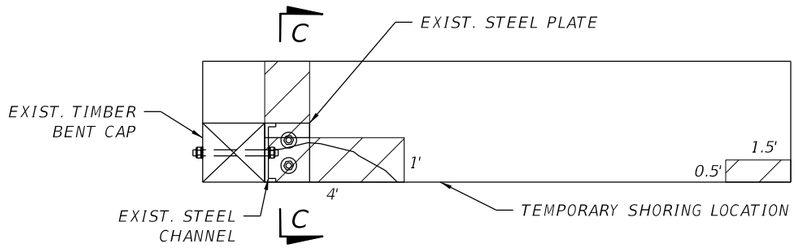


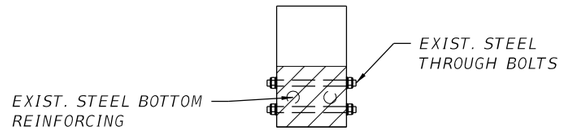
VIEW A-A

(EXIST. 8"X18" CONCRETE BEAM, LOOKING NORTH)



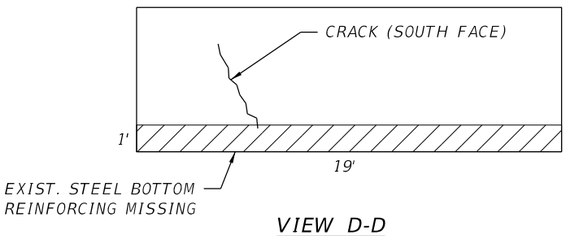
VIEW B-B

(EXIST. 8"X18" CONCRETE BEAM, LOOKING SOUTH)



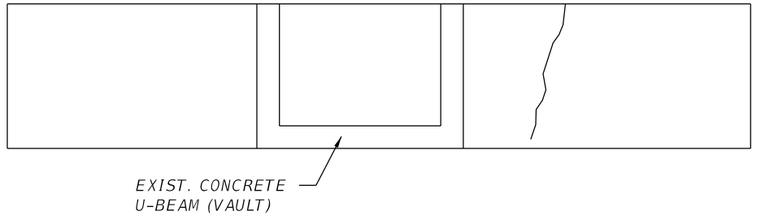
SECTION C-C

(EXIST. 8"X18" CONCRETE BEAM, LOOKING EAST)



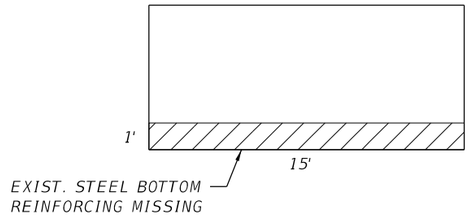
VIEW D-D

(EXIST. 8"X48" CONCRETE BEAM (WING), LOOKING SOUTHWEST)



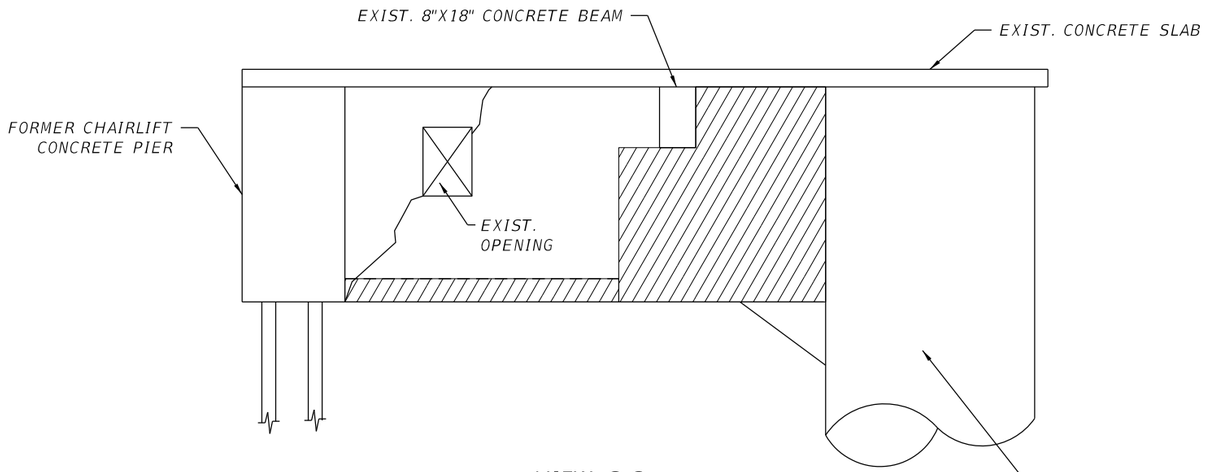
VIEW E-E

(FORMER CHAIRLIFT CONCRETE PIER, LOOKING NORTH)



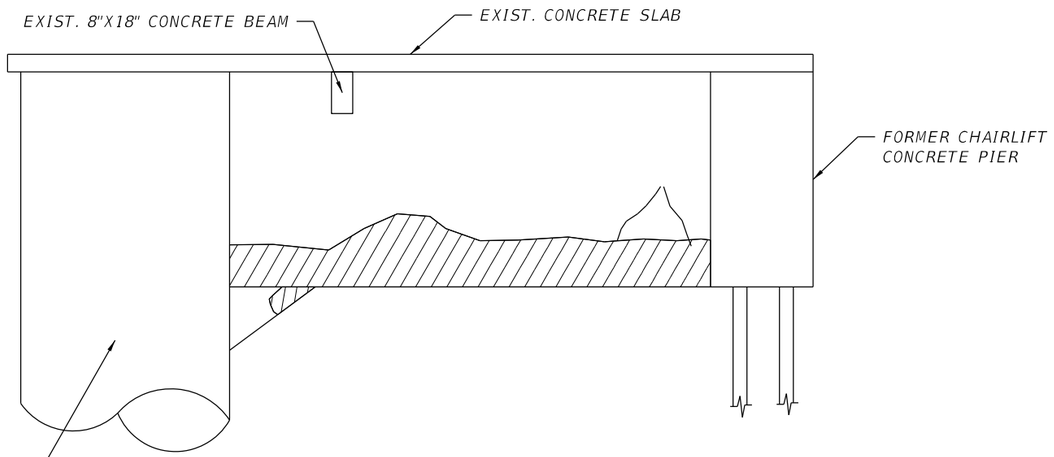
VIEW F-F

(EXIST. 8"X48" CONCRETE BEAM (WING), LOOKING SOUTHEAST)



VIEW G-G

(EXIST. CONCRETE U-BEAM (VAULT), LOOKING EAST)



VIEW H-H

(EXIST. CONCRETE U-BEAM (VAULT), LOOKING WEST)

LEGEND

CONCRETE SPALL/DELAMINATION

CRACK > 0.01" WIDE

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THE CITY OF DAYTONA BEACH

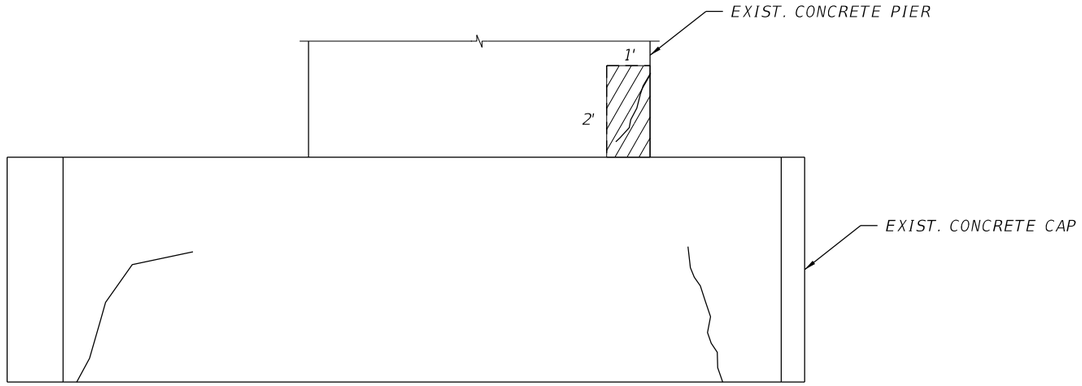
ROAD NO.	COUNTY	CDB PROJECT NUMBER
MAIN ST	VOLUSIA	

SHEET TITLE: ELEVATIONS AND SECTIONS - BENT 2 TO BENT 5

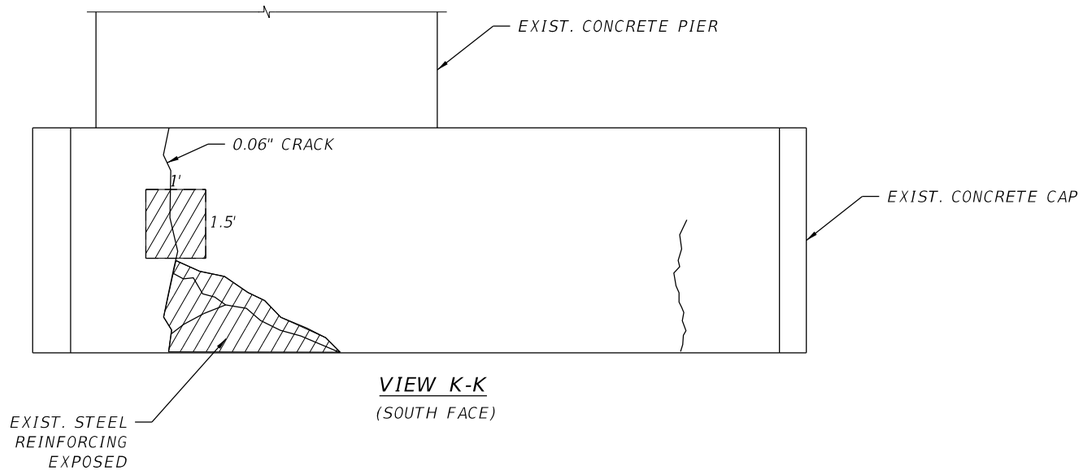
REF. DWG. NO.:

PROJECT NAME: DAYTONA BEACH MAIN STREET PIER EVALUATION

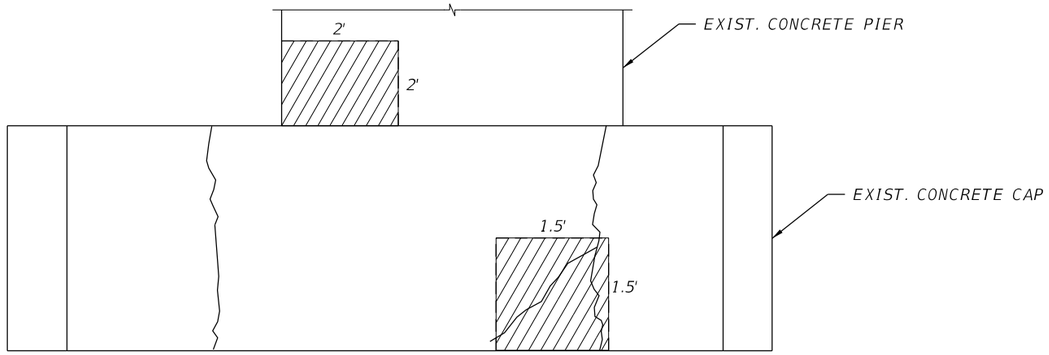
SHEET NO.: 3



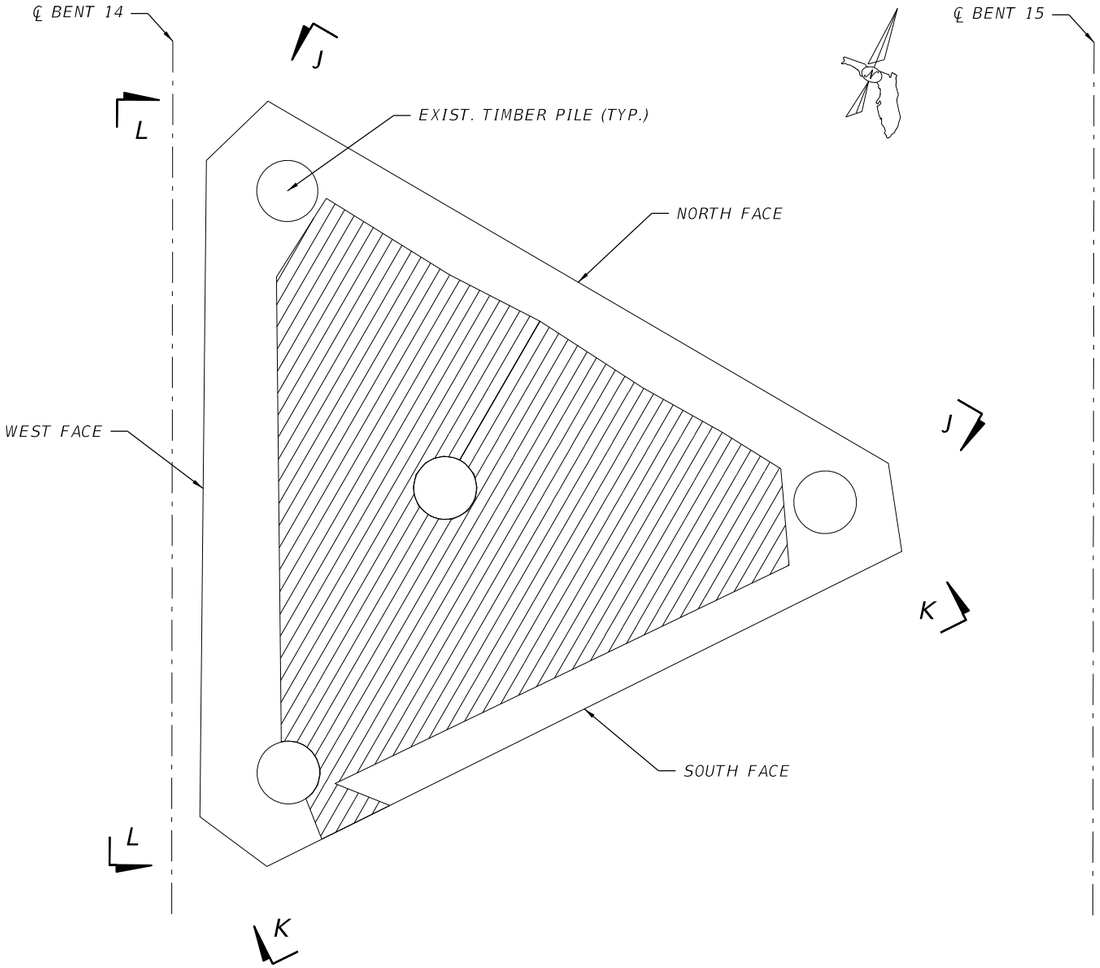
VIEW J-J
(NORTH FACE)



VIEW K-K
(SOUTH FACE)



VIEW L-L
(WEST FACE)



CAP BOTTOM DETERIORATION PLAN
(FORMER CHAIRLIFT CONCRETE PIER SUPPORT BETWEEN BENTS 14 AND 15)

LEGEND

CONCRETE SPALL/DELAMINATION

CRACK > 0.01" WIDE

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THE CITY OF DAYTONA BEACH

ROAD NO.	COUNTY	CDB PROJECT NUMBER
MAIN ST	VOLUSIA	

SHEET TITLE:
PLAN - BOTTOM DETERIORATION AND ELEVATIONS, BENT 14 TO BENT 15

REF. DWG. NO.:

PROJECT NAME:
DAYTONA BEACH
MAIN STREET PIER EVALUATION

SHEET NO.: 4