ADDENDUM NO. 03 – SEPTEMBER 7, 2016

The following shall be made part of the above referenced Bid Documents for the construction of the Hoboken Pier A Substructure Rehabilitation. The changes indicated shall be reflected in the bid costs to be submitted to the **City of Hoboken by 1:30 P.M. on September 20, 2016.**

SPECIFICATION CHANGES OR CLARIFICATIONS

Bid Submission Date Extension

1. Please update all references to bid submission date within the bid documents to reflect the new bid submission date: 1:30 P. M. on September 20, 2016.

2. Please note the following exerpt from the bid documents:

   "No oral interpretation of the meaning of the specifications will be made to any bidder. Every request for an interpretation shall be in writing, addressed to the City's representative stipulated in the bid. In order to be given consideration, written requests for interpretation must be received at least ten (10) days prior to the date fixed for the opening of the bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications, and will be distributed to all prospective bidders, in accordance with N.J.S.A. 40A:11-23. All addenda so issued shall become part of the contract documents, and shall be acknowledged by the bidder in the bid. The City's interpretations or corrections thereof shall be final."

GENERAL QUESTIONS

1. Please provide any documentation, dive reports, and photographs of the existing conditions of the Pier A structure. Also, please provide available photos of the areas of concrete spall repair under the deck and on the edge beams.

Please find selected portions of the September 2014 Hoboken Pier A Structural Analysis & Feasibility Study attached to this addendum for reference purposes only.

END OF ADDENDUM

SEPTEMBER 2014
CITY OF HOBOKEN

HOBOKEN PIER A STRUCTURAL ANALYSIS & FEASIBILITY STUDY - SELECTED PORTIONS

STUDY REPORT

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Ocean and Coastal Consultants | COWI

2 SITE DESCRIPTION

Pier A is located along the shoreline of Hoboken, NJ on the west bank of the Hudson River. The pier is located approximately 2 nautical miles north of the confluence between the Hudson River and the Upper New York Bay (See Figure 01).

Pier A is approximately 328 feet wide (parallel to the river) and extends approximately 730 feet offshore into the Hudson River. To the south of the site is the Hoboken Terminal, which includes a NY Waterway ferry terminal, and to the north is a pedestrian walkway constructed of a high-level platform and a granite block seawall. The pier itself supports a pedestrian park, which includes a large green-space, walkway, and a gazebo (See Photograph 1).

Photograph 1 – Overview of Pier A (looking southwest).

Pier A was originally constructed in the 1870's and utilized as the homeport for two (2) transatlantic passenger ships. The pier was later used as the port of embarkation for WWII soldiers travelling to Europe. The pier was controlled by U.S. Government until 1952, when it was leased by the Port Authority of NY/NJ (PANYNJ). Under PANYNJ control, the pier was rebuilt into its current size and configuration. The City of Hoboken obtained ownership of the pier in the past decade. Reference drawings "Pier A Rehabilitation Contract No. HWD 544.007" dated May 1996, detail a major rehabilitation effort performed at the pier. This effort included installation of concrete encasements on the top 10 feet of all structural piles.

3 INSPECTION OF HOBOKEN PIER A

3.1 Description of Structure

Pier A is supported by 1,284 accessible structural piles which, in-turn, support concrete pile caps, edge beams, and precast concrete deck planks. Approximately 73 steel H-Piles do not have concrete encasements. These piles are abandoned in-place and have been excluded from this inspection effort. Additionally, ten (10) steel H-Piles are visibly accessible at the inshore extent of the pier (Bent 8N/S). Piles along this bent are typically buried beneath the mudline and, therefore, have not been included in the totals described above.

Concrete encasements have been installed at all accessible structural piles, 1,284 piles (See Photograph 2). These encasements extend from the pile caps down approximately ten (10) to twelve (12) linear feet, based on reference drawings. At locations where batter and plumb piles are in close proximity at the mudline (limited clearance for individual encasements), large concrete box encasements were installed.

Photograph 2 – Typical concrete encasement above water.

For the purpose of this inspection, the bents have been numbered from 8 to 44, from west (inshore) to east (offshore) (See Figure 02 and Figure 03). Additionally, due to the overall width of the pier, and to keep consistent with previous inspections, each bent has been split into N, North, and S, South, halves, e.g. 9N and 9S. Bents are constructed of between 14 and 21 structural pile rows, which are not consistently spaced throughout the pier. Rows are numbered from the perimeter of the pier, 1, to the center, sequentially. Where batter piles exist they are noted with a " ' " symbol (representing the term prime) and assigned to the same row as the nearest plumb pile (See Figure 04).

Structural concrete pile caps extend along the width of the pier at each bent. The pile caps support precast prestressed concrete deck planks which span between pile caps (See Photograph 3). The exact construction of the pile cap system, simply reinforced vs pre(or post)stressed, could not be determined from the visual inspection. If reference drawings are located or additional investigations performed, the reinforcement type and layout can be determined. Additionally, a "Rail Road(RR) Well" exists in the center of the pier, between Bent 35 and the inshore extent of the pier. At the "RR Well" the pile cap is discontinuous and an additional 48 inch tall pile cap is installed directly below the primary pile cap elevation (See Photograph 4).

Photograph 3 – Typical pile cap and deck plank system.

Photograph 4 – Pile cap system below RR Well at Bent 13N.

A cast-in-place reinforced concrete edge beam and fender girder, as noted in the reference drawings, spans along the northern and southern perimeters of the pier (See Photograph 5). No fendering is in place along the perimeter of the pier. Reference drawings detail that all fendering was scheduled to be removed during the 1996 rehabilitation effort.

Photograph 5 – Typical Edge beam (looking southwest).

Bag encasement are present at Bents 9N/S, 10N/S, 11N/S, and 44N/S (See Photograph 6). At Bents 9N/S, 10 N/S, and 11 N/S, bag encasements were likely utilized as an alternative repair due to the difficult subsurface conditions, which made excavation problematic. Additionally, they may have been utilized due to limited clearance between the pile cap and the mudline. At Bent 44N/S, bag encasements may have been installed during or after the rehabilitation effort to span between the bottom of the encasement and the mudline.

Photograph 6 – Typical Bag Forms at Bent 11N (looking west).

Average water depths at the eastern (offshore) edge of the platform are approximately 12 feet at mean low water (MLW). The average water depths on the north and south edges of the pier vary between approximately 5 feet and 12 feet at MLW.

3.2 Observed Conditions

Overall Pier A is in **Poor** condition. There are significant portions of the facility with major to severe deterioration due to corrosion of exposed steel H-Piles below existing concrete encasements (See Appendix C for a description of deterioration terminology and ratings). The sections below detail the observations collected by OCC during the inspection effort.

3.2.1 Structural Piles

The concrete encased H-Piles throughout the structure have widespread major to severe deterioration. Primary major to severe deterioration mechanisms include exposed steel H-Piles below the concrete encasement with heavy pitting, section loss, isolated perforations through the flanges, and voiding of the concrete encasement topping (See Photograph 7 to Photograph 9). Isolated piles have voiding of the concrete encasement (See Photograph 10). Moderate to major deterioration mechanisms observed include erosion of the concrete encasement, scour of the concrete encasement with no exposed steel, and vertical cracking through the encasement (See Photograph 11 and Photograph 12).

Photograph 7 – Heavy pitting at Pile 43N-3.

Photograph 8 – Significant section loss of flange edge at Pile 43N-3.

Photograph 9 – Severe corrosion perforations through flange at Pile 10N-1.

Photograph 10 – Voiding of concrete encasement topping exposing structural steel at Pile 11S-5.

Photograph 11 – Encasement erosion with exposed welded wire reinforcement at Pile 13S-1.

Photograph 12 – Vertical cracking at Pile 13M-12.

Where Level III investigations were performed, the observed section loss consistently fell within the major to severe condition rating (greater than 30 percent section loss). For this reason, OCC performed additional cleanings to determine the correlation between Level I ratings and Level III measurements. This effort was out of the originally defined scope and was performed to reinforce the inspection observations.

This effort confirmed that nearly every pile with exposed steel are rated major or severe.

Ultrasonic Thickness (UT) measurements were collected at 36 piles throughout the pier. At each location, measurements were taken at one (1) elevation on all four (4) flanges. The average steel section losses measured during this 2014 inspection effort ranged from 29.5 to 61.5 percent, for an average of 47.5 percent.

OCC compared the 2011, Boswell, and 2014, OCC, steel thickness data sets and calculated an average corrosion rate of 20.7 mils per year or 10.4 mils per face per year. Typical corrosion rates at this water elevation typically range from 4 to 9 mils per face per year ("Handbook of Corrosion Protection for Steel Pile Structures in Marine Environments", 1981). However, it is commonly understood that the short exposed height of uncoated steel and the presence of a concrete encasement can create a corrosion cell with rapid localized steel loss. Table 3-1 - Average UT Measurements provides a breakdown of analysis performed on the two (2) data sets.

Table 3-1 - Average UT Measurements

DATA SET	ORIGINAL THICKNESS (IN.)	2011 AVG. THICKNESS (IN.)	2014 AVG THICKNESS (IN.)	% LOSS OF SECTION	MEASURED CORROSION RATE (MILS/YR)
BOSWELL (2011) (44 PILES)	0.615	0.385	---	37.3	---
OCC (2014) (36 PILES)	0.615	---	0.323	47.5	---
BOSWELL/OCC FULL DATA SETS	0.615	0.385	0.323	47.5	10.4*

* Corrosion rate calculated shows corrosion occurring to each face of flange.

The concrete encasements appears to have been originally topped with shotcrete (gunite), which is a concrete placement method where cementitious mixture is sprayed into place with a compressed air powered nozzle "gun". Based on the inspection observations for piles below the "RR Well", this topping appears to have eroded over time and exposed the structural steel to further corrosion damage. In this area, the lower pile cap supporting the "RR Well" places the pile topping elevation below mean high water (MHW). This exposes the pile toppings to higher wave, current, and salt water exposures than adjacent piles. These are all mechanisms which drive erosion and voiding deterioration. Overall, approximately 72 percent of the piles within this area have erosion or voiding occurring (See Photograph 13). Limited access was available to assess the extent and condition of exposed steel within the voids.

Photograph 13 – Typical concrete topping voiding at Pile 24S-18.

Additional voiding is present at the top, middle, and bottom of isolated concrete encasements. These voids are due to formwork and/or placement defects caused during installation where concrete fill was lost and/or not properly set during installation. As a result, voids have formed and, on isolated elements, are exposing the structural steel to corrosion deterioration (See Photograph 14).

Photograph 14 – Concrete encasement voiding with exposed structural steel at top of Pile 13N-14.

Encasement erosion, vertical cracking, and scour observed throughout the pier at isolated locations are deterioration mechanisms, which will continue to progress and will need to be addressed in the future. The erosion and vertical cracking observed provides chloride intrusion paths. Chlorides, along with oxygen and water, are primary ingredients in the corrosion process. Once corrosion has begun within a reinforced concrete structure, rapid deterioration and expensive repairs typically follow.

Similarly, observed scour, if it progresses, can expose additional steel H-Piles and cause corrosion damage. In marine construction, concrete encasements typically extend a minimum of two (2) linear feet into the mudline to protect the encasements from scour and other deterioration mechanisms. Comparing the 2011 Bowell drawing with OCC's observations the locations of exposed and embedded encasements correlate well. This may be indicative that active scour is not occurring at this site.

Finally, where steel H-Piles are exposed at the inshore extent of the pier, Bent 8N/S, the H-Piles typically have moderate corrosion (See Photograph 15).

Photograph 15 – Typical moderate corrosion at exposed pile on Pile 8S.

3.2.2 Concrete Superstructure

The Pier A superstructure is in typically moderate condition with isolated areas of major deterioration. Typical deterioration mechanisms include isolated spalling, corrosion cracking, heavy efflorescence, and mechanical damage (See Photograph 16 through Photograph 20). Additionally, top deck observations include displaced granite pavers due to plant growth between pavers and the concrete deck and displaced brick pavers (See Photograph 21 and Photograph 22).

Photograph 16 – Isolated open spalling of concrete deck plank between Bents 11N and 12N. Note exposed and corroded prestressing strands.

Photograph 17 – Isolated open spalling of concrete edge beam between Bents 24N and 25N.

Photograph 18 – Isolated corrosion cracking to concrete pile cap above 14S-4

Photograph 19 – Heavy efflorescence between Bents 41 N/S and 42 N/S.

Photograph 20 – Typical mechanical damage to edge beam above 34S-1.

Photograph 21 – Isolated displaced granite block paver above 16S.

Photograph 22 – Displaced brick pavers above 28S.

Approximately 315 square feet of open spalling is present on deck plank and edge beam locations throughout the pier. The majority of the observed spalling is present on precast deck planks between Bents 11N and 12N, as also noted in the 2011 Boswell Report. Open spalling occurs when corrosion of the internal steel progresses to a point when the concrete cover breaks away from the structure due to internal pressures. In these areas, internal steel, prestressing strands and/or reinforcing steel, are exposed to the saltwater environment. Where open spalling has exposed prestressing strands in the deck planks, the strength of the member has been compromised. Prestressed elements are more sensitive to corrosion damage and may require more substantial rehabilitation efforts to repair. Between Bents 12S and 14S hand-applied spall repairs have been installed to the underdeck, these repairs appear to be holding soundly (See Photograph 23).

Photograph 23 – Isolated hand applied spall repairs between 12S and 14S.

Observed corrosion cracking and heavy efflorescence cracking are providing a chloride intrusion path (See Section 3.2.2 and Photograph 24). These areas will continue to deteriorate over time and will ultimately become maintenance/rehabilitation items.

Photograph 24 – Efflorescence cracking along northern edge beam (looking southwest).

Displaced granite pavers are a potential pedestrian tripping hazard (See Photograph 21 and Photograph 22). Though these defects are not structural, they present a safety hazard and need to be addressed.