

CDMS/Fishermans Memorial

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DESIGN MEMORANDUM

To: CDM Smith, Inc.
260 west Exchange St., Suite 300
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Attention: Kimberly R. Drake, RLA

24 March 2014

From; John Gaythwaite, PE, D.PE, D.CE

RE: City of New Bedford, MA Fishermans Memorial: Stone Pier Evaluation & Restoration Recommendations

This memorandum serves to summarize our evaluation of the subject stone pier with recommendations for its restoration with particular regard to proposed improvements. Our effort included review of preliminary design plans and various archive and record documents and recent subsurface investigations conducted by CDMS, a site visit and general visual inspection conducted on 3/5/14, and determination of extreme water levels and wave and environmental conditions affecting the site.

General Description: The pier is of stone fill granite ashlar masonry construction founded on firm beach sands and gravel. The stone masonry is placed in “stretcher and header” fashion with a broken bond pattern and with ranged (uniform depth) courses. Archive plans indicate that the outermost stone walls were placed atop a concrete footing at about the mean low water (MLW) level with the inshore portions founded directly on beach sand. Typical granite block size is estimated as around one ton. The top of stone walls perimeter is capped with a reinforced concrete curb/cap that extends approximately 10 inches above the deck surface which is paved with bituminous concrete. The pier is approximately 64 feet wide by 330 feet long overall and projects in a west to east direction into the outflow region of the Acushnet River and approach channel to New Bedford Harbor between Butler Flats to the north and Clark Point to the south. The water depth is nearly zero relative to mean lower low water (MLLW) at its outboard end where the top of the side walls are approximately 10 feet above the bottom and the beach level trends upward to the pier deck level at its inshore end along Rodney French Boulevard. A stone rubble mound groin extends seaward from the outshore end of the pier.

Current Material Condition: The pier is currently in overall fair condition with some serious localized deficiencies due to missing and displaced stones, primarily at the outshore end, damaged and deteriorated concrete cap and substantially cracked pavement. In addition; there are concrete portions of wall below the second and third courses down

along the north side of the pier that are severely eroded and undermined along most of the exposed length and there is a large void due to missing stone(s) at the bottom course of the northeast corner. The northeast corner has consequently settled and rotated outward slightly. The concrete below the stone courses appears to have been placed as a repair at some unknown time. Additional deficiencies include general overall apparent loss of grout from joints. There is another relatively large void due to a missing stone on the outshore face adjacent to the stone groin on the south side. Most of the displaced and missing stones are located along the outshore face and north east end of the pier. The south side of the pier appears to be in generally better condition than the north side except for a section of severely cracked and spalled concrete cap with exposed and corroded reinforcing near the outshore end. Archive plans show 3 feet or more water depth below MLW at the end of the pier indicating that the pier has since accreted sand, itself acting as a groin. The attached smoothed field notes summarize the general findings and notable deficiencies.

Environmental Exposure: The pier is exposed to the open waters of Buzzards Bay to the south through southeast with an approximately 9 to 10 nautical mile fetch to the Elizabeth Islands over which sizeable storm waves can be generated. Hurricanes and southeasterly gales constitute the greatest threat to this structure especially when abnormally high, storm surge, water levels allow large waves to impact and overwash the structure. The attached figure summarizes normal and extreme water levels at a transverse section of the pier near its outboard end. Tidal data and reference datums were obtained from NOAA, NOS and extreme water levels from FEMA Flood Insurance Rate Maps (FIRM) and Flood Insurance Study (FIS). The FIRM gives Base Flood Elevations (BFE) for the extreme elevation that water rises to including wave crest elevation and/or run-up height above the 100 year return period still water level (SWL). For the 100 year event the pier deck is fully inundated with over 5 feet of water (SWL) over the deck and with much higher wave crest elevations. For the 10 year return period event the SWL is at the top of concrete cap elevation with several inches of water over the deck. Depth limited breaking wave heights have been estimated and their profiles are shown for both the 10 and 100 year events assuming that waves break near the outshore end of the pier with the sea bed at about MLLW level. In reality these waves would actually be approaching more nearly end on than shown in the figure. It can be readily surmised then that the pier will be overwashed by waves and the uprush from broken waves for storm surge events associated with 10 year and greater return periods. Tidal and/or river run-off currents are not expected to be a problem at this site but could be a contributing factor under extreme storm events.

Ice is not known to be a particular problem at this site but could contribute to the long term deterioration of the pier due to pile up of ice sheets over extreme cold winters and during spring break up. Freeze-thaw damage to concrete and pavement contributes to cumulative damage over time.

Proposed Improvements: Proposed improvements to Fishermans Memorial include construction of a new elevated promenade to be placed on top of the pier deck and consisting of a light weight fill core with a cobble stone wall and plantings along most of

the north side and stepped granite block wall along the south facing side. The fill area will gradually rise from existing grade near the inshore end of the pier to an elevated viewing area approximately 8 feet above the existing deck near the outshore end of the pier. An approximate outline of this structure is included on the attached figure. It is readily apparent from the figure that the new fill structure will be exposed to inundation and the erosive forces of wave action associated with storm events around the 10 year return period and higher. The cobble stone wall on the north face is especially susceptible due to its relatively steep slope, the nature of its construction and the fact that most wave damage to the existing pier appears to have been concentrated along the northeast end and north facing outboard edge. The exposed fill behind the top of the wall is of particular concern under the 50 to 100 year event scenarios as it is most vulnerable to wave erosion and saturation from overtopping.

Summary & Restoration Recommendations: The pier is currently in only fair condition with significant local deficiencies that should be addressed prior to implementing improvement plans. Extreme high water levels and wave action pose a threat to the longevity of the pier. The following restoration measures are recommended to restore the pier to near its original condition and to better assure long term durability.

1. Replace and/or reset all missing and/or displaced granite block masonry.
2. Remove deteriorated and friable concrete from sections of concrete wall along north edge of pier and place new more durable concrete down to existing concrete footing.
3. Remove all spalled and damaged concrete cap (preferably entire pier perimeter) and replace with new reinforced concrete cap doweled into top stone course. Provide ample scuppers for deck drainage.
4. Chink any large open joints between granite masonry and point all open joints above around MHW with suitable grout.
5. Remove existing bituminous concrete paving and replace with new reinforced concrete deck slab of adequate thickness on prepared base material. The slab could, alternatively be constructed flush with the top of concrete cap and sloped to drain directly overboard thus eliminating need for scuppers.

The proposed improvements are susceptible to direct wave action and overwash erosion. In general, providing a more impermeable structure and rapid drainage will help to mitigate these effects. Further discussion among design team members is warranted prior to recommending specific measures. Handrails, such as employed at the nearby fort Rodman Pier, are recommended along the pier perimeter where falling may be a hazard.

Attachments:

Inspection Field Notes, 3/5/14

Figure: Pier Section & Extreme Water Levels

References:

CDM Smith: Drawings; “New Bedford Fishermans Memorial Improvements”,
5 sheets, January 2014. Borings & Test Pit Logs, 2/28/14 and
Miscellaneous correspondence thru date.

City of New Bedford: Miscellaneous archive plans provided by CDMS.

FEMA: FIS #25005CV000A, Bristol County, MA, July 7 2009.
(New Bedford Community #255216) and FIRM

NOAA, NOS: Nautical Chart #13249 and tides& currents website.