CITY AND BOROUGH OF WRANGELL BARGE RAMP

CONDITION ASSESSMENT

MARCH 2025

PND PROJECT NO. 252032

PREPARED FOR:

CITY & BOROUGH OF WRANGELL
GATEWAY TO THE STIKINE

PREPARED BY:

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March 10, 2025 PND 252032.01

Mr. Steve Miller
Port and Harbor Director
City and Borough of Wrangell (CBW)

Subject: Wrangell Barge Ramp – Condition Assessment

Dear Mr. Miller,

On March 4th, 2025, PND Engineers (PND) traveled to Wrangell to examine the condition of CBW's barge ramp. This letter report is intended to provide an overview and document what was observed in the field. Representative photos are included to illustrate the conditions observed.

BACKGROUND

The Wrangell Barge Ramp was originally installed in the late 1970's and is a 17-ft wide by 140-ft long, orthotropic steel box-girder bridge. The barge ramp was designed with a 9-ft diameter submerged steel tank supporting the seaward end, while the shoreward end is supported by steel bearing assemblies anchored to a concrete abutment. The design allows the seaward end of the barge ramp to be raised or lowered by adding or removing compressed air, respectively, within the submerged tank.

In the early 1990's, the barge ramp was repainted, in-place by a local contractor, and in 2021, the floatation tank was removed, repaired, and repainted. New bolts were installed when the tank was reattached to the barge ramp.

OVERVIEW

PND performed a condition assessment and load analysis in 2011, which provided the background and basis for comparing and evaluating the barge ramp's current condition. The 2011 effort included an underwater examination of the floatation tank; however, the field work for this report consisted of an above-water, "Level 1" (visual) only of all major structural components of the barge ramp.

Access beneath the barge ramp was accomplished through use of a boat. The barge ramp was examined for obvious mechanical damage, corrosion and other evidence of deterioration, with particular attention being given to the condition of the protective coatings.

OBSERVATIONS:

The current overall condition of the barge ramp is poor. It is over 40 years old and time, the elements, and the inherent nature of freight handling operations have all continued to contribute to significant deterioration. Protective coatings for the structural steel are either completely gone or in poor condition, causing significant corrosion of the steel. In addition, the profile of the barge ramp indicates it is bent, likely due to being overloaded.

The following specific conditions were observed:

- Abutment - The steel bridge bearing assemblies appear to be functioning adequately; however, protective coatings have been completely gone for many years and the steel components have varying levels of corrosion. All plate steel has a moderate level of corrosion with some flaking, while the bearing assembly anchor bolts are corroded to the extent that the threads are barely visible and the anchor bolt nuts no longer have sharp edges but instead are “conical” shaped. “Doubler” plates have been added on the bottom surface of each bearing saddle due to the extent of mechanical wear that had resulted in the elevation of the barge ramp deck dropping below the elevation of the concrete abutment and upland approach.
- Barge Ramp Superstructure - Overall condition of the barge ramp steel elements is poor. In the 2011 report, condition of the paint coating system was noted as poor, particularly on the underside of the main box-girders where a significant amount of surface corrosion was documented. With a compromised coating system and daily exposure to salt spray, the level of corrosion has notably increased on all ramp elements. In particular, corrosion of the box-girder bottom flanges has progressed extensively and varies from “moderate” to “severe” as defined by the ASCE Guide *“Waterfront Facilities Inspection and Assessment”*. This means the steel exhibits extensive pitting and localized section loss (i.e. flaking) from laminar corrosion (layered appearance of steel easily removable by hand – see photos).

  Most importantly, while condition varies along the length of each girder, significant portions of the bottom flange-to-web structural welds also exhibit this high level of corrosion. This condition represents a greater structural concern, particularly in an overload situation. If the deteriorated welds crack due to overstress and a crack propagates along the girder length, the box-girder webs could eventually separate from the bottom flange, leading to failure of a girder and the barge ramp.

  In addition, the barge ramp was observed to be bent (i.e. negative curvature from ramp self weight only), likely due to being overloaded. Typically, bridges of this length are fabricated with a positive “camber” of 2-3 inches above horizontal. A string line run along the barge ramp revealed a negative camber of slightly over 1 inch. On site was a steel electrical cable spool (see photos) nearly the height of two stacked shipping containers. This, along with the capacity of steel flats (38 tons maximum gross weight) and containers (45 tons maximum gross weight), would far exceed the barge ramp safe load capacity stipulated in the 2011 load analysis when transported by the forklifts currently on site. According to the equipment data plates, the forklifts weigh approximately 77 tons total, with 46 tons on the front axle and 31 tons on the rear (steering) axle. The combined total on the front axle with either a flat or container at its maximum gross weight would be more than 80 tons which is significantly greater than the 70-ton axle and 77-ton total forklift vehicle weight load limit currently posted on the barge ramp.

  Overstress (beyond yield strength of the material) of a structure with full-thickness of steel and full-strength of welds will result in permanent deformation (i.e. structure being bent). On the other hand, overstress of a structure with reduced steel thickness will result in permanent deformation at a lower load, and a structure with less than full-strength welds has the potential for failure.

CONCLUSIONS:

Current condition of the barge ramp, combined with the magnitude of operational loads imposed by current freight handling equipment warrants concern for potential failure of the ramp. Short-term recommendations include reducing the current magnitude and frequency of operational loads to the greatest extent possible, and consideration be given for different means/methods of freight handling and/or an alternative location for freight operations (i.e. pass/pass at concrete dock adjacent to boat lift). If the loss of girder flange steel thickness due to corrosion is quantified as a uniform 1/8-inch, then the ramp capacity would be reduced to approximately 96% of the original capacity. This equates to a maximum axle load of 67 tons and a total forklift vehicle weight of 74 tons.

Long-term recommendations would include substantial refurbishment or full replacement of the barge ramp. With the current equipment and anticipated loads, a new barge ramp with greater capacity would be a more feasible option.

PND appreciates the opportunity to assist you with evaluating the condition of CBW's barge ramp and providing recommendations for your consideration. Please feel free to contact us at your convenience if you have any questions or wish to discuss any content of the report.

Sincerely,

PND Engineers, Inc. | Juneau, AK

John DeMuth, P.E., S.E.
Vice President

Attachment – Photo Log

FIGURE 1. Overall view (south side looking north) of barge ramp.

FIGURE 2. Profile of the barge ramp (south side).

FIGURE 3. Barge ramp deck looking ramp from abutment.

FIGURE 4. Floatation tank operation platform and ramp connection struts (south side).

FIGURE 5. Floatation tank connection plates with new bolts.

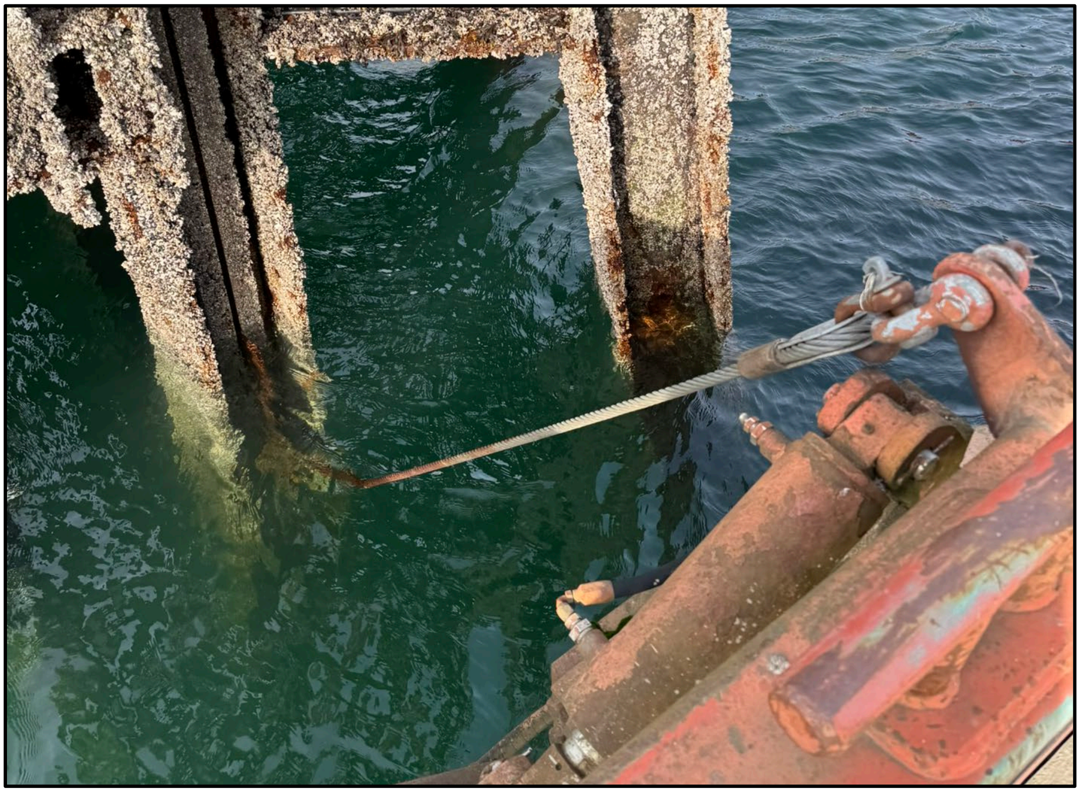

FIGURE 6. Tether cable on north side of barge ramp.

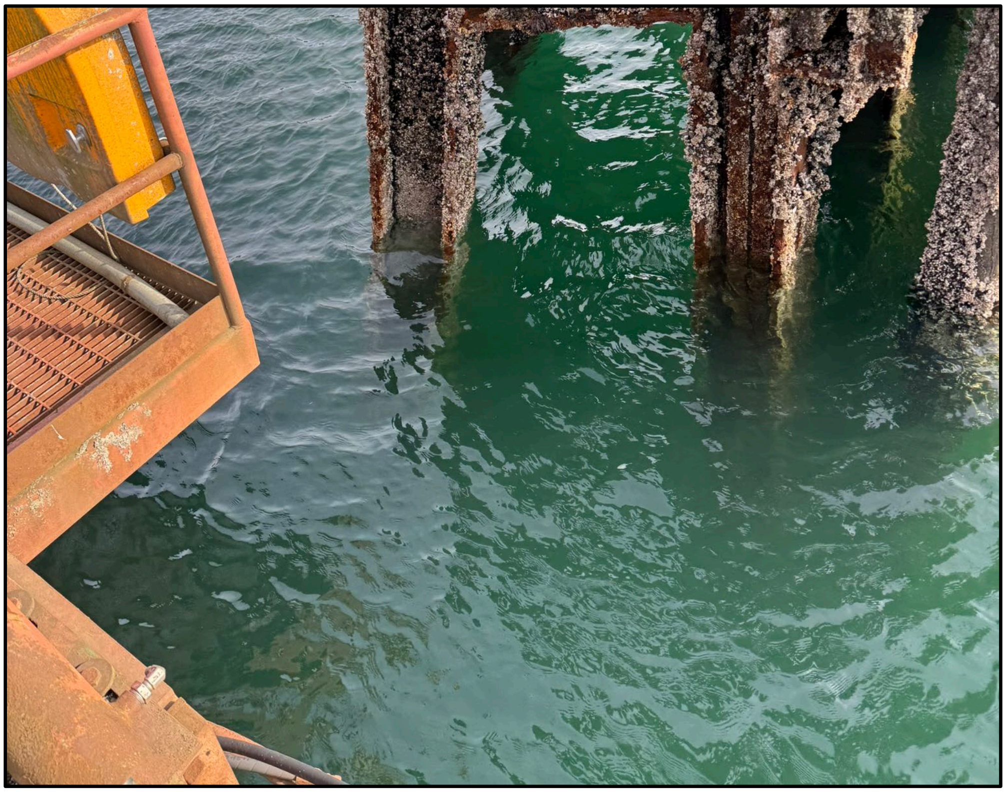

FIGURE 7. Tether cable missing/detached from barge ramp on south side.

FIGURE 8. Bottom flange of barge ramp girders, looking shoreward from floatation tank.

FIGURE 9. Typical barge ramp girder bottom flange – coating loss and laminar corrosion.

FIGURE 10. Close-up of laminar corrosion and deteriorated weld on barge ramp girder bottom

Figure 11. Corrosion and loss of weld material along bottom flange edge at web junction.

Figure 12. Corrosion at abutment bearing assembly; deformed/repaired saddle bearing.

FIGURE 13. Cracked repair weld at abutment bearing pivot pipe.

FIGURE 14. Typical coating failure and advanced corrosion of ramp floor beam.

FIGURE 15. Close-up of advanced corrosion at typical floor beam connection.

FIGURE 16. Typical blistering of deck plate (underside) between deck ribs.

FIGURE 17. Sag at mid-span of the barge ramp (i.e. ramp bent due to overloading).

FIGURE 18. Forklift used for handling freight; 77 ton weight; 33 ton safe working load.

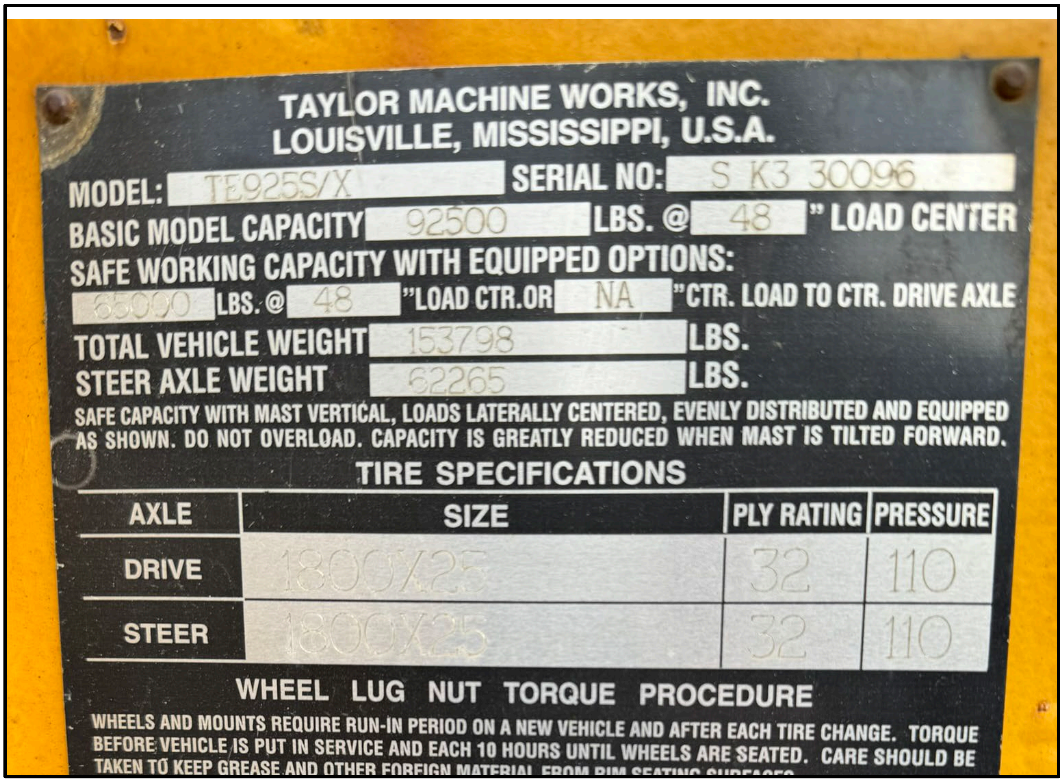

FIGURE 19. Data plate on forklift with weight and lifting capacity.

FIGURE 20. Steel flats for handling freight with weight capacities.

FIGURE 21. Steel electrical cable spool; weight estimated to be over 40 tons.