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Gantry (structure no. 20)
Stabilization & Reuse Proposal

Preface & Scope

After a comprehensive investigation and analysis of the built fabric on the island conducted by the building analysis team a collection of buildings and structures were deemed suitable for stabilization and possible reuse; the gantry structures (no.20 on the island map, slide 2) were among those chosen.

The scope of this proposal includes the gantry structure proper as well as the adjoining dock and dolphin structures (slide 3). The gantry structure is comprised of a vertical and horizontal structural element, the latter will be referred to as the 'slip' in this proposal.

Historically referred to as the 'ferry dock,' the gantry and slip structures were constructed on North Brother Island in 1948 in response to influx of WWII veterans and their families were housed on the island following the war (slide 4). The island was upgraded with a ferry dock and gantry system to accommodate the increased traffic to the island. A complementary ferry dock was installed at 134th Street, just across the East River, that same year. The ferry bridges acted as gangways to load passengers and vehicles onto the boats and absorb some of the impact of the boats engaging the slip.[i]

Historically, the gantry was the doorway to the island, and the slip its threshold—both symbolically and functionally. It is the intent of this proposal to return the gantry to its former role on the island as a symbolical gateway and a functional entrance point to the island.

General Description & Rapid Conditions Assessment

The unstable nature of the slip and dolphin structure made detailed survey of the gantry impossible by land or by water. A remote observation methodology was adopted using binoculars from multiple vantage points on the dock and along the shore to assess the condition of the gantry structures.

The gantry structure (vertical) is composed of a steel super structure and is supported by a partially submerged reinforced concrete and wood pile foundation system. The primary skeleton is clad in corrugated steel sheeting, mechanically fastened to wooden nailers attached to the horizontal steel angles of the gantry (slides 20-22). The horizontal boat slip structure is comprised of a steel primary structure with wooden secondary overlay structure. The adjoining dock is of reinforced concrete that sits upon a wood pile foundation. The projecting 'dolphin' system is constructed from driven, submerged wooden piles (slide5).

The most pressing issue of the gantry is the rapidly deteriorating and severely comprised condition of the corrugated iron cladding (slide 6, 18). The cladding is heavily corroded and due to the compromised condition of the wooden nailer attachment detail are unconstrained and pose severe threat in even moderate winds.

The vertical component of the gantry, the primary steel super structure, is generally stable throughout and only superficial, generalized surface corrosion is apparent (slide 7). Significant, however, is the heavy loss of cross-section of members directly adjacent to the reinforced concrete pile caps (slide 36). Standing water and snow on these components invariably submerges these lower members in excess levels of moisture exacerbating their deterioration.

The horizontal slip structure of the gantry is heavily compromised and unstable (slide 8). The primary supporting steel members are exhibiting heavy loss of cross-section, primarily on their underside where they are in close proximity to the water (slide 31). The lift beam component, the member directly attached via cables to the gantry lift mechanism, is heavily deflected and damaged (slide 30). The wooden elements of the slip are missing or severely deteriorated (slide 26).

Deterioration Pathologies: Wind + Water + Gravity

The gantry is the most environmentally exposed collection of structures on North Brother Island. They are immersed in a constant marine environment and submitted to persistent wind loads (slide 9).

An investigation and analysis of the typical meteorological year, sourced from nearby LaGuardia Airport, reveals that wind speeds originate primarily 50° from north at an average of 5.4 m/s; however, gusts can exceed 16.5m/s between 50°-60° (slide 10). Heavy and persistent wind loads create immense overturning force exerted upon the piles and pile caps (slide 35), which are in a state of rapid deterioration. This combination of pathologies poses a significant threat to the gantry structures.

The exposure of low-hanging elements of the gantry, particularly those on the slip and pile caps, to inundation during high tide contributes to exacerbated deterioration at these locations (slide 11). Furthermore, the reinforced concrete pile caps are exposed to high tide as well as constant salt-spray driven into the concrete by the wind. Wind drive rain is considered to be the primary mechanism of deterioration of the wooden nailer elements, the failure of which has comprised the cladding detail entirely.

Lastly, the horizontal slip structure acts as a significant dead load upon the gantry as it is still presently affixed via cables to the lift mechanism (slide 12, 24). It is though that to some degree this aids in counteracting overturning on the structure due to wind, however the additional weight on the structure poses a threat to the integrity of the structures as a whole as the conditions of the cables and lift mechanism is unknown at this time.

Intervention Approach & Precedent Study

The intent is to stabilize the gantry and slip structure at the beginning of phase one for the following reasons (slide 13):

1. The current state of the gantry is stable, yet as the most exposed structure on the island presents an urgent need for prompt action
2. Stabilization of the gantry, slip and dock will provide a safe and efficient means for loading and unloading personal and resources onto the island during the remaining intervention phases
3. As one of the most visible structures from the shore and water, this project will act as a ‘poster project’ for the whole-island effort

In preparation for this proposal the 69th Street Transfer Bridge stabilization and reuse project was analyzed (slides 14-15). The project is similar in scope and the construction of the structures involved are also similar. The project, begun in 2008 and currently still underway, was coordinated by the City of New York Parks & Recreation and funded by the Riverside Park Fund. It is located at the intersection of 69th Street and the Hudson River in New York City. The strategies adapted to stabilize the structures have been adopted for the gantry at North Brother Island.

The intervention strategy for the gantry structure can be seen in detail in slides 16-48, and are listed below:

1. Remove projecting dolphin structure to allow for construction and future boat access
2. Remove and store cladding panels
3. Stabilize slip, install supporting steel substructure, disconnect from gantry structure
4. Relocate slip for offsite rehabilitation and reconstruction, allowing for construction access to gantry
5. Install flat sheet-steel sarcophagus around existing wood piles and pile cap and fill with marine-specific concrete
6. Stabilize pilecap reinforced concrete foundations
7. Replace and stabilize lower gantry steel angles that have corroded
8. Install steel pilecap anchors to counteract overturning forces
9. Stabilize and reinforce existing concrete dock and wood pile foundations as necessary, assumed stable otherwise
10. Reinstall cladding per new design
11. Install permanent concrete piles to support reconstructed floating slip
12. Reinstall slip structure upon new pile-supports

The objective for the design of the new cladding system was first and foremost to mitigate the heavy wind loads acting upon the structure. The historic configuration of the cladding system would act as a sail, in terms of increased surface area for prevailing winds to apply additional pressure to. Furthermore, as it has been determined that reconstruction of any structure on the island is not consistent with our comprehensive preservation approach, returning the gantry to a fully clad structure was not considered as a design alternative. Moreover, the gantry has undoubtedly stood longer as an unclad or partially clad structure longer than it has as a fully clad one; in other words the interpretive value of the gantry is manifested in the ability to see the structure below the cladding and not focused on the cladding itself. In this way, the secondary design objective was to reinterpret this aspect of the structure. Thus, the comprehensive approach for the redesign of the gantry cladding was to first design a series of geometries to shed wind loads from the prevailing direction and to expose the structure below in a new, and bold way, appropriate for the new and improved doorway to the island. Corrugated metal was chosen, similar to the original, however stainless steel is the proposed metal to promote material longevity in a corrosive marine environment and to catch the light of the setting sun to passers-by on the shore and in boats—a beacon of sorts. Computational fluid dynamic studies were employed to fine tune the behavior of these cladding panels for wind performance (slides 44-46). The final product can be seen on slides 47 and 48.

Endotes

Council, Historic Districts. "A Guide to Historic New York City Neighborhoods: Port Morris & the 134th Street Ferry Bridges- the Bronx." In *Six to Celebrate*, edited by Historic Districts Council, 8-9. New York City, 2013.

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[i]Historic Districts Council, "A Guide to Historic New York City Neighborhoods: Port Morris & the 134th Street Ferry Bridges- the Bronx," in *Six to Celebrate*, ed. Historic Districts Council (New York City2013).