HEAVY MOVABLE STRUCTURES, INC.
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NYCDOT Shore Road (Pelham) Bridge

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MARRIOTT'S RENAISSANCE HOTEL AT SEAWORLD
ORLANDO, FLORIDA

Background

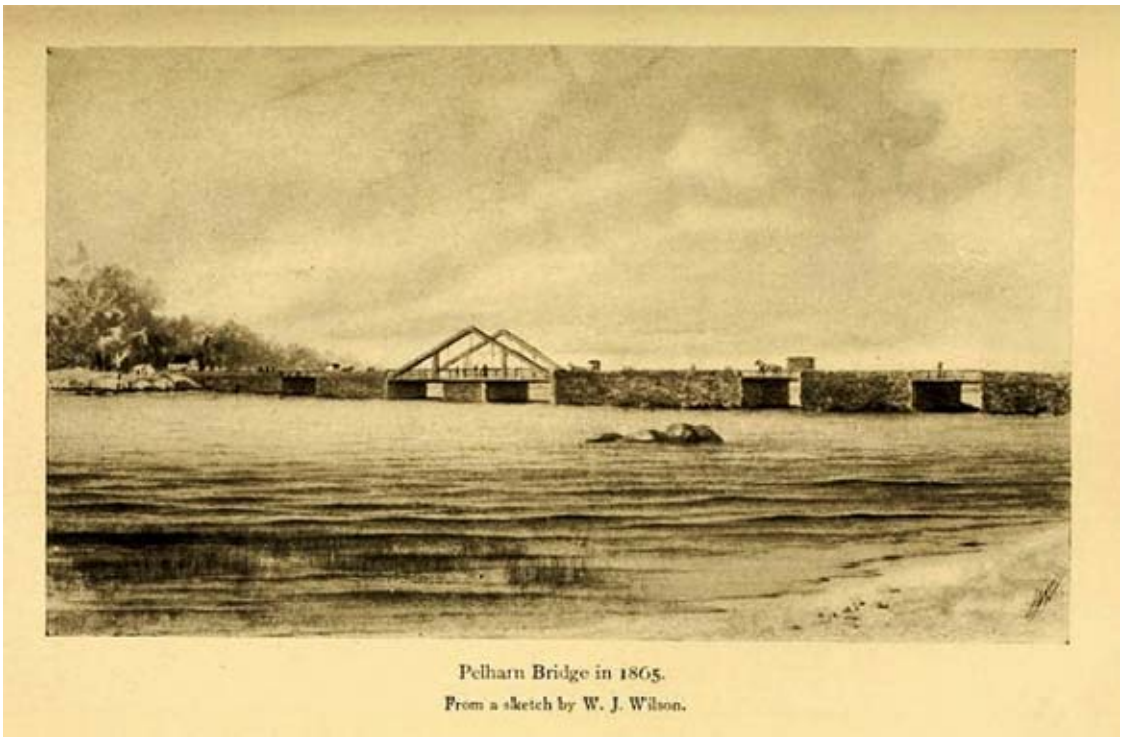
The existing Shore Road Bridge over Hutchinson River (Eastchester Creek) opened to traffic in 1908. The movable span is a double-leaf Scherzer Rolling Lift span flanked by two short fixed steel spans over each counterweight and three arched concrete spans at each approach making the overall bridge 865 feet long. Each moving leaf is approximately 40 feet long. The span provides unlimited clearance over a 60-foot wide channel when open but the low, 14-foot clearance when closed results in the need for over 750 navigation openings per year. Virtually all openings are for heavy commercial traffic serving port facilities north of the bridge along the border between the Bronx and Westchester Counties. At their peak, there were six movable bridges over the creek, but high level fixed bridges have replaced two of the northerly ones. The existing Shore Road bridge is the southernmost of the bridges crossing over the creek and is the fourth movable bridge at this site. The bridge has reached the end of its service life and will be replaced.

While the northern reaches of the creek are industrial, the south end lies completely within Pelham Bay Park, the largest park in New York City. Although the park setting and high demand for pedestrian and bicycle facilities discouraged use of a high-level bridge, NYCDOT wanted to reduce the number of span openings. The navigation study concluded that a 30-foot high movable span would cut the number of openings in half. Based on analysis of data from marine use and DOT's goals for this project, the proposed movable span was recommended to be a 168-foot-long twin double-leaf bascule. This increased the channel width to 115 feet, nearly double the width of the current channel, and reduced the potential for vessel impacts. This paper describes the preliminary studies and design development for the replacement bridge, the fifth movable span at this site.

History

In the early years of the United States, transportation infrastructure was sparse. Private companies often needed to take the lead in building roads and bridges and they then charged tolls to pay off the costs. Transportation along the corridor from New York to Boston followed one of several coastal routes along turnpike toll roads. In Westchester County, just north of New York City, the route between the towns of Westchester and Eastchester needed to cross Eastchester Creek, sometimes referred to as Hutchinson River. The first toll bridge, which included a wooden swing span, was built at this location in 1812 by the Eastchester Bridge Company. The bridge was referred to as the Pelham Bridge due to its proximity to the Village of Pelham. After the bridge was destroyed by a storm, a second wooden swing span was built at the site in 1834. This bridge remained as a toll bridge until Westchester county bought it and later replaced it with an iron swing span in 1870. While the iron swing span was quite elegant and a major improvement over the prior wooden spans, the era of iron bridges was short lived due to the advantages offered by modern steel bridges. In addition, the 1870 swing bridge was too narrow for the growing traffic demand.

By the late 1800's, the sparsely populated area to the east of the Pelham Bridge was the target of the New Parks Movement which sought to build parks for the expanding New York City population. Although the boundaries of New York City would not incorporate the area for nearly a decade, New York City was able to acquire the property for Pelham Bay Park by eminent domain and established what would become the largest park in New York City. Most of Pelham Bay Park is to the east of Eastchester Creek, but it also encompasses the Shore Road (Pelham) Bridge and a substantial area on the west side of the creek. When the City of New York acquired the area, there was immediate demand for a new bridge. This demand resulted in the current rolling lift bridge, which was built in 1908. The bridge is referred to as the Shore Road Bridge by NYCDOT due to the name of its connecting roadways.



Second Pelham Bridge, 1834-1869

Third Pelham Bridge, 1870 - 1908

Existing Conditions

Constructing the existing Shore Road (Pelham) Bridge was challenging from the start. There was controversy as to whether the bridge would be built by the City Parks Department or the Department of Transportation, and the architectural details of the new bridge came under review by the City Arts Commission. When all was said and done, the new bridge was built just north of the old swing bridge and incorporated not only a movable span but also three 105-foot-long arched concrete spans at each approach. At the time, parkways were being built to provide access to parks throughout the region as well as scenic routes for users of motor cars, which were just coming into more common use. Attention was paid to the appearance and architectural treatment of the new parkway bridges. The bridge has unique architectural details, including prominent masonry towers at each corner of the movable span that were intended to act as wayfinding elements for mariners navigating along Eastchester Creek. The overall architectural style was known as Arts & Crafts, which was common in building construction at the time. The concrete arches were an early form of reinforced concrete which was built using the Melan System, a unique concrete reinforcement technique.

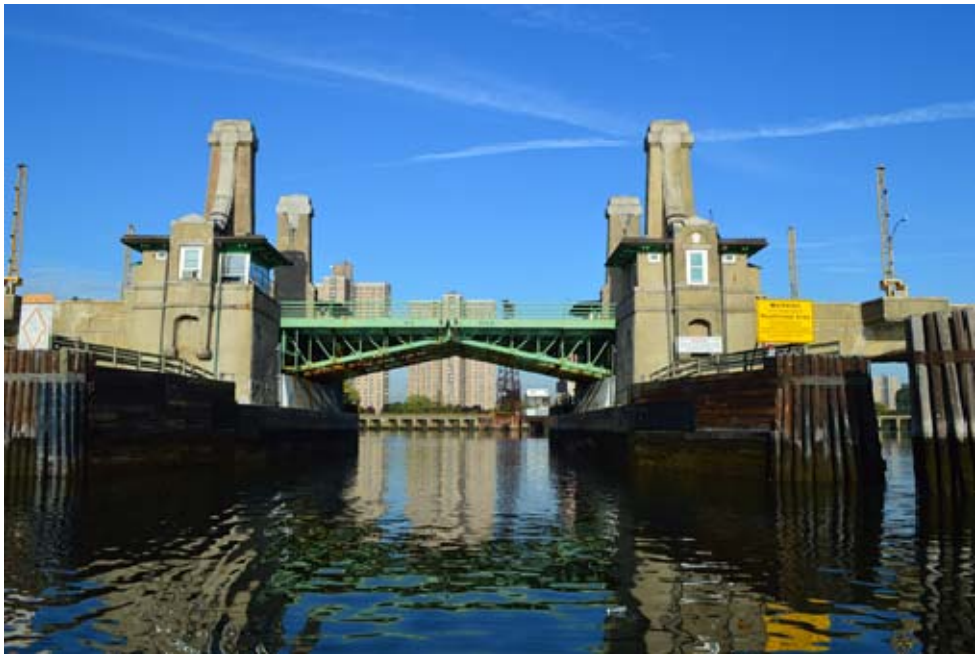
Pelham Bridge Concrete Arch Construction using the Melan System

The movable span is a double-leaf, Scherzer Rolling Lift Span with a total of four truss lines per leaf. The Scherzer patent bridges were in common use at the time, and this bridge is listed in their catalog. The mechanical components were typical of that bridge type, but the size of the span was fairly small for commercial navigation as it provided only a 60-foot channel.

Pelham Bridge Scherzer Span Under Construction

In the 1930's, the Army Corps established a Federal Channel at Eastchester Creek. The channel necked down at the existing Pelham Bridge and the adjacent Amtrak railroad bridge to the North. The creation of the Federal Channel contributed to the growth of industry up river, particularly at the boundary between the Bronx and Westchester County where today the river is lined by port facilities including bulk oil facilities, sand and gravel yards and scrap facilities. Vessels bound for these facilities need to pass through the Shore Road Bridge. There are currently approximately 750 span openings per year, with virtually all of them for commercial vessels. In many instances the vessels require opening of the 14-foot-high Shore Road Bridge but not the 30-foot-high Hutchinson River Parkway Bridge upstream. The narrowness of the channel and frequent vessel impacts have been a concern to NYCDOT and vessel operators.

Scrap Barge Passing the Shore Road Bridge



Existing Shore Road (Pelham) Bridge

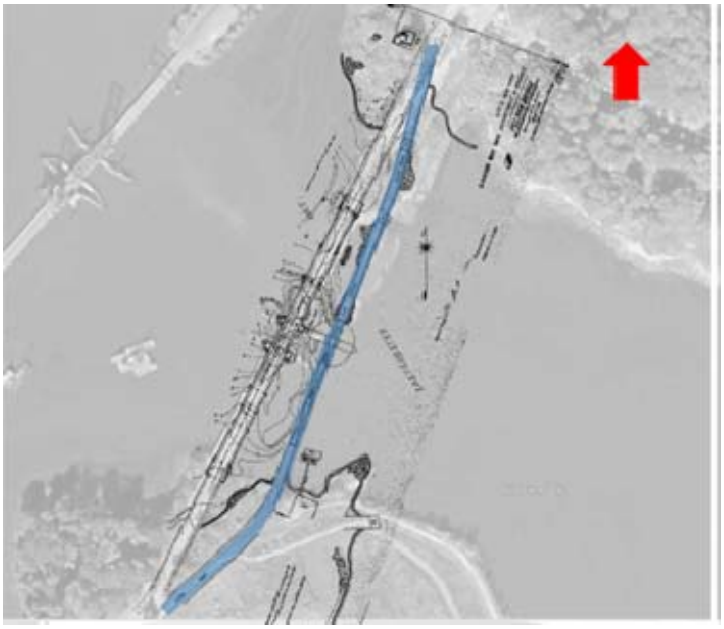
While there were less than 200,000 passenger cars registered in the US when the bridge was built in 1908, this number grew 50-fold over the next ten years and another 20-fold through the present day. Over the last 110 years, the traffic demand on the bridge has changed yet the structure has held up well. Unfortunately, time and exposure to the saltwater environment have taken their toll on the bridge. This, in combination with nonstandard geometric features, the narrow channel and the need for improved pedestrian / bicycle facilities led to the conclusion that the bridge needed to be replaced.

Alternative Development

To screen the replacement alternatives and move the project forward, various design options needed to be compared to the project goals and objectives. Some of the key concerns included:

- Provide 75-year service life
- Eliminate non-standard geometric features
- Meet applicable New York City and New York State DOT design criteria
- Improve operational reliability
- Protect electrical and mechanical from floodwaters
- Eliminate vessel impacts to fenders
- Minimize adverse environmental effects
- Improve pedestrian and cyclist facilities
- Minimize construction traffic impacts
- Minimize future maintenance and operational costs
- Reduce the number of movable span openings

There is no established right of way for the bridge, but both approaches are within city owned park lands. Therefore, the Parks Department was a major stakeholder in the project. To meet current geometric standards, some areas of the park would need to be occupied by the new bridge approaches. To minimize the time that the bridge was under construction and help contain costs, an off-line replacement was preferred. Alignments to the north and the south of the present alignment were considered, but it was decided that the best alignment was to the south, close to the alignment of the prior swing span. Upon completion of the new bridge, the footprint of the old bridge will be restored as parkland.



Current and Prior Bridge Alignments

Proposed Bridge Alignment

Although low level movable bridges were considered for this project, they would not meet the goal of reducing span openings and they would also be low to the water and subject to flooding. One of the larger hurdles was comparison of a mid-level movable bridge option to a high level fixed bridge option. A high-level bridge had been dismissed in a prior study in favor of a mid-level bascule. In addition, the local community had shown a preference for lower profile bridges on the nearby City Island Bridge project. However, the high-level bridge was revisited to confirm whether it could be made to work for this site. The high-level bridge would have steeper grades, a higher initial cost, and would require raising the City Island Road intersection in the park. This bridge type also necessitated more complex maintenance of traffic and resulted in more wetlands and park impacts. These disadvantages were weighed relative to the advantage of eliminating future span openings with a fixed bridge.

A mid-level double-leaf bascule was selected as the preferred alternate as this best met the overall project goals and objectives. The southerly alignment and mid-level profile allowed for roadway grades of under four percent while meeting grade before the City Island Road intersection and avoiding the landfill at the southwest quadrant. The new 168-foot trunnion bascule will span over a 115-foot-wide channel, nearly doubling the channel width and reducing the potential for fender impacts. The number of span openings will be cut in half. The new bridge will be built as twin double-leaf bascules with the potential for taking half of the bridge out of service in the future for reconstruction. The inability to take the bridge out of service made maintenance of the existing bridge challenging. The new bridge will incorporate a wide shared use pedestrian / bicycle facility which offers improved connectivity with bike facilities within the park.

Proposed Double-leaf Bascule

Future Work

The environmental review and design approval is scheduled for completion in 2018 followed by final design of the new bridge. Construction is expected to start in 2022.