

**HEAVY MOVABLE STRUCTURES, INC.
NINETEENTH BIENNIAL SYMPOSIUM**

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**Southwest First Street Bascule Bridge
Replacement**

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**RENAISSANCE ORLANDO AT SEAWORLD
ORLANDO, FLORIDA**

Abstract

The complex \$67 million in-line replacement project of the SR 969/SW 1st Street Bridge over the Miami River required improvements to the navigation channel horizontal clearance, increasing the vertical clearance over the local roadways of North River Drive and South River Drive, and bicycle and pedestrian facilities that meet current standards. Primary challenges were minimization of impacts to the community and the adjacent NRHP-listed Miami River Inn within a very constrained urban right-of-way. Retaining the cultural and historic context of Miami's South River Drive Historic District was an important component of the design requirements.

The new 507-foot replacement bridge includes a 315-foot double-leaf bascule span over the Miami River with a 125-foot navigation channel. Two new approach spans provide 18 feet of clearance over North River Drive and South River Drives. The new bascule span includes an innovative barrier-mounted span lock system to facilitate maintenance and an Exodermic® concrete deck to improve rideability and protect the underlying structural steel. Bridge foundation design features to protect adjacent structures were the requirement of preformed holes for prestressed driven concrete piles and use of micro piles near the NRHP-listed Miami River Inn.

Mitigation of impact to historical resources and the community were critical. Landings for the "Catwalks" from the historic Miami River Inn were incorporated into the new bridge approaches. Temporary traffic control plans used the West Flagler Street Bridge as a detour. Pedestrian access to the Miami Greenway was maintained at all times. A detailed project-specific vibration and settlement monitoring plan was developed to protect adjacent structures including residential condominiums and the Miami River Inn. Coordination with a Bridge Aesthetics Committee assisted in getting community input for a design contextually consistent with the NHRP South River Drive Historic District.

Historical and Regional Importance

The original Southwest 1st Street bascule bridge was completed in 1929 and had been in continuous service since it was demolished to make way for the construction of its replacement in 2019. Serving as the eastbound connection between the neighborhoods of Little Havana and Downtown Miami, this bridge is a core artery through the heart and soul of Miami-Dade County in South Florida. Straddling the Miami River, numerous cargo and pleasure vessels ply the channel daily while pedestrians make their way up and down the Miami River Greenway on the north and south banks.

Immediately west and south of the bridge lies the historic Miami River Inn, which makes up the majority of the South River Drive Local and NRHP Historic Districts. An additional historic property, the J.W. Warner house, sits just to the west along Southwest 1st Street. These structures predate the 1929 bridge, with three of the Miami River Inn buildings connected to the bridge via catwalks.

With the area undergoing a renaissance, the crossing's importance is further highlighted. Just north of the bridge along both the east and west approaches stand new apartment buildings, demonstrating the growth that the area is experiencing.

Design Features

Substandard features of the original 1929 structure posed significant maintenance issues for the Department in addition to being structurally deficient. Low clearance over both North and South River Drives to the east and west respectively led to multiple vehicle impacts on the approach spans. Additionally, the bascule span itself was relatively low, resulting in several vessel collisions and frequent openings. Furthermore, the channel was skewed to the river and relatively narrow at only 75 feet between the fenders. The replacement structure, therefore, squeezed increased vertical clearance over South River Drive, North River Drive, and the Miami River itself, between SW 5th Avenue, the nearest intersection to the west, and an I-95 ramp just to the east. Furthermore, founding the bascule piers on land helped increase the channel width to 150 feet while facilitating construction, though cofferdams were none the less necessary due to proximity with the river.



Vehicle impact damage to the 1929 structure approach span girder flanges.

An Exodermic® deck system on the movable span provides for three structurally efficient, smooth-riding and quiet traffic lanes over the river, with bicycles and pedestrians accommodated by shoulders and broad sidewalks. At sidewalk level at mid-span, barrier-mounted hydraulic span lock assemblies provide for easy maintenance.

Maintenance considerations also informed the mechanical and control system design along with established FDOT requirements. An electro-mechanical drive system consisting of two redundant 150



Deck-mounted span lock assembly with hatches open.



A view of the machinery from behind.

horsepower motors, a central primary reducer with differential, and two secondary reducers operates each leaf. Relay-based controls interface with modern flux vector drives to energize the motors and provide for safety interlocking while a PLC monitors the system to provide certain operational and fault information for maintenance staff.

Historic considerations were of course important in the design of the new river crossing. Commitments made during the Project Development and Environment (PD&E) study in accordance with the National



Provision was made to connect to the existing catwalks at the Miami River Inn.

Miami River Inn buildings via catwalks, which were incorporated with the new structure. This required some creativity to engineer as it was necessary to support the existing catwalks during construction as well as interface them with the new, higher sidewalk profile.

Environmental Policy Act ensured that the new bridge and its construction do not unduly impact—and rather complement—the local area. This included selection of substructure type and subsequent vibration monitoring to avoid damaging adjacent historic structures as well as architectural design to blend with the existing neighborhood while also channeling the area's more recent development.

One set of design features of particular historical importance are the catwalks. The 1929 structure was connected to the adjacent historic

Construction Considerations... and Challenges

The Southwest 1st Street bridge is the eastbound half of a one-way pair with the Flagler Street bridge, located only about 500 feet to the north. We were able to modify the Flagler Street bridge control system from one-way to two-way traffic with little more than the addition of a set of traffic signals and some



Note the proximity of the adjacent historical structures to the site—especially the abutment and walls.

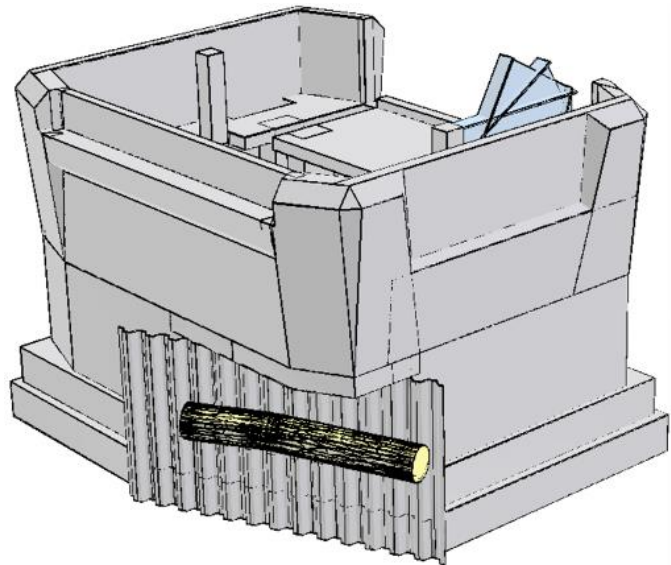
temporary electrical work. Eastbound traffic was then routed from the Southwest 1st Street river crossing to Flagler Street for the duration of construction, subjecting the traveling public to only a relatively minor inconvenience considering the in-line replacement.

As noted above, there are several historical buildings immediately adjacent to the bridge and roadway, requiring typical urban construction techniques and additional vibration monitoring to ensure that there were no lasting impacts to the community.

As with all projects, there were issues during construction. However, all the core stakeholders worked together to reach quick, efficient solutions. An unforeseen buried utility was discovered crossing directly through the proposed northeast corner of the far bascule pier. In strict accordance with Murphy's Law, this discovery occurred just before placement of the sheet pile cofferdam, requiring an immediate, all-hands response by the design team to redesign the bascule pier to accommodate the utility

Summary

The bridge was opened to the public in January of 2022 and has been operating as expected since then. The contractor was able to receive their schedule bonus irrespective of the utility issues and various stakeholders have expressed satisfaction with the end result. All in all, the Southwest First Street bridge over the Miami River ended up being a model of innovation and cooperation between the public, the owner, the design team, and the contractor.



The far bascule pier was redesigned on the spot to accommodate an unforeseen buried utility.