Heavy Movable Structures, Inc.

SIXTH BIENNIAL SYMPOSIUM

October 30 - November 1, 1996

Doubletree Resort Surfside
Clearwater Beach, Florida

Rehabilitation of the Dorset Avenue Bridge over Inside Thorofare, Ventnor City, Atlantic County, New Jersey

by

Richard C. Kreppel, P.E., A.G. Lichtenstein & Associates, Inc.

1996 MOVABLE BRIDGE SYMPOSIUM

REHABILITATION OF THE DORSET AVENUE BRIDGE OVER INSIDE THOROFARE VENTNOR CITY, ATLANTIC COUNTY, NEW JERSEY

By: Richard C. Kreppel, P.E.

A.G. LICHTENSTEIN & ASSOCIATES, INC.
45 Eisenhower Drive
Paramus, New Jersey 07652

General

Dorset Avenue Bridge over Inside Thorofare is a double leaf Strauss Bascule structure that was in need of major rehabilitation after more than 60 years of service. Atlantic County Freeholders authorized the complete replacement of the mechanical and electrical systems, architectural renovation of the four bridge towers, structural repairs, lighting, approach roadway work including an interconnect to traffic signal operations, fender reconstruction and other miscellaneous repairs. These improvements were based on a detailed inspection, analysis and feasibility study prepared by Lichtenstein in 1986.

The bridge was built in 1926 and carries Dorset Avenue over Inside Thorofare, part of the Intracoastal Waterway, in Ventnor City which is located just south of Atlantic City, New Jersey. The bridge is a double leaf Strauss Bascule with a span length of 79'-0" providing a clear horizontal channel width of 50'-0". Each leaf consists of two deck girders with floorbeams, stringers and an open steel grid deck. The main span is flanked on each side by 70' approach spans also consisting of a two girder/floorbeam/stringer superstructure supporting a half concrete filled steel grid deck.

The operating mechanism is the patented Strauss type of the underdeck counterweight variety. The existing structure was powered by two motors, one per leaf. The motor control centers are located in the lower level of the bridge towers.

At the roadway level of the bridge, a clear roadway width of 36'-0" is provided between the curbs flanked by 8'-0" sidewalks. The bridge serves as the only connector within the city limits between the east side of the city which is primarily commercial and the west side which is primarily residential. All emergency services are situated on the east side of the bridge.

Because of Ventnor's proximity to Atlantic City and its own summer tourist attractions, traffic movements in the area are of concern particularly in the summer. Therefore any construction activities that impacted this vital link in the traffic network needed to be carefully scheduled. Seasonal traffic requirements extend through the Miss America Pageant activities which take place at the end of September each year.

During the feasibility study phase of the project, it was determined that a complete replacement of the mechanical and electrical system was necessary because of extensive wear over its 60+ years of service. The motors and exposed gears had been submerged on many occasions during times of extreme high tides. Excessive wear on the counterweight trunnions had been detected thereby requiring their replacement. The main trunnions were found to be in good condition. The concrete counterweight was severely spalled because of its continual submergence by salt water caused by overtopping of the counterweight pit and by infiltration through deteriorated mortar joints between the ashlar blocks making up the counterweight pit. Contributing to the spalling condition was the rusting of the steel shot in the counterweight concrete mix used to increase the concrete unit weight.

The structural steel portion of the bridge was rusted and in need of cleaning and painting but was otherwise in fairly good condition so that no major structural work was necessary. The timber fender system was in poor condition and required complete replacement.

In order to address the above deficiencies in a construction contract, several items of work required closure of the bridge for a period of time. The bridge had to be in the open position per Coast Guard requirements for Intracoastal Waterway craft using Inside Thorofare. Operations for replacement of the electrical and mechanical systems and the replacement of the

counterweight trunnions needed roadway traffic detoured. An investigation was made into performing the rehabilitation one span at a time thus enabling one span of the bridge to remain operational for marine traffic while keeping the bridge open to vehicular traffic. This was discounted for two reasons:

1) Access to the counterweight trunnions was prohibited with the span in the down position.

2) The overall inconvenience to Ventnor City would be prolonged.

Based on this, it was determined that the roadway would be closed to traffic so that the bascule leaves could be raised and tied back in the open position while the counterweights were temporarily supported and the counterweight trunnions removed, reworked and replaced. During this same time period the electrical and mechanical overhaul would be performed.

Community Involvement

When it had been determined what needed to be done to the bridge and what manner would best serve the overall construction, the project was presented to Ventnor City officials. City officials were not particularly pleased that the bridge would have to be closed to traffic for a period of time but understood that the decision to do so was well founded. As such, they agreed to the plan but requested that the period the bridge would be closed be as short a duration as possible so as to minimize inconvenience to the general public and to minimize the impact to public safety since the western side of the city would be separated from emergency services located on the east side by a long detour route. Given these restrictions, the design and construction process was tailored such that portions of work requiring the complete closure of the bridge could be performed in a 60 day time frame. It was also determined that the optimum time of year for this work would be between the dates of January 1, 1995 and March 31, 1995. The specifications were written such that the Contractor could close the bridge for a continuous 60 day period at any time between these two dates. A $3,000 per day damage clause was included for failure to open the bridge within the 60 day period and a $1,500 per day incentive was

provided for early completion. As the design phase continued, Ventnor City was kept well informed of aspects of the project which may adversely affect emergency response times. City officials felt it would be prudent to provide a field office located on the west side of Ventnor City for the sole use of Ventnor City officials as an emergency command post.

To meet this stringent schedule, it was understood that multiple work shifts would be required by the Contractor. This scenario was presented to the city who agreed that the schedule should be made part of the specifications, however, the city had a noise ordinance which would be violated if the Contractor was allowed to work the extra shifts necessary. To remedy this situation, the city passed a temporary waiver of the ordinance for this project.

The specifications also allowed the Contractor to commence those construction activities which did not impact boat or vehicular traffic or require closure of the roadway starting August 15, 1994 and to complete all construction activities no later than May 25, 1995, in time for the summer tourist season.

Procurement of Materials

In recognition of the time delays that would result should the Contractor not secure the proper materials necessary to complete the work during the bridge closure, the specifications were written such that the Contractor would not be allowed to close the bridge until all materials were on site. Many of the materials required for the project, primarily the electrical and mechanical items, were long lead time items. This necessitated a very early submission of shop drawings, an expeditious review by the Engineer and a timely fabrication by the suppliers. In recognition of these long lead items, the Engineer analyzed procurement times required for the various materials and recommended that the County pre-purchase the secondary reducers during the design phase of the project which the County did. The time frame expected for supplying this item would not have allowed for its delivery by the January 1, 1995 date for closure of the bridge.

Proposed Work

The rehabilitation plans provided for the complete replacement of the mechanical and electrical system. A four (4) motor system was proposed controlled by a Programmable Logic Controller (PLC). Mechanical equipment was physically located as high as possible to minimize submergence during extreme high tides. Where components could not be set above these limits, lifting lugs, disconnects and lifting devices were provided to enable County personnel to lift the apparatus above flood water levels. The Motor Control Centers (MCC) were situated in the towers at the roadway level thereby eliminating their susceptibility to submergence. Two (2) new submarine cables were installed, one for communication between the operator's house and the MCC across the channel and the other cable for power. Renovations of the four operator/control towers were performed. One of the towers was converted to a comfort station. The entire bridge was cleaned and painted and miscellaneous structural steel repairs were also made. The entire fender system was replaced in-kind.

Construction

Bids for construction were received on February 24, 1994 with the low bidder being Cornell & Company of Westbury, New Jersey. The contract was awarded and shop drawing review began in July 1994. Actual construction activities commenced in August of 1994. At the pre-construction meeting, arrangements were made with local officials for monthly briefing meetings to keep local officials apprised of the ongoing work situation. During the closure of the roadway, these meetings were held every two weeks.

From August through January, prior to closure of the bridge, the Contractor performed many operations both in preparation for the closure and independent of the closure. These work items are described below.

The counterweight pits were rehabilitated by repointing the ashlar blocks and rebuilding the concrete walkway on the channel side of the pit. This was a first priority since making the counterweight pit water tight was essential prior to repairing the counterweight concrete.

After the counterweight pits were repaired, work began on the repair of the counterweights. The specifications required a micro-silica additive to the concrete mix for the counterweight repair. The Contractor chose to apply the concrete pneumatically.

Work began on the supports for the new machinery where there was no interference from the existing machinery while it was still operational. The new submarine cables were installed across the channel. Portions of the fender system which did not require that the bridge be in the open position were reconstructed. During this period shop drawing reviews, material ordering and delivery of material took place in preparation of the closure of the roadway.

On January 3, 1995 at 5:30 A.M., Ventnor Police began to detour traffic away from the bridge and the contractor moved his operations onto the structure. A 30 ton crane was placed on each approach span, and supply trucks offloaded right onto the spans. The bridge was raised to the fully open position and the tie-backs secured. This was the last time the bridge opened under power from the existing machinery. The power was cut to the bridge and the rehabilitation began.

The Contractor placed identical iron worker and labor crews on each side of the bridge so work would proceed in step. Two-ten hour shifts were used at this point. Iron worker and labor crews worked the first shift and a second labor crew worked the second shift during the demolition phase of the work. Electrical crews worked the first shift and the painting contractor varied his shift to work around the other crews.

Existing mechanical and electrical equipment was removed. The existing girder racks were carefully removed from the girders and transported to the fabricator for use as templates for fabricating the new racks. One hundred ton jacks were placed under each counterweight and

engaged to relieve the load from the counterweight trunnions. Once completed, the counterweight hangers were cut and all existing connections removed. At this time, the remainder of the fender system was replaced.

The electrical crews performed the necessary work to provide power to both sides of the bridge through the new submarine cables. Motor control centers were installed on each side of bridge. Installation of the new drive system commenced with separate crews at each of the four locations. Concurrently, the new counterweight trunnions and hangers were installed. Once in place the counterweights were engaged by releasing the jacks.

With all machinery and electrical items in place, the tie-backs were removed. Though not ready for opening to traffic, the bridge was ready to be tested and balanced.

Many days of testing took place to verify all phases of the PLC operation. Balance testing utilizing the strain gauge method was conducted and weight adjustments were made.

At this time, traffic gates and lights were installed on each side of the bridge, fender lighting systems and tide gauges were placed to aid boat traffic, and overhead lights were installed for roadway lighting.

A new timber deck sidewalk was installed on each side of bridge and new galvanized steel guide rail was erected along the bridge roadway.

On March 1, 1995 at 11:00 A.M., the bridge was reopened to traffic. This occurred 56 days from the closure date, four days ahead of schedule. At that time, the final phases of the project began.

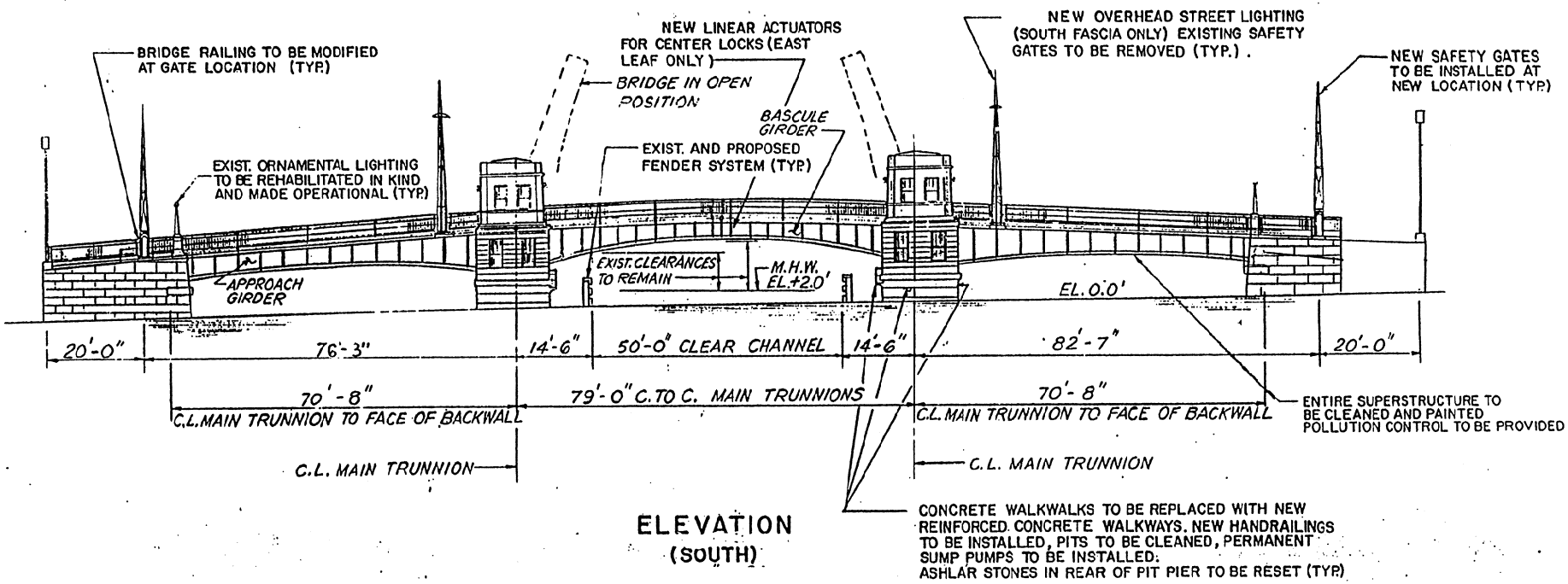
The Contractor conducted training sessions for all County bridge tenders. Over a period of time, all tenders were instructed on operation of the new system. Once the County was assured of their operators' familiarity with the new system, the County re-assumed operation of the bridge.

The exterior of the four towers were cleaned and restored to an original "look" condition. Roofs and walls were patched, windows and doors replaced, a textured, colored sealant in the shade of the original buildings was applied to provide a uniform appearance. Ornamental lights similar to the original lighting were installed on the houses.

The construction of the interior of the towers varied with the intended use of the towers. The control room area was insulated and ac/heating units, telephone, cable and marine radio installed for the operator's use and comfort. A second tower was insulated, ac/heating units installed and equipped with full rest room facilities for the sole use of the operators. The two towers with the motor control centers along with all four lower level machinery rooms were cleaned, patched and painted.

Conclusion

This project is a prime example of the benefits of involving the local authorities in a project that greatly affects the community. Had the project proceeded with little or no input from local authorities, the bridge would certainly have been closed for an extended period of time at a great impact to both the City and the County. By presenting the project to the community early in the planning stages for coordination prior to construction, the community's input was systematically incorporated into the Contract Documents. Additionally, the early involvement of the community promoted communication among City and County officials and the designer as to what could and what could not be realistically accomplished. By implementing incentives and disincentives, the Contractor was well aware of the importance of an expeditious completion of work. Much has been accomplished from the procedure carried out which can be applied to other projects that are locally sensitive.



ELEVATION
(SOUTH)

REHABILITATION OF THE DORSET AVENUE BRIDGE OVER INSIDE THOROFARE VENTNOR CITY, ATLANTIC COUNTY, NEW JERSEY