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Autor: Winders, E.E.
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19. Troy-Green Island Bridge, New York (USA)

Owner: *New York State Department of Transportation*
Design Engineer: *N. H. Bettigole Co.*
Construction time: *42 months*
Service date: *September, 1981*

Summary — including Innovative Design Features

- Towers: The counterweights pass beneath the level of the roadway, reducing the height requirements of the towers.
- Counterweights: Four individual counterweights are used rather than two.
- The tower piers, supported to 56 ft below the mean high water level, are set on 76 caissons, each 3 ft in diameter.
- Main drive: The two 36-ton sheaves on each side of the river are driven as a pair by a single main gear reducer.
- Bracing system: The K bracing system used in the towers has produced a structure satisfactorily free of vibration and movement.
- Maintenance and repair: Through the use of weathering steel, stainless steel and high density concrete overlays, the bridge is as nearly maintenance free as possible.
- Sheathing: In addition to its inherent maintenance advantages, the stainless steel tower sheathing achieves an aesthetic compatibility and acceptance with the environment.

Alternates considered

A 200-ft double-leaf bascule as an alternate bridge design would have required substantially larger piers than the vertical lift bridge; and thus in order to satisfy the minimum US Coast Guard river channel clearance, the vertical lift solution was desirable as being more cost effective, aesthetically pleasing, and less impacting on the hydraulics of the area.

Project Description

September 12, 1981, highlighted the grand opening of the new Green Island Bridge crossing the Hudson River at Troy, New York. This structure replaces the former vertical-lift bridge which collapsed in March, 1977, due to the failure of an undermined pier supporting the east structure.

The project consisted of a vertical-lift bridge across the east channel of the Hudson River which includes the 30' vertical lift span, two short tower spans and two approach spans. In addition, a continuous structure crosses the west overfluct channel of the river. Included within the project scope were the improvement and reconstruction of access roadways from the communities of Green Island and Troy,

New York. The length of the project is 2,120 ft and provides for one sidewalk, one bicycle lane, and four lanes of vehicular traffic.

The structure over the east channel, the navigable channel, is a 204-ft, 2.8 million pound lift-span serviced by 200-ft approach spans. The movable span, like each of the others, is of multiple stringer type construction and incorporates a lifting girder at each end. Power is provided by four 60 hp motors each turning 15-ft diameter sheaves through a pinion and bull gear arrangement. Forty-eight (2 3/8" diameter) wire ropes, twelve in each of the four towers, connect the lift-span to the counterweights.

The towers are constructed outside the fascias of the bridge and are connected by stiffening struts over the roadway (which contain the machinery houses). The towers consist of structural steel framing and are sheathed with stainless steel to enhance aesthetic appeal. The sheathing completely encloses the operating machinery, counterweights and the operator's house.

The west channel bridge is a two-span continuous structure 370 ft in length. Its superstructure consists of multiple steel stringers supporting a reinforced concrete deck.

Priority Time Schedule

Because the collapsed bridge was a vital link to the economic functioning of the area and its replacement, an urgent matter, NYSDOT acted to "fast-track" the design effort. Contracts I and II incorporated the substructure of the vertical-lift bridge and were completed in September, 1978, and January, 1979, respectively. Contract III, which included the superstructure of the vertical-lift bridge, the west channel structure and all roadway improvements, was completed in March, 1979. The total design effort was completed in less than ten months.

Conclusion

The bridge provides a transportation corridor to downtown Troy, a city of 56,000 people, and to the Town/Village of Green Island, with its 2,665 people. In anticipation of heavy traffic usage, this four-lane structure is designed to accommodate 20,300 vehicles per day expected by 1995. The exclusive bike lane has been identified by the Capital District Transportation Committee as part of a Primary Urban Arterial Bikeway Route. Also, a sidewalk has been included (on the bridge) to accommodate pedestrians with access features for the handicapped.

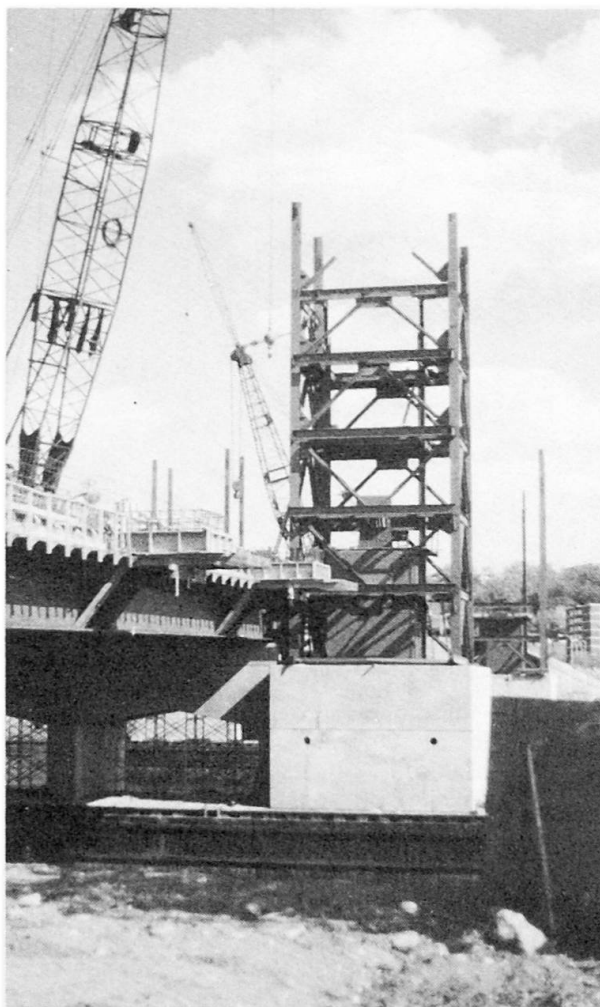
Further, the Hudson River is the primary access route for shipping into New York State through the Erie and Champlain Canals. In 1980, for example, the Erie Canal handled more than 600,000 tons of shipping while the Champlain network

handled more than 1,000,000 tons. Also, over 2,600 recreational vehicles travelled this section of the river in 1981.

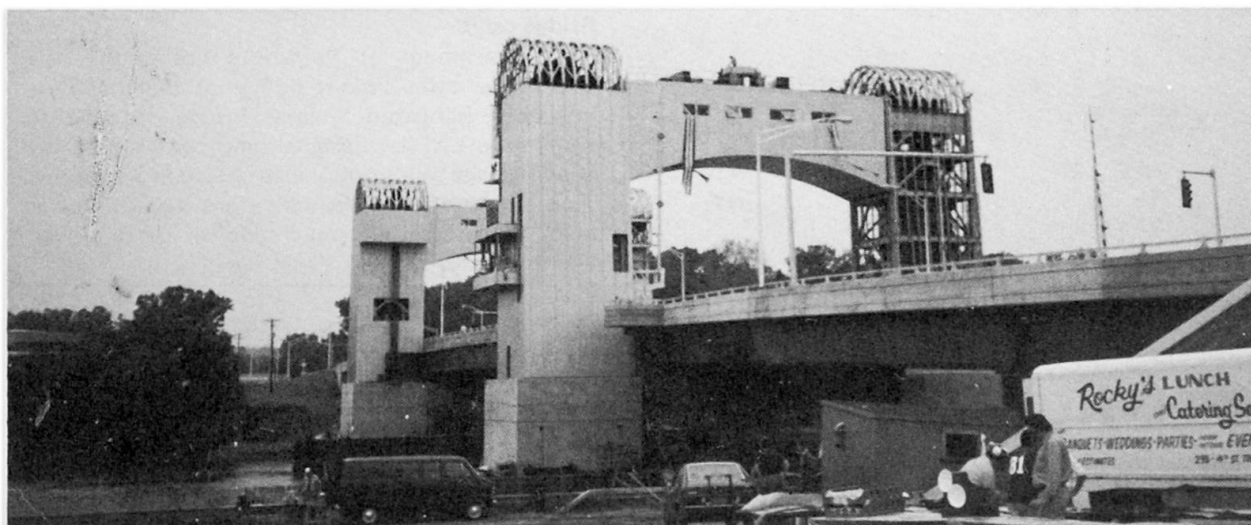
During normal operating conditions, the lift span requires two minutes to raise and two minutes to lower. In addition, back-up emergency motors are capable of lifting the span in only eight minutes. Minimum vertical clearance when the bridge is open is 60 ft above the mean high water level, thereby allowing even the highest commercial or recreational vessel in this area to pass beneath without restriction.

Understandably, the bridge, in the eyes of local residents, is the "gateway".

(E. E. Winders)



Vertical lift tower under construction



Towers being sheathed view