Heavy Movable Structures, Inc.

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Use of Temporary Acrow Panel Lift Bridge at the Tomlinson Bridge Project in New Haven, Connecticut

by

Bill Killeen, ACROW Corporation of America

USE OF TEMPORARY ACROW PANEL LIFT BRIDGE
AT THE TOMLINSON BRIDGE PROJECT
IN NEW HAVEN, CONNECTICUT

NOTE: A carousel slide projector is needed.

a. Why a temporary movable bridge is being used.

Traffic volume on U. S. Route 1 in New Haven dictated maintaining traffic. The engineers, Hardesty & Hanover, had two choices. Traffic could be directed over a partially disassembled existing double leaf bascule bridge or incorporate a temporary movable bridge on a parallel alignment and route traffic to it.

Additional studies were conducted by Connecticut, Hardesty & Hanover , and Parsons Brinckerhoff of New York City before coming to the decision of using a detour bridge. Partially disassembling the existing bridge would compromise its integrity. The cost for structural work required to upgrade the double leaf bascule and approaches became prohibitive. Thus, it was decided to move forward with the design of a temporary movable bridge. Following further studies, it was decided that a vertical lift bridge would provide the best service and economy for this temporary crossing.

b. Characteristics of Acrow Vertical Lift Bridge

1. The clear simple span of the movable section is 45.8 meters.
2. The road width is 7.3 meters.
3. On the north side there is a cantilevered sidewalk with a 1.5 meter width and 1.5 meter tall handrails.
4. The bridge deck is comprised of 3 X 1.8 meter orthotropic steel units with the road surface coated with high friction epoxy aggregate.
5. Steel "Jersey" barriers provide traffic protection on the lift span.
6. At each corner there is an Acrow four-panel square tower that is approximately 18 meters tall. Travelling up and down inside each tower is a 38 tonne counterweight. Counterweights in the north towers are heavier than those in the south towers due to the sidewalk.
7. Spanning transversely from tower to tower is the crossbeam which houses the counterweight and hoist sheaves and supports the machinery span.

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8. The machinery span supports the winch and spans 45.8 meters longitudinally from crossbeam to crossbeam.

9. The control cabin is supported over the eastern roadway by propped cantilevers bolted to the towers.

10. Worker access from the ground to the cabin is provided by scaffolding stairs.

11. To access the crossbeams and machinery span, you need to walk through the control cabin and climb a caged ladder. The ladder terminates at the lower access deck on the crossbeams. To access the machinery span, you climb two ladder rungs to the upper crossbeam access deck and then walk down two steps onto the machinery span.

12. The opening and closing times are approximately two minutes.

13. The main span was designed for AASHTO HS20 loading. It was also designed for 2,000,000+ cycles of load and a deflection ratio exceeding L/1000.

C. Mechanical Aspects

1. The main span weights approximately 150 tonnes.

2. The out of balance weight is about 5 tonnes span heavy.

3. The system incorporates independent counterweight and hoist wire ropes. The counterweight ropes are 28 mm, and the hoist ropes are 15 mm.

4. Centered on the machinery span is a hoist with a four-line rope drum. The hoist can lift a safe working load of 15 tonnes or three times the out of balance weight.

5. The hoist has two 480 volt motors. The primary motor operates through a frequency controller. The frequency controller allows the hoist to lift slowly for the first 300 millimeters, then ramp to full speed, and then ramp back to 0 for the last 300 millimeters as the bridge reaches the upper limit. The same happens in reverse. The secondary motor is a small full-duty motor used during inspections and emergencies where the primary motor is not operating.

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Mechanical Aspects (continued)

6. The counterweight ropes pass over two 658 millimeter sheaves, and the hoist ropes pass over three 390 millimeter sheaves. The lower hoist rope sheave is adjustable so that the bridge can be leveled for lifting.

7. There are four counterweight ropes per corner. There is one two part hoist rope per corner.

8. The dead end of the hoist rope incorporates load cells for monitoring lifting loads.

9. All live load reaction is passed through to the bridge bearings.

10. Counterweight ropes attach to high strength rods at the counterweight. These rods pass through a void in the counterweight. Rope load equalization is achieved by attaching center holed jacks to the rods. The jacks are manifolded together. Equalization is achieved due to the manifolding.

d. Electrical Aspects

1. The interlock system is as it would be on many movable bridges. The operator must follow the sequence, otherwise the system will not operate.

2. The traffic lights are switched to red, and the gong sounds. The gates are lowered. With the gates down, the crash barriers can be lowered. Once the barriers are down, the winch motor is energized. Press the automatic up button, and the span raises to the maximum limit. At the top, the navigation lights change to green.

3. This is a hard wired system not utilizing a PLC.

4. Many operation signals come from a series of rotary limit switches mounted at the end of the winch rope drum.

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5. There are two separate operations desks. There are the normal operations desk and the emergency operations desk.

6. When using the emergency desk, all interlocks and limits are bypassed except for an extreme upper limit switch.

7. Electrical power is supplied via the east approaches. Should power be lost, a generator is staged at the end of the east approach. It is necessary to toggle a switch to connect the generator to the system.