A Lift Bridge Constructed on 4 Per Cent. Grade

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A lift bridge of unusual design was put in operation last fall at the Main St. crossing of the Barge Canal in Fairport, N. Y. The old crossing at this point was made by a fixed bridge 80 ft. long, on a skew of about 32°, having a clearance of 12 ft.; the barge-canal construction required a length of 139 ft. and a clearance of 15.5 ft., the elevation of the water being the same in both cases. Economical prism alignment required that the increased width for the new canal be made on the south side, and that the north abutment of the new bridge be located on

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FIGS. 1 AND 2. FAIRPORT, N. Y., LIFT BRIDGE; ON 4% GRADE AND 32° SKEW
(Upper view, finished bridge; lower view, erecting extension girder)
the site of the old abutment. In order not to increase
the grade of the north approach, which was already pro-
hibitive (10%), and on account of a railway crossing at
the foot of this approach, it was impossible to design a
structure of the fixed type. On the other hand, it was
desired to reduce the grade of the north approach, and
this could only be accomplished by a bridge of the lift
type. It was necessary, however, that the south end of
the structure conform to the original elevation of the
street, on account of its proximity to several village busi-
ness blocks and also on account of the intersection with
West Ave. at the southwest corner. This condition could
be met by constructing the bridge on a grade. As the
width of West Ave. was reduced one-half by the location of
the south abutment, provision had to be made to allow
the full width to the street when the bridge is in the
“down” position.

After considering these controlling features the type of
bridge adopted by the department was a four-post lift,
constructed on a 4% grade and at a skew of 32°. The
trusses were of the Warren type; but the west truss in-
stead of being designed a through truss for its entire
length was shortened about 25 ft. and the remaining dis-
tance spanned by an extension girder carrying a 20-ft.
roadway shelf in the shape of a triangle. When the bridge
is down, its appearance is the same as that of a bridge of
the fixed type; the counterweights, lifting frame, etc.,
are concealed in underground rectangular reinforced-
concrete pits. The improvement to Main St. is very
marked in that the old north approach has been reduced
from a 10% to a 4% grade.

The length of the span between center line of lifting
posts is 139 ft.; distance between trusses is 40 ft.; dif-
ference in elevation between one end of the bridge and the
other is 5.54 ft. Cantilevered brackets on the outside of
each truss carry the sidewalks which give an additional
width of 10 ft. The total weight of the steel is 350 tons.
The extension girder is made up of two plate-girders 58
ft. long, 10 ft. deep at one end and 8 ft. deep at the other,
placed parallel, and joined together by diaphragms.
The girders are joined to the truss at the second panel-point
by riveting the end diaphragm to the lower chord.
No other rigid connection is made; the south end of the truss
simply rests upon a bearing plate attached to the dia-
aphragm at this point. The truss sits between the girders
in such a manner that the top of the flanges on the girder
are level with the top of the floor-beams. The floor is com-
posed of two thicknesses of yellow pine, the lower being
4-in. treated timber and the upper a 2-in. untreated wear-
ing surface.

The bridge has a lift of 10 ft. 7 in. It is operated by
two 37-hp. motors located under the east sidewalk near
the center of the span. The operating shaft runs across
the bridge, and the bridge is raised or lowered by two
cables (in the lower chord of each truss) which run over
sheaves on the end posts and the lifting frame to anchor-
ages in the pit floor and sidewalls.

The moving part of the bridge, which weighs about
375 tons complete, is balanced by two reinforced counter-
weights (one in each pit). Four 13½-in. cables are
attached to the counterweights at each corner of the
bridge, and these pass over large sheaves on the balancing
shaft to the lower chord of the lifting frame. The south
weight is about 10 tons heavier than the north due to the
additional weight of the extension girder. About 15
tons of concrete blocks are provided for adjustment pur-
poses. The balancing shaft rests on heavy beams which
span the pits near the top. The operating machinery has a
total weight of 46 tons.

The motors are for three-phase 60-cycle alternating
current at 220 volts. The synchronous speed is 600 r.p.m.,
and the power supply is controlled so as to limit the torque
of each motor to 4/3 normal. The average time for rais-
ing the bridge is 45 sec. Automatic cutout switches are
provided for safety in operation.

The operator’s cabin is located near the southeast
corner of the bridge and is a two-story frame structure
about 10x12 ft. in plan. Stairs are provided for foot
travel when the bridge is raised. The pits have rein-
forced-concrete walls 3 ft. thick and are 10 ft. wide, 53
ft. long, and 28 ft. deep. They have a covering of 12-in.
I-beams incased in concrete, with trap-doors at the end
posts for access to the machinery.

Each corner of the bridge and each bearing on the
masonry is at a different elevation because of grade and
skew; the floor-beams are level at right angles to the truss.
The end of the bridge, from one lifting post to the other,
is on a 2½% grade, but the lifting posts and the frame-
work are so constructed that the lower chord of the lifting
frame is horizontal, and the lifting posts are plum. The
anchorages in each pit are at the same elevation, and the
counterweights move vertically in a horizontal position.

The total cost of this bridge to the state, exclusive of
the excavation charge, was $75,000. H. S. Kerbaugh,
Inc., was contractor, and F. P. Williams, of Rochester,
Division Engineer.

![Uncovered Pit, showing Balancing Shaft, Cables to Counterweights, Etc.](image-url)