

## APPENDIX A

### Original Design and Construction of the South Grand Island Bridges

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The South Grand Island bridges each carry one direction of Interstate 190 and are located between the Towns of Grand Island and Tonawanda in Erie County, New York. Construction of the southbound bridge was completed in 1935 whereas the twin northbound bridge was completed in 1963.

The bridge centerlines are 125 feet apart and each structure has a total deck length of 3,437 feet. Each structure has 27 spans which range from 60 feet to 600 feet in length and are constructed with superstructures that rest on 26 piers and two abutments. Longitudinal thermal expansion is accommodated on both structures with an array of different bearing types and a combination of 28 modular and armored deck joints.

Both bridges were originally constructed to provide a 24-foot-wide roadway surface. The northbound bridge has a pedestrian sidewalk on the east side, while the southbound bridge has a pedestrian sidewalk (presently closed) on the west side.

The main spans of the bridges have 5 truss spans 1,760 feet in length which span over the shipping channel. The truss spans are comprised on each side with an anchor span, a cantilever span, and are connected with a suspended span. A maximum vertical clearance of 100 feet is provided over a 400-foot-wide wide navigation channel below. The suspended span is connected and supported by the cantilever spans by two large pins. These pins (non-redundant features) connect the vertical truss members to the top and mid-chord of the through-truss. The verticals at these two locations are unique, and vulnerable by current design standards, in that they are a tension-compression member with one section contained inside the other section. The interior section of the verticals acts in compression, supporting the weight of the suspended span, while the outer section acts longitudinally and rotates about the supporting pins due to loading on the bridge. To allow this rotation of the suspended span, bottom pin holes in these vertical members are slotted. Top pin holes are not slotted, but movement of the suspended span is further accommodated by a sliding arm in the top chord.

Truss members, mostly consisting of non-redundant members, are comprised of built-up riveted box-shaped chords, diagonals, and posts, with rolled floor beams and stringers comprising the framing system. Typical truss chord members, diagonals, and vertical members are further stiffened by latticing. The truss spans also support a catwalk, with OSHA non-compliant features, which is located along the centerline of the superstructure.

Both bridges have 22 approach spans that are 1,623 feet in length. The approach spans consist of built-up riveted deck girders supporting top-set transverse floor beams. In the approach spans, at every pier and every



*During construction of second (northbound) span - 1962*



*View of bridges from the shore of the Niagara River*

in tension, as the suspended span translates longitudinally and rotates about the supporting pins due to loading on the bridge. To allow this rotation of the suspended span, bottom pin holes in these vertical members are slotted. Top pin holes are not slotted, but movement of the suspended span is further accommodated by a sliding arm in the top chord.

other panel point, floor beams are additionally supported by a cross frame spanning the girders. Bottom lateral bracing is present in all girder spans, spanning struts of adjacent cross frames, providing additional lateral stiffness to the girders.



*Aerial view. The southbound structure is closest to the viewer.*

Originally, both bridges had three different types of bearing details: roller nest expansion bearings, rocker expansion bearings and fixed bearings. Throughout the years, many of the bearings were replaced to improve overall functionality.

For the northbound bridge, the approach span piers are supported on steel H-piles while the truss spans have a combination of spread footings founded on rock and steel piles. For the southbound bridge, the approach span piers have a combination of timber and steel piles while the truss spans have a combination of spread footings founded on rock and timber piles