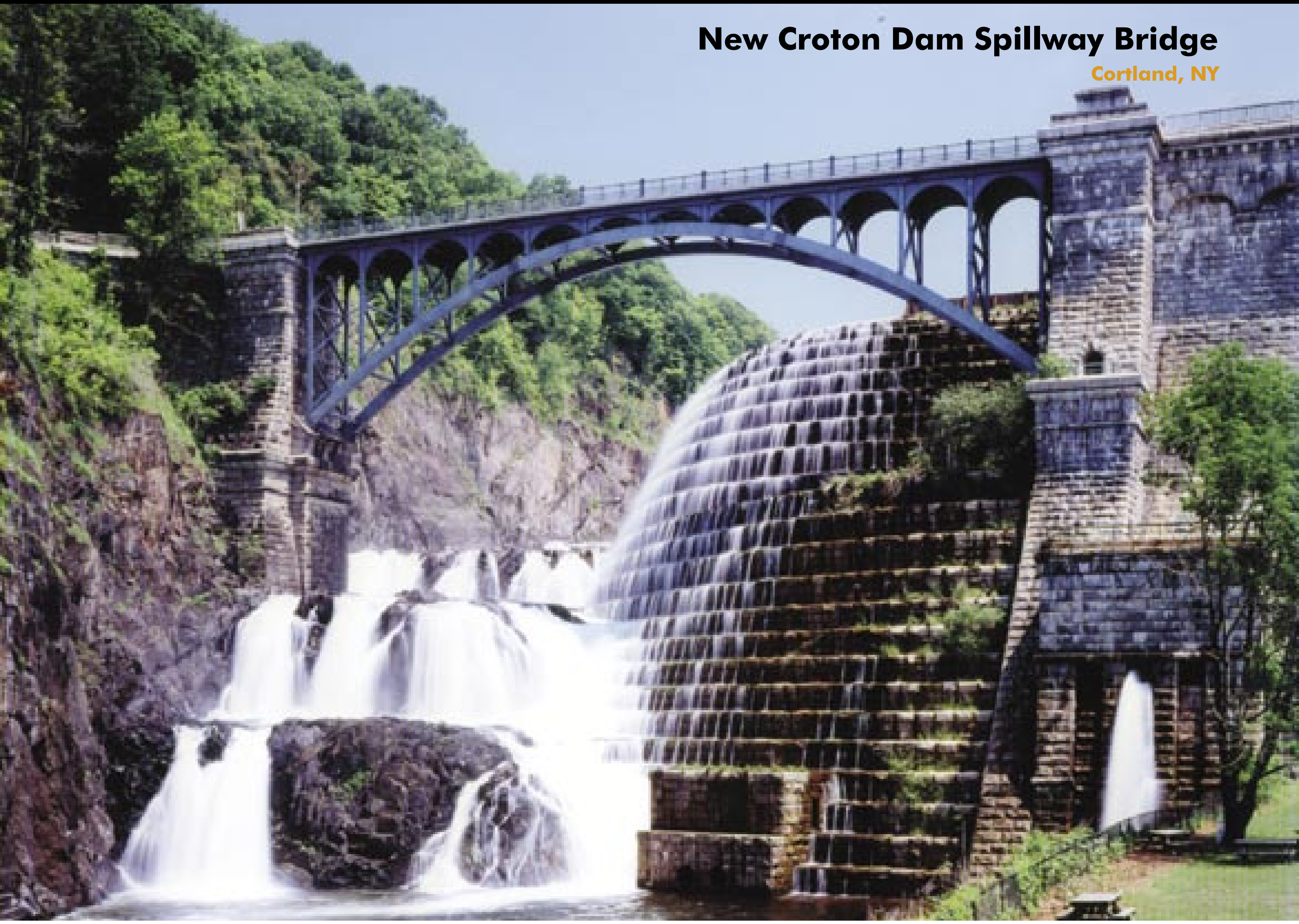
# New Croton Dam Spillway Bridge

**Cortland, NY**



Hardesty & Hanover

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**Engineering Software**
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**Detailer**
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The historic New Croton Dam has been a key element of the New York City reservoir system since 1906. A new 200'-long steel arch bridge over the New Croton Dam spillway now provides a focal point for this historic stone masonry dam in time for its 100th anniversary.

Large arch base displacements and other problems necessitated emergency closure of the previous bridge to traffic. This bridge was constructed in 1975 to replace the original structure, which was constructed in 1905. The design team was challenged with a fast-track bridge replacement and overall aesthetic improvement, as well as maximizing service life and devising innovative procedures for erection over the spillway torrent.

Structural steel was chosen for this $4.6 million project because it could be crafted to an efficient form that was both light in appearance and timelessly durable. An innovative erection scheme was devised that supported both a work platform and erection shoring from the existing arches to facilitate rapid, economical erection.

## Replacement Design

The replacement bridge's design was completed and all permits and approvals were obtained in a three-month compressed schedule. Designers were faced with a dilemma as to whether to attempt a replication of the original 1905 structure or to create a visually distinct yet context-sensitive structure. A consensus was reached that the new bridge should be an improved and more durable version of the original.

Spandrel columns distribute deck loads over the length of the arch, as opposed to concentrating at the center. Spandrel columns not only allow the span to function efficiently as an arch, but also serve to restrain the arch bases to prevent displacement. The new arch bases were anchored at the skewbacks using rock anchors. Another basic design element was a lateral seismic restraint at deck level. By allowing the deck system to be partially supported by the abutments, multi-rotational bearings could serve double duty as seismic restraints.

It was decided to space the spandrel columns uniformly and further apart for compatibility with the dam detailing. The arches' fascia panels were designed as stiffened steel plates with a tube welded to their arched edge for stiffening and to add visual relief. The panels were set to the back of the spandrel columns to add shadowing and further relief to avoid a flat appearance.

The 1975 bridge had the deck girders nested into and supported on the abutments. The deck joints formed a "U" in plan with inherently problematic longitudinal joints at the gutter lines. In order to eliminate these longitudinal deck joints, the deck was stopped flush with the face of the masonry abutment and a concrete seat was cantilevered out to support the deck bearings. This seat was visually concealed in the shadows of the deck system. It was anchored into the dam masonry with rock bolts and into the rock face beyond the fill at the north abutment.

The new steel superstructure included 2' by 3' welded box sections for the ribs, welded steel box sections with integral connection plates at the spandrel columns and spandrel girders, and a rolled floor beam and stringer system. Bracing elements at the columns and arch ribs were sealed HSS. The new arch ribs were fabricated in three sections with bolted field splices for easy, cost-effective erection. The new ribs would bear on the existing granite skewbacks outboard of the 1975 bridge arches where the 1905 bridge was seated.

The new bridge seats and deck incorporate high performance concrete and solid stainless steel reinforcing steel for maximum service life.

All structural detailing was aimed at minimizing corrosion potential, so sealed welded boxes and HSS were used. Details that deflected and accumulated spray away from spandrel column bases were incorporated.

The visible finish coat of all steel is a highly durable, thermally sprayed metalizing coating. The metalizing coating was an 85% zinc, 15% aluminum material with a penetrating sealer, but no paint. The inaccessible interiors of the HSS were coated by hot dip galvanizing, and the exposed exteriors of the HSS were metalized for visual continuity. The interiors of the sealed welded boxes were painted to avoid potential warping associated with hot dip galvanizing.

## Construction and Erection

Construction started in summer 2003. Initial fieldwork proceeded while shop drawings were prepared and fabrication commenced. Steel was shop assembled to assure proper fit-up.

The spillway was a particularly difficult work site. Not only did heavy flow in the spillway channel preclude shoring from below, but the entire structure would also be difficult to access during the phases of demolition and new construction. While details of the erection scheme were left up to the contractor, it was felt that there would be an advantage to building the new arch ribs outboard of the existing ones. There was ample space for anchoring the arch to the skewbacks at the original location. With this arrangement, the new arch ribs could be installed before removal of the existing arches. The existing bridge could then be used for access and staging purposes.

The existing deck girders were first supported on temporary columns and partially removed so the construction of the new bridge seats could be expedited and erection of the new bridge could proceed uninterrupted. Due to a similar profile of the existing and proposed arches, it was decided to use the existing arches to support the new arch segments being erected. Later, the old ones were supported by the new ones while they were disassembled. Temporary beams below the existing arches cantilevered out to support the new ribs, as well as the work platform and protective shield. The deck was removed to lighten the load on the existing arch ribs and eliminate an obstruction to the rib erection. The new arch ribs were erected in segments with cranes from both ends of the bridge. The splices were bolted up and the bases grouted to prepare the ribs for carrying the load. The underslung beams were then connected to the new arch ribs and platform loads were transferred to them. As the existing arches were cut for removal, their loads were also transferred to the new ribs. The original work platform remained in service for the entire construction period. The remaining steel was erected using cranes at either end of the bridge. ★