George Washington Bridge
An old bridge with new tricks.

On October 24, 1931 the opening ceremony of the George Washington Bridge began with a dedication speech from then Governor of New York Franklin D. Roosevelt. The Governor who was soon to be the 32nd President of the United State spoke from a podium at the bridge's center span about the marvels of the Civil Engineering. At the time of construction the George Washington Bridge was twice as long as any bridge in the world spanning the Hudson River connecting Fort Lee, New Jersey to Northern Manhattan. If the visionaries of the time could see the expansion and growth this iconic bridge has provided to the area they would be impressed with the work and security the structure continues to provide today.

The bridge has a total length of 4,750 feet with a Main Span of 3,500 feet. The two roadway decks provide a total of 14 lanes of traffic, 8 on the upper roadway and 6 running on the lower roadway. The lower deck was added in 1962 well after the original opening of the structure. The additional deck was determined to be necessary due to the constantly increasing traffic congestion on the bridge. Over time the bridge has been updated and recently the owner has made a significant commitment to rehabilitate the suspension system of the bridge. The bridge is owned and operated by the Port Authority of New York and New Jersey, a bi-state agency that also owns all vehicular bridges and tunnels between the two states.

As part of the rehabilitation project WireCo WorldGroup has been contracted to supply the replacement suspenders and ancillary components for the suspension system. The suspenders are the structural support elements fabricated with wire rope that support the roadway deck from the main cable. This bridge has four main cables each containing 61 strands, with each strand made of 434 individual wires. Each suspender assembly is individually produced and comprised of a component wire rope with socketed ends. The wire rope component is a 2-7/8" diameter ASTM A603 Structural Wire Rope in a 6x36WS construction with an Independent Wire Rope Core, see Figure 1. The minimum breaking force of the wire rope is 760,000 lbs.

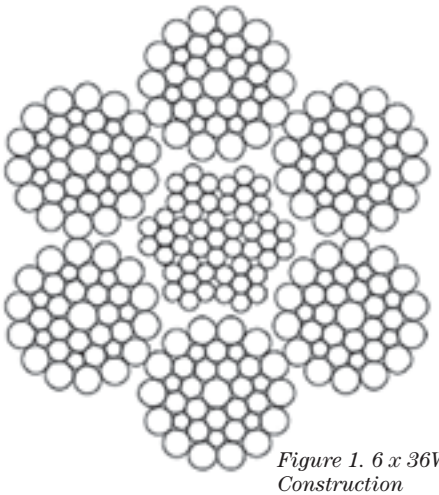

Figure 1. 6 x 36WS Construction

The wire rope is formed from wires produced using high carbon steel. Each wire is individually coated with Zinc-Aluminum Mischmetal for improved corrosion resistance. This coating product is produced by WireCo but not widely used in the United States. This product is becoming more common due to the superior corrosion protection it provides. Ageing tests have shown the Zinc-Aluminum coating to provide improved corrosion resistance in comparison to conventional galvanized coating due to a surface barrier layer of very passive aluminum oxide. Combining the passive corrosion inhibition of aluminum oxidation with the active and passive effects of zinc results in approximately two times the amount of corrosion protection compared to standard zinc coated wire. The coating also provides an anodic feature that heals over the exposed steel when the wire is abraded or scratched exposing the base steel. To provide additional corrosion resistance to the wire rope a blocking compound is applied to the

Photo 1. The East Tower of the George Washinton Bridge

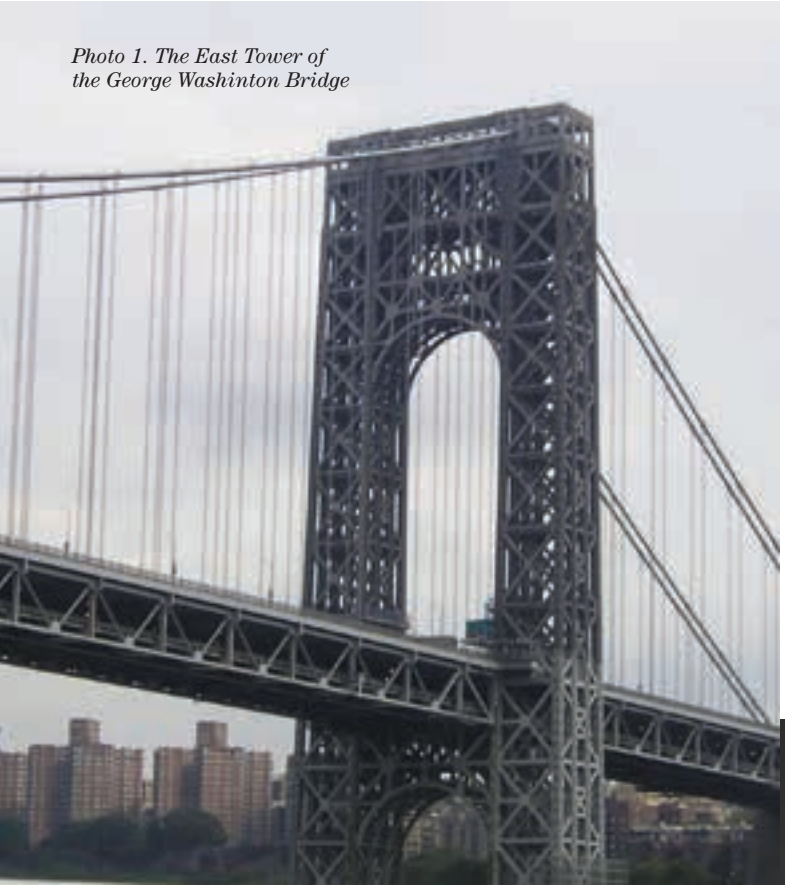

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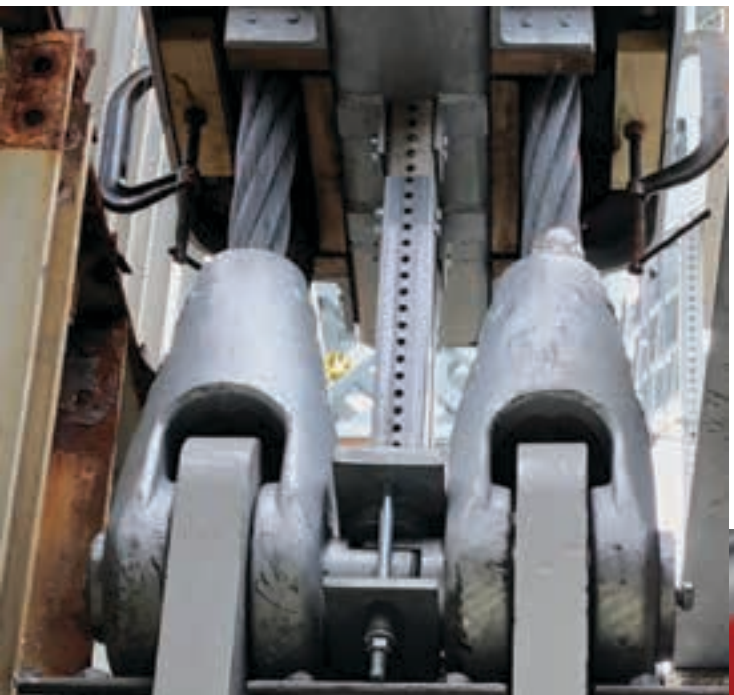
Photo 3. Assembly installation on the bridge deck.

individual strands during the stranding operation to ensure that internal coverage of the wires is provided. Over 160,000 feet of structural wire rope will be required to produce the 592 suspenders required for the complete project. Each suspender is being fabricated at WireCo's fabrication facility in St. Joseph Missouri.

Every design element in the rehabilitation of the structure is intended to extend the working bridge life into the future. The suspender fabrication incorporates a special open socket design with High Temperature socketing medium. This socketed end connection must provide a minimum time at temperatures in excess of 1,200 Degrees Fahrenheit. The specialized sockets designed by WireCo were required to fit within specified dimensions that allow the sockets to be orientated below the walkway deck. Due to this requirement the socket ear lengths are shorter than standard sockets with an increased thickness. These changes allow more tensile strength in the socket body while increasing the bearing surface of the pin in the socket ears, see Photo 2. WireCo performed several FEA analysis reports on the sockets and has conducted numerous tensile test show the ultimate breaking force of the wire rope as completed.

The fabrication of the assemblies requires a strict length tolerance for the completed assemblies. Therefore WireCo is prestretching each assembly to remove the construction stretch in addition to marking the longitudinal arrangement of the wire rope at the time of measurement. Each length of wire rope is measured while a constant load in held on the wire rope, with each suspender requiring a different load the process requires detailed record keeping and product tracking methods. The technical requirements also require a proofload be applied to the socketed end terminations to ensure the workmanship of the socket pour is efficient.

Photo 2. High-Temperature Sockets Installed with pins.



Billed as "the busiest bridge in the world," the George Washington Bridge services vehicles traveling in the New York City area. To ensure traffic disruption was minimalized the completed suspenders were packaged in pairs allowing the installation of the assemblies onto the bridge directly from the shipping reels. This allows the contractor the ability to install the assemblies onto the main cable with only closing one lane of traffic on the upper roadway deck. Photo 3 shows a picture of the shipping reels staged for installation.

The supply of the suspender ropes is a long term project spanning into 2024. Due to the nature of the production one side of the bridge will be completed on opened to pedestrian traffic prior to moving all of the equipment and tools to the other side.

WireCo has a long history of supplying bridge cables to high profile structures throughout North America. The success of these projects is due to their commitment to customer requirements and the diligent Engineering practices required to fulfill the specification requirements. For additional information about WireCo WorldGroup's involvement with the George Washington Bridge Rehabilitation or their structural project history please feel free to contact them.



Timothy W. Klein, WireCo WorldGroup Engineering, on the GWB Project site.