INTERNATIONAL MOLYBDENUM ASSOCIATION
THE VOICE OF THE MOLYBDENUM INDUSTRY

Restoring the George

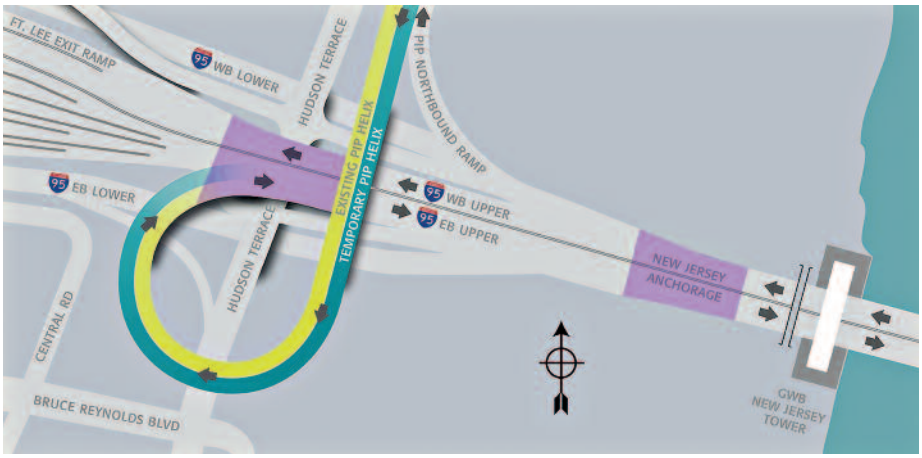
Hundreds of thousands of vehicles hurry across the George Washington Bridge every day. The aging bridge is one of only three ways to enter Manhattan from New Jersey by car, and it sees more vehicle traffic than any other bridge on Earth. But it is in need of critical repairs. Coming to George's aid is Type 316LN stainless steel rebar, which will revitalize the crumbling concrete decks of this most important passageway.

First built in 1931, the George Washington Bridge spans the Hudson River, connecting the Washington Heights neighborhood of Manhattan with Fort Lee in New Jersey. An unrivaled average of 300,000 vehicles cross the bridge every day. Its importance as a travel route means that any type of disruption poses a major challenge to both commuters and those tasked with maintaining traffic flow.

Repairing giant George

When it debuted during the Great Depression, the George Washington Bridge was a state-of-the-art engineering marvel – twice as long as any other suspension bridge before it. The George is truly massive; its highest towers rise 185 meters above the Hudson, and its upper and lower decks carry eight and six lanes of traffic, respectively. Despite its size and grandeur, after nearly 88 years of heavy traffic, drastic temperature swings, and exposure to both de-icing and marine salts, this vital passageway is in grave need of repair. Indeed, minimal updates have been made to the bridge since 1961, when the lower deck was added. To meet current repair needs, the Port Authority of New York & New Jersey (PANYNJ), the owner of the bridge, is undertaking a decade-long, 1.9-billion-dollar rehabilitation initiative. 'Restoring the George' consists of 11 individual projects, each with staggered starting dates to minimize impact on traffic.

Currently, one of these projects is incorporating approximately 1,300 tons of Type 316LN stainless steel concrete rebar, for both pre-cast components and cast-in-place deck segments. This rebar will be integral to replacing the decks of the massive helix on-ramps and of the merging lanes that lead on and off the bridge into New Jersey. However, any construction has to be carefully planned to avoid the blocking of lanes, which would cause major delays to commuter traffic. To this end, work takes place only one or two lanes at a time, from midnight to 5am, mostly on weekends. The installation of durable stainless steel instead of lower-cost carbon steel rebar will help to extend the service life of the bridge decks significantly, minimizing future repair, maintenance needs, and associated traffic delays.



Palisades Interstate Parkway (PIP) on-ramp helix at the New Jersey end of the bridge where Type 316LN stainless steel rebar is being incorporated. A temporary on-ramp has been constructed to divert traffic during the restoration. © The Port Authority of New York and New Jersey

Stainless steel rebar to last for generations

New York City winters and salty coastal air, combined with an unparalleled level of traffic, mean the George Washington Bridge takes an exceptionally hard beating. During winter, the bridge is frequently exposed to aggressive de-icing salt slurries that permeate the bridge deck. The salts eventually reach the steel reinforcing bar embedded in the concrete. Regular carbon steel rebar corrodes in this situation. Rust forming on the steel surface is porous and more voluminous than steel. As it exerts pressure on the concrete from within, the concrete spalls and crumbles, allowing even more salts to penetrate the deck, further accelerating deterioration.

New York City's high level of chloride salt exposure, therefore, necessitates an especially corrosion-resistant solution – Type 316LN stainless steel rebar. Thanks to the addition of 2% molybdenum, this alloy has excellent corrosion resistance ›

to chlorides from de-icing salt or marine atmospheres. Stainless steel rebar is a small, but growing market segment in construction where local conditions are especially hard on carbon steel rebar, such as in North America's 'Snow Belt', or along its coasts. The corrosion of carbon steel rebar is the primary factor in the deterioration of concrete, so molybdenum-containing stainless steel rebar will not only last longer than carbon steel rebar, but also contribute to the longevity of surrounding materials. The result is a bridge that will need comparatively little maintenance over its lifecycle.

Because stainless steel rebar is not affected by chlorides that permeate the concrete over time, the traditionally used thickness of the concrete cover, needed to delay carbon steel corrosion, can be significantly reduced. The bridge deck can therefore be made lighter, reducing the load on the foundations and support structures, which in turn can be downsized as well, leading to overall cost savings. The total project cost increase, as installed, is consequently quite modest when using stainless steel rebar, typically in the range of 1 to 10%. The much longer service life of the structure translates to significantly lower life cycle cost.

Although the harsh environment, age and traffic volume collectively pose a unique challenge in maintaining the George Washington Bridge, the use of stainless steel rebar ensures that it will be a long time before its deck has to be restored again. With the help of molybdenum-containing stainless steel, the George will provide a safe passage over the Hudson, with minimal disruption, for many generations to come. (FS, KW)

Even though the George Washington Bridge is nearly 90 years old, it adapted to increasing traffic by adding a second deck below the original one in the 1960s, and is now the busiest bridge in the world.
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