Standing on ropes
New York City plans for major rehab of George Washington Bridge suspension system

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Five hundred ninety-two. That’s the number of suspenders holding up the deck of the George Washington Bridge connecting upper Manhattan and New Jersey.

And 592 also is the number of suspenders that will be replaced in the rehabilitation of the bridge’s suspension system, Peter Zipf, chief engineer for the Port Authority of New York and New Jersey, told ROADS & BRIDGES.

Considering that the George Washington Bridge is 82 years old, and the ropes are original equipment, the bridge has held up very well.

“We’re very happy with the life of these ropes,” Zipf said. “For a suspension bridge of this nature, many of the ropes of common bridges have already been replaced. Many of the suspension bridges across the country have had their ropes changed after 60 to 70 years of service.”

The Port Authority knows the condition of the ropes because they have done testing, both destructive and nondestructive.

“When we put in the lower-level deck in the ’60s, we actually removed some of the ropes and did full destructive testing to see their break point,” Zipf said. “Our concern is the tensile strength of the ropes.”

They pulled out six more ropes in 1999 and tested their tensile strength to see where they broke.

Photo courtesy of the Port Authority of New York and New Jersey.
"We’ve also implemented nondestructive testing, where you put an electromagnetic pulse through the cable and look for a variation in the response, which may be indicative of flaws due to corrosion.

"What we’re finding is that over the years, we have lost some capacity within the ropes, but nothing that we’re concerned about as of today," continued Zipf, "because the bridge itself was designed very robustly. At one point it was to carry even a rail transit system on it, so it has a high factor of safety. We are seeing corrosion, particularly at the connection points where the ropes connect to the main floor beams at the upper roadway level. We’re watching it very closely.

"We are looking at innovative ways of modifying that socket connection with ideas like putting a pin connection in there. That would give us an opportunity to allow for air to circulate around the socket and make inspections easier."

Each rope is 2\(\frac{3}{8}\) in. in diam. and contains 283 individual wires. They run from a socket connection in the roadway deck up to a saddle over the main cable and down to another socket in the deck.

"In addition to replacing the ropes, we’ll be unwrapping and exposing the main cables," Zipf explained. "At that point, we’ll be taking a very close, in-depth inspection of the cables, repairing any of the miscellaneous broken wires within the cables. We’ll replace what we call the wrapping wires and the seals. And we’re also looking at the possibility of installing a dehumidification system for the main cables that pushes air through to help minimize corrosion. Corrosion is the big thing that we’re concerned about on this whole suspension system, keeping moisture out, eliminating rust, so that we don’t have any corrosion going on."

When they take the wrappings off the main cables, they will force a wedge into the cable to spread the wires apart and try to see into the innermost part of the cable. Broken wires will be spliced back together. Segments of corrosion can be removed and replaced with new wire spliced into the existing good wire.

The Port Authority has seen no significant loss of strength in the main cables, although there is some corrosion at the bottom of the cables.

Eliminating moisture is the key. A dehumidification system would need minimal air flow through the cables, and there is minimal empty space within the cables.

"The dehumidification system will push air through ports along the main cable," Zipf explained. "One would push air; one would pull air."

Maintenance is a major factor in deciding on such a dehumidification system.

"You want to make sure you put a system in place that in fact you can assure will have the full maintenance over the next 80 years. You don’t want to put a dehumidification system in place that you would not be maintaining."

The main cables—four in all—are 3 ft in diam. and contain 26,474 wires each, running from foundation blocks in New Jersey, over the towers, to similar foundations in New York. At the ends, each cable is connected to the foundation through 61 anchor strands.

Those anchor strands are another area of inspection and rehab work. The Port Authority has seen some rust on the anchor strands but minimal broken wires.

The Port Authority expects to do the anchor strand rehabilitation first. Then to clear space for the rope replacement, they plan to move utilities that run along the bridge. Contracts for the anchor strands and utilities will be let this year.

The Port Authority expects to finish the final design for the rehab project by the end of this year. The engineer of record on the design is Ammann & Whitney, headquartered in New York City. The Port Authority then plans to award a contract for the suspender rope replacement in mid-2014. The rehabilitation of the George Washington Bridge suspension system is expected to last eight years.

For more information about this topic, check out the Bridges Channel at www.roadsbridges.com.