Blatnik and Bong Bridges Wire Rope Replacement:

Maintaining Minnesota’s Unique Bridge Inventory

Laura M. Amundson, PE, Vice President
Parsons Brinckerhoff    Minneapolis, Minnesota
Blatnik and Bong Bridges Wire Rope Replacement

- Configuration and existing condition of the deck suspender system
- Removal and replacement procedure
- Results of destructive testing
- Recommendations for maintenance
In 2007, a fracture critical inspection of the Blatnik Bridge revealed condition issues with the wire rope suspenders.

A similar inspection of the Bong Bridge suspenders indicated corrosion of the suspenders at the socket area.

Recommendations were made to perform destructive testing on selected samples from both bridges.
How Unique are the Blatnik and Bong Bridges?

• There are only eight bridges in MnDOT’s inventory with suspended decks.
• The deck area of the Blatnik and Bong Bridges together, represents 60% of the total area of all bridges with suspended decks.
Duluth, Minnesota

Bong Bridge

Blatnik Bridge
• Two suspenders from each bridge were selected from a single travel direction to minimize lane closures

• Four suspenders at each panel point

• 1 5/8” diameter suspender

• Specified minimum breaking strength 246,000 lbs
Blatnik Removal Locations

West Truss Panel Point 16S NW Rope – Six Broken Wires – Worst Case – a similar condition suspender 17N was selected

West Truss Panel Point 15N SE Rope Typical Case with Stage 3 and 4 corrosion
Richard I. Bong Memorial Bridge
• Two suspenders at each panel point
• 2 9/16” diameter
• Specified minimum breaking strength 784,000 lbs
Bong Removal Locations

Panel Point 7R (East Truss)
East Strand, Shim
Corrosion, Zinc Corrosion – Worst Case

Panel Point 3R East Strand – Typical Case
Load is applied to jack the suspender against the lower arch tie

The lower suspender socket can then be slipped out of its support

The load is slowly released from the jacking frame and the suspender is removed

The reverse sequence is conducted to replace the suspender
Jacking System and Sequence

- A worst case suspender and a suspender in average condition were removed from each bridge.
- Two jacking systems were fabricated under the contract, one for each bridge due to the vast difference in jacking load necessary to remove the suspenders.
Jacking System Components

Clamping plates
Installing the Jacking Frame
Removing the Suspender
Removing the Suspender
Install New Suspenders
Replace – New Hanger
Areas of corrosion and damage are noted before load testing is undertaken.

Damage shown here is located 6 feet from the bottom socket.
Testing

Suspendingers are delivered to the testing facility full length

18 foot-long test assemblies are prepared using each existing socket and new sockets are cast on the cut end

Modulus of elasticity and load to failure tests are performed on each sample
Testing
Testing - Zinc Cones

Zinc cones removed from production socket body.
Testing - Zinc Cones
Testing – Bong Bridge Zinc Cones

Zinc cone is cut in half to reveal full zinc penetration throughout
Testing – Complete Tensile Failure
Testing – Ductile Failure

Ductile cup and cone failure
Testing

Bong Suspender

Blatnik Suspender
Testing
Testing Results

- Testing shows some degradation of the Blatnik Bridge suspenders primarily due to abrasion where the suspender passes through the floorbeam cutout
  - This issue was rectified in an earlier rehab ('90s)
  - Test to failure is generally ductile with several wires showing shear failure on the worst case

- Bong Bridge suspenders show no degradation other than minor loss of galvanizing and corrosion at the shims
Recommendations

- Proactive maintenance to regularly clean and paint suspenders
- Inspection to monitor condition
- Targeted replacement of suspenders if inspections show deteriorating conditions
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