Implementation of Cathodic Protection as a Bridge Preservation Effort at the Sunshine Skyway Bridge in Florida

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Bridge Background

- The Sunshine Skyway Bridge is located on the west central coast of Florida.
- Part of I-275 connecting the cities St. Petersburg and Bradenton across the Tampa Bay entrance.
- In May 1980, a ship impact caused the collapse of the southbound main span of the previous bridge at the location.
- In 1987, a new bridge with state-of-the-art technology at the time and improved safety features was opened to replace the old bridge.
- The new bridge is considered the “flag bridge” of the State and receives significant local and national media attention.
Bridge Profile

A complex structure with numerous critical structural components
Maintenance requires detailed attention to many components

Total Bridge length: 4.14 miles

Figure courtesy of FDOT Structures Office
Skyway Preservation Committee

- Established in 1999 to assist on the maintenance of the bridge.
- Goal is to look ahead on the service life of the structure to identify potential service life limitations and recommend efforts to prevent future conditions that could negatively affect the structure service life.
- Exceeding the 100 year service live is the group’s mission.
- Composition includes members with expertise in
  - Structural & Post-Tensioning Engineering
  - Corrosion
  - Maintenance Engineering & Contractors
  - Academia consultants (on-demand)
Due to the aggressiveness of the environment, corrosion is considered to be the major item of concern regarding the 100 year plus service life of the bridge.
Cathodic Protection as a Preservation Effort

Main Piers Pylons Footers (Galvanic System)

Main Span Columns (Impressed Current System)
- HOLLOW INSIDE
- CRACKS FOUND ON THE FOOTERS WALL DURING CONSTRUCTION
- INSIDE CHAMBER IS FILLED WITH WATER ON BOTH PYLONS FOOTERS
- THE REINFORCEMENT HAS ~ 4 INCHES OF COVER.

- CORROSION OF THE ECR WAS DETECTED BUT, ONLY ON REBARS INTERSECTED BY CRACKS.
Pylon CP Design
(Galvanic System)
Pylon CP Design

- Bulk anode assembly containing 100 Lb. zinc each
- Four assemblies installed per footer
- Connection wires routed to a central location to monitor performance
System providing excellent performance
Main Span Columns CP

- **Concerns:**

  - Many old and new cracks are showing severe amounts of moisture and efflorescence.

  - After sealing, water continued to leak out of the crack, suggesting water inside column or on upper portion of the crack.

Jan/2009
CP Jacket Components

Ti Mesh anode w/basalt reinforcement.

Light weight sectional aluminum forms.
Completed ICCP Jacket

Wiring to Rectifier

Energized by zones due to different current requirements as dictated by concrete conditions.
CP Electronics

Wires routed to inside the segment and connected to a datalogger and telemetry system
Criteria for Cathodic Protection

Cathodic protection requires monitoring it’s performance

- NACE RP 290: Impressed Current Cathodic Protection of Reinforcing Steel in Concrete
- NACE RP 216: Sacrificial Cathodic Protection of Reinforcing Steel in concrete
- EN ISO 12696: Cathodic Protection of Steel in Concrete

Available criteria is based on the polarization of the steel by means of measuring voltage potentials and currents applied.
ICCP performance data

Processed Data

Voltage Potential (V) Title

Column 117 - (Jan 2018)

Days

Column 1 - Zone 1
Column 1 - Zone 2
Column 2 - Zone 1
Column 2 - Zone 2
Conclusions

- Cathodic protection systems at the Skyway bridge are working satisfactory and should be big contributors for maintaining a 100 year plus service life.

- Other bridge preservation efforts have also been applied to the bridge or are scheduled for application such as: general cracks sealing, recoating of bearings and stays, and NDE inspection for the stays and post-tensioning systems.

- In general, bridge preservation efforts are expected to produce long term financial benefits to the State regarding the Skyway Bridge.
Thank You!