Corrosion Mitigation using Impregnation on Bonded PT

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Background

- Grouted Post-Tension Tendon Issues
  1. Bleed water voids
  2. Segregated grout
  3. Soft grout
  4. Chloride contaminated grout
  5. Sulfate contaminated grout
Post-Tension Cable Impregnation

• Corrosion protection for bonded post-tension and pre-stressed cables
• Uses corrosion inhibiting impregnation material
  – To make grout / concrete corrosion resistant
  – Coats exposed steel in voids to form a film and prevent corrosion
Impregnation Pattern
FDOT Jacksonville Bridge
Six Months later
Corrosion Testing of Impregnation Material on Exposed Steel
Corrosion Rate Test Specimen
Test Specimen Impregnation
Average Percent Change in Corrosion Rate
4 Days After Wetting Test Specimen

Control

Impregnated
Average Percent Change in Corrosion Rate
Over 40 Days After Wetting Test Specimen

Control

Impregnated
Test Specimen Undergoing Potentiostatic Testing
Verification of Corrosion Protection of Tendons with Voids

Potentiostatic Testing Tendons in Uncontaminated Grout with 4.5% Void

94.7% Reduction
PTI Treated with Voids vs. Untreated Tendons with Voids
Potentiostatic Testing
Tendons in Chloride-Contaminated Grout (2% Cl)

93.1% Reduction
PTI Treated vs. Untreated Tendons
Figure 1: Three impregnated and three control specimens were placed in a salt-fog chamber on mid February 2015. Voltage potentials (CSE) are obtained twice a week to identify time of corrosion initiation.
Figure 2: Two of the control specimens exhibited corrosion initiation after around 15 days of exposure. After 90 days of exposure the impregnated tendons stabilized as a corrosion free state. The third control specimen has stabilized a voltage potential close to that of the impregnated specimens but it is uncertain if corrosion has initiated.
PT Corrosion Evaluation
(Moisture Testing)
PT Corrosion Evaluation
(Moisture Testing)
PT Corrosion Evaluation
(Moisture Testing)
PT Cable Drying
Standard Life Building Initial Measurements
Post-Tech CE* Test Results

% RELATIVE HUMIDITY

TEMPERATURE Deg. C

- Data
- CE M.C.=0.003k
- CE M.C.=0.007k
Standard Life Bldg. Final Measurements
Post-Tech CE* Test

% RELATIVE HUMIDITY

TEMPERATURE Deg. C

Data
CE M.C. = 0.003k
CE M.C. = 0.007k
Varina Enon
Segmental Bridge
External Cables
PT Impregnation of Internal Tendons
Post-Tension Cable Impregnation Summary

• The durability of grouted post-tension tendons is highly dependent on the quality and integrity of the grout
• Evaluation of existing structures is key to understanding the condition of the post-tension tendons
Post-Tension Cable Impregnation Summary

- Impregnation is a corrosion protection process for tendons with grout defects
- Corrosion resistance of treated tendons is improved
- Impregnation may also be suitable for new structures where long service life is desired and the use of bonded tendons is preferred
Thank You

Questions