



Corrosion Mitigation using Impregnation on Bonded PT

PTI April 2016

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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





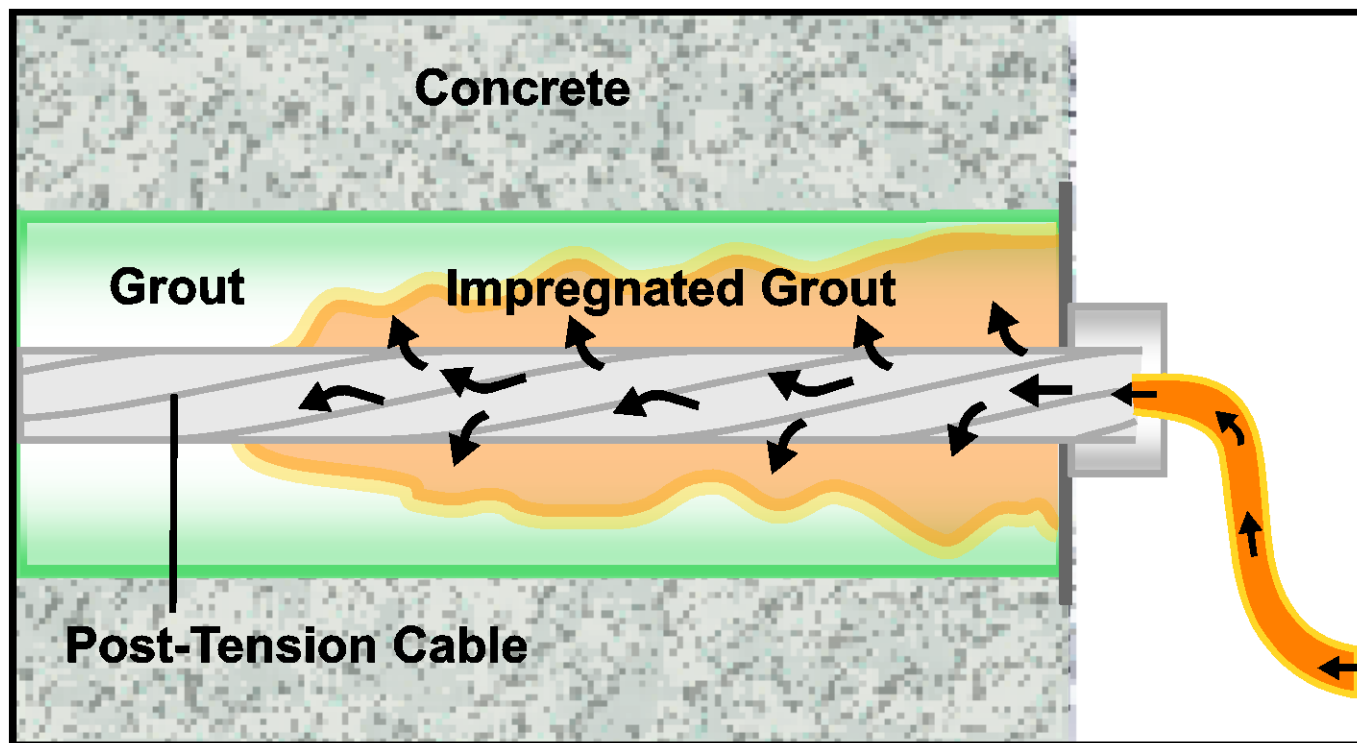




Post-Tension Cable Impregnation

- 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





S2-E2L-US

US























Six Months later









Corrosion Testing of Impregnation Material on Exposed Steel





Corrosion Rate Test Specimen

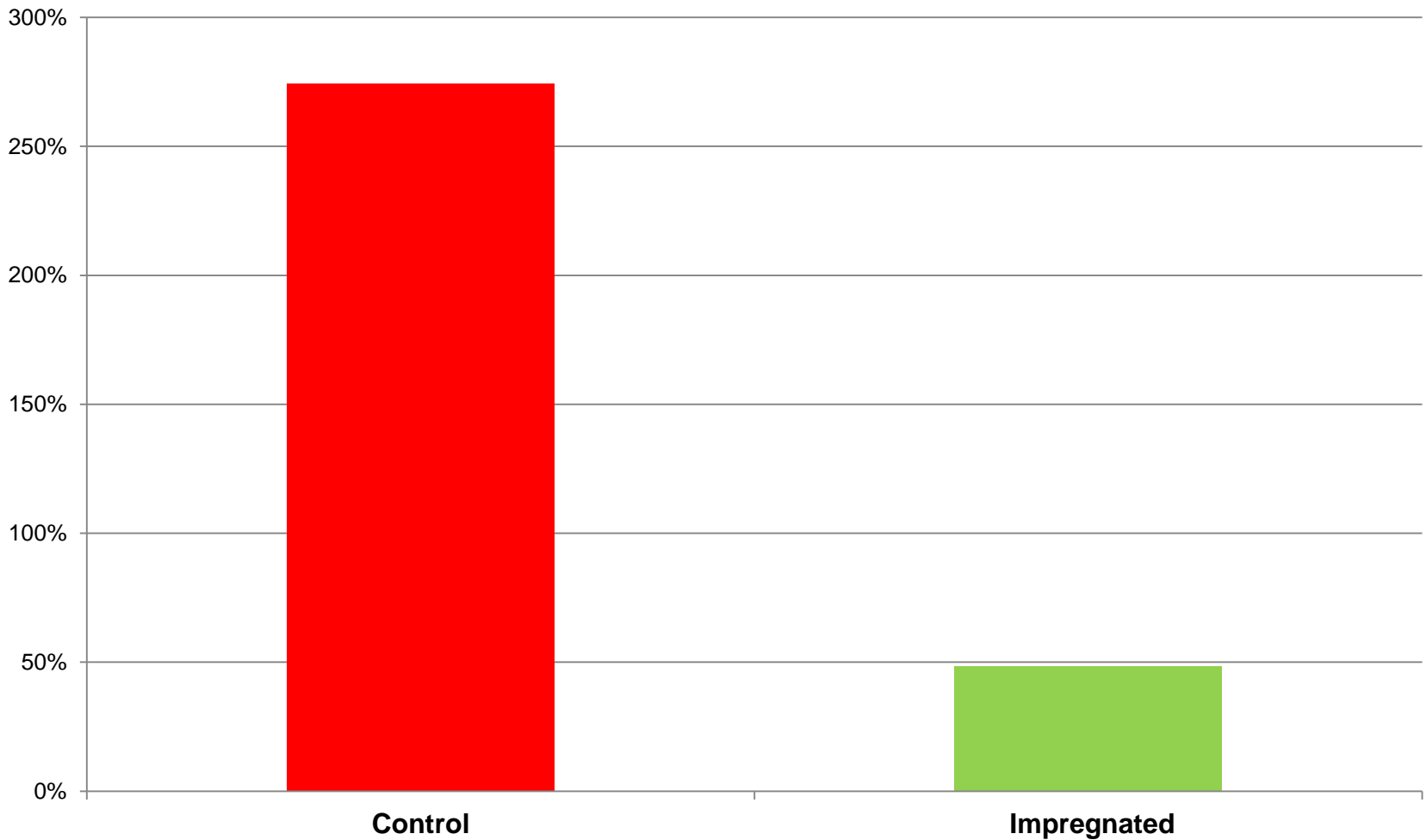


Test Specimen Impregnation

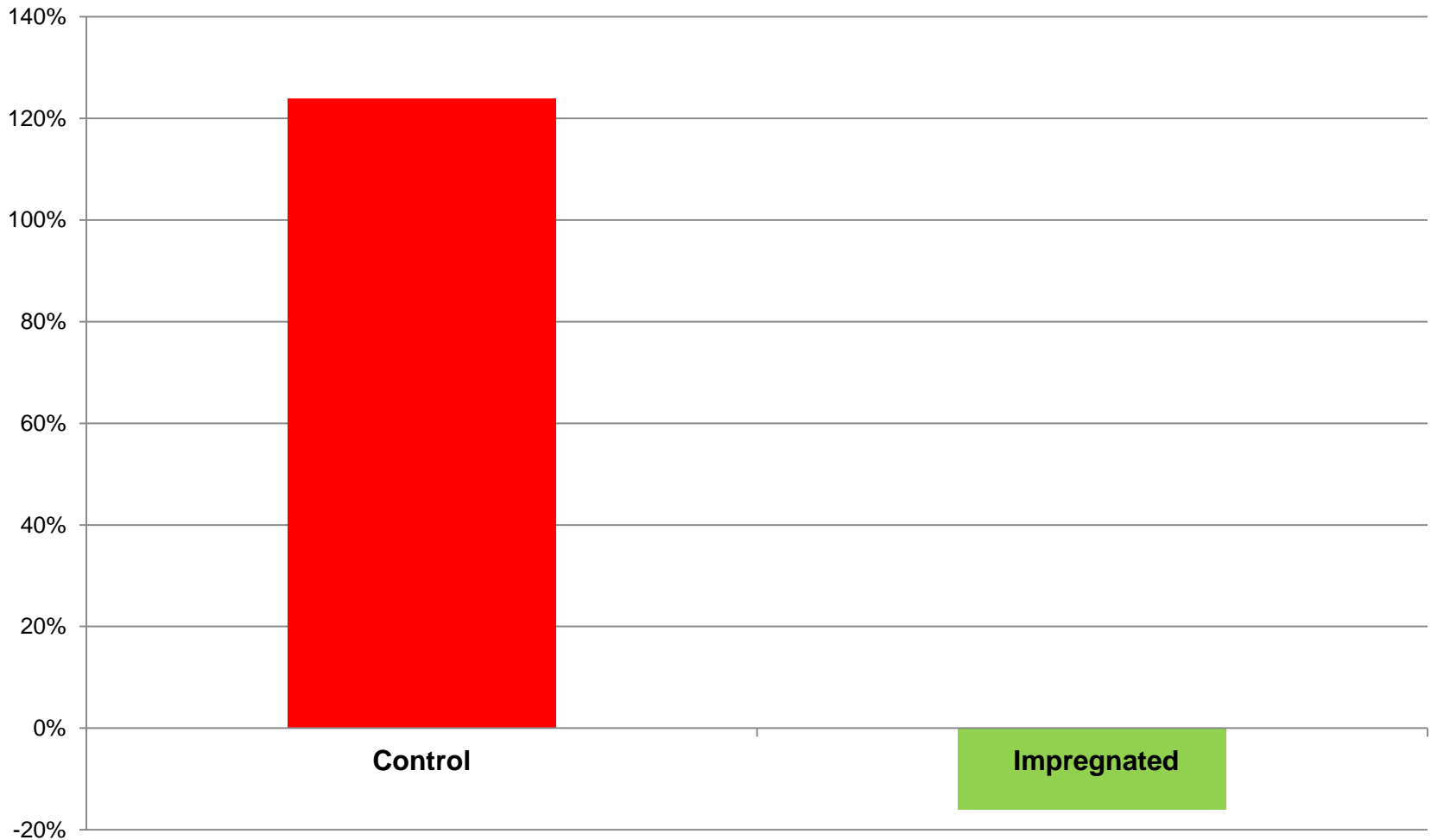


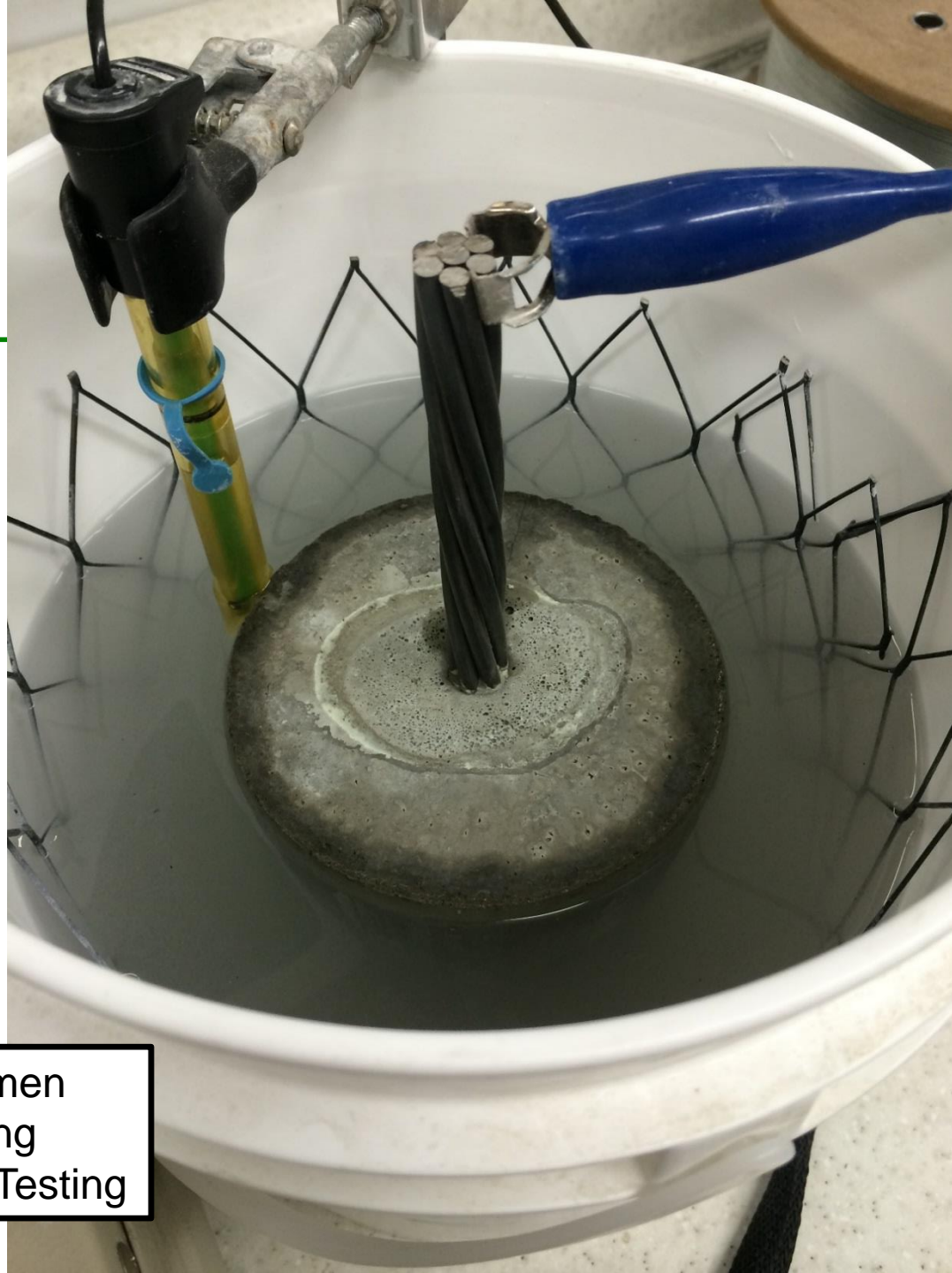
Average Percent Change in Corrosion Rate

4 Days After Wetting Test Specimen



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

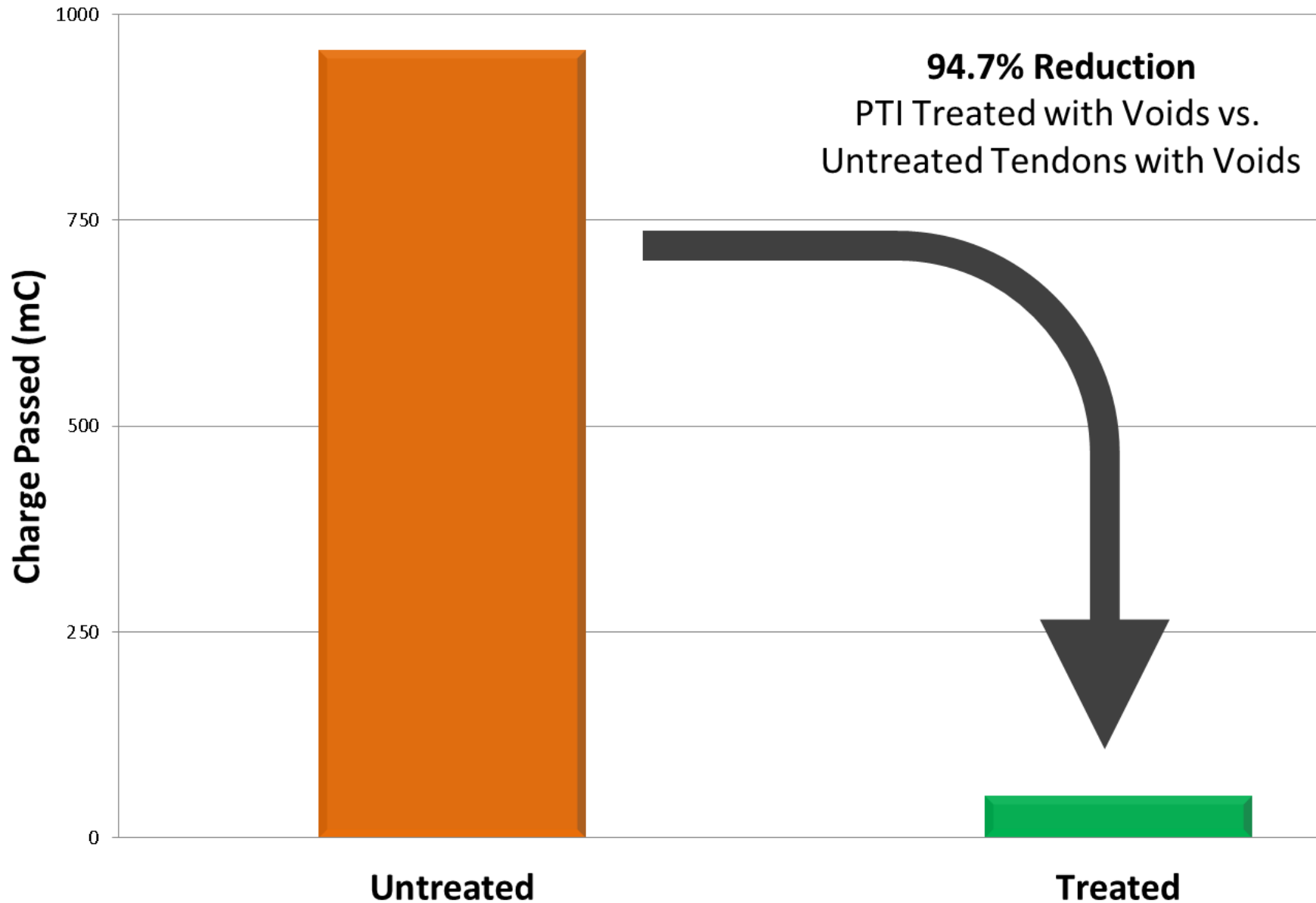




Test Specimen
Undergoing
Potentiostatic Testing

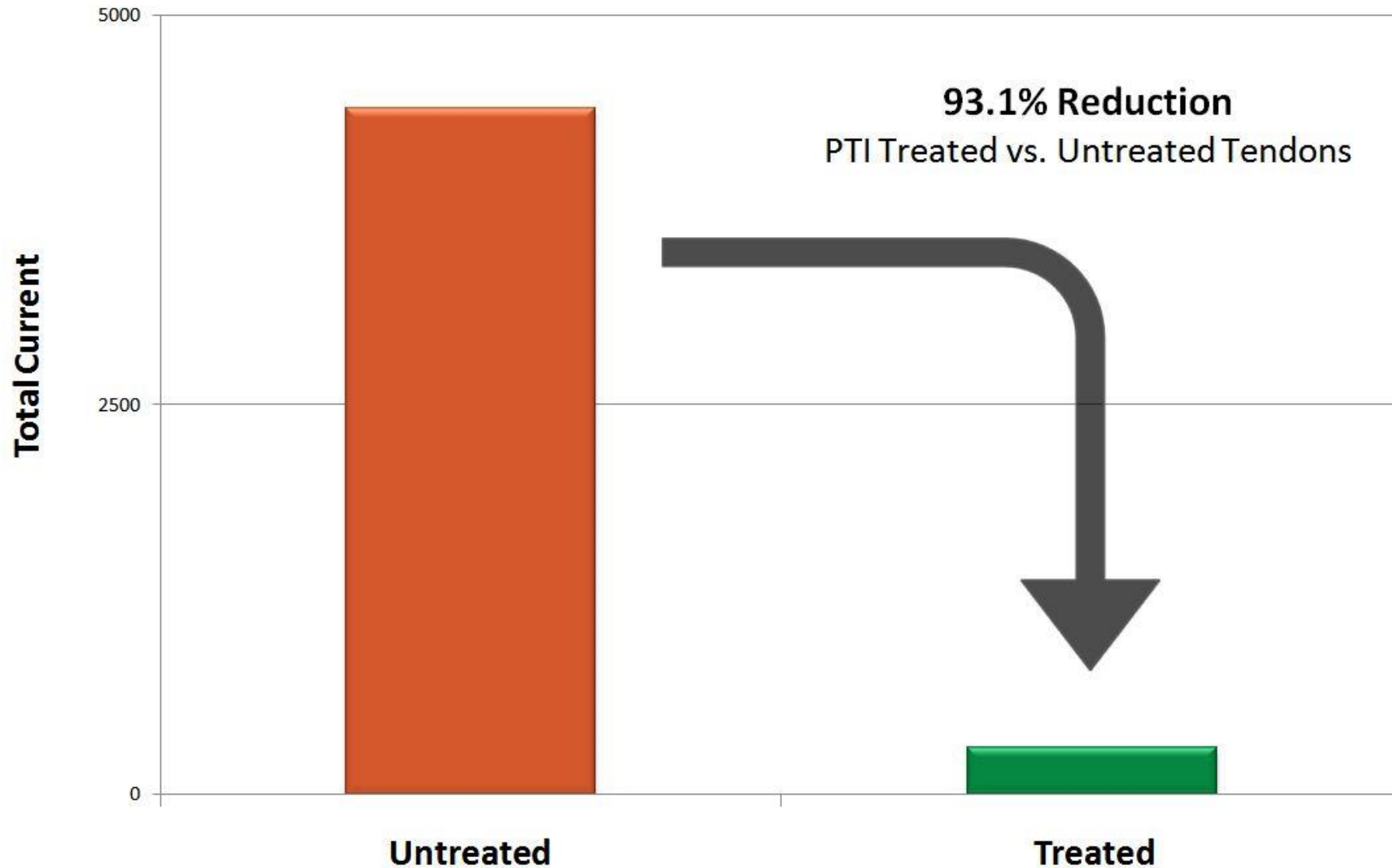
Verification of Corrosion Protection of Tendons with Voids

Potentiostatic Testing Tendons in Uncontaminated Grout with 4.5% Void



Potentiostatic Testing

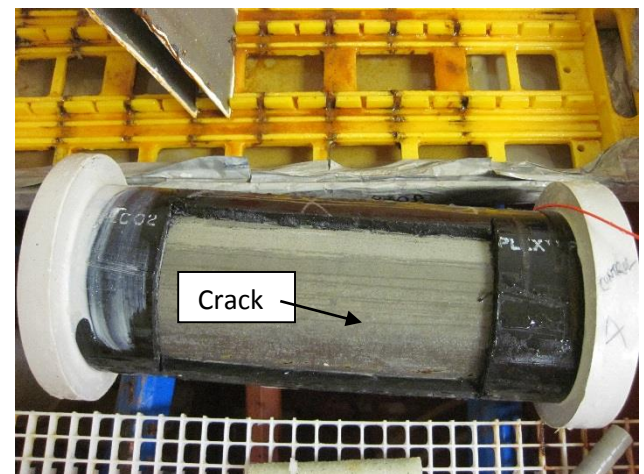
Tendons in Chloride-Contaminated Grout (2% Cl⁻)



SALT-FOG CHAMBER EXPOSURE



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.



SALT-FOG CHAMBER RESULTS

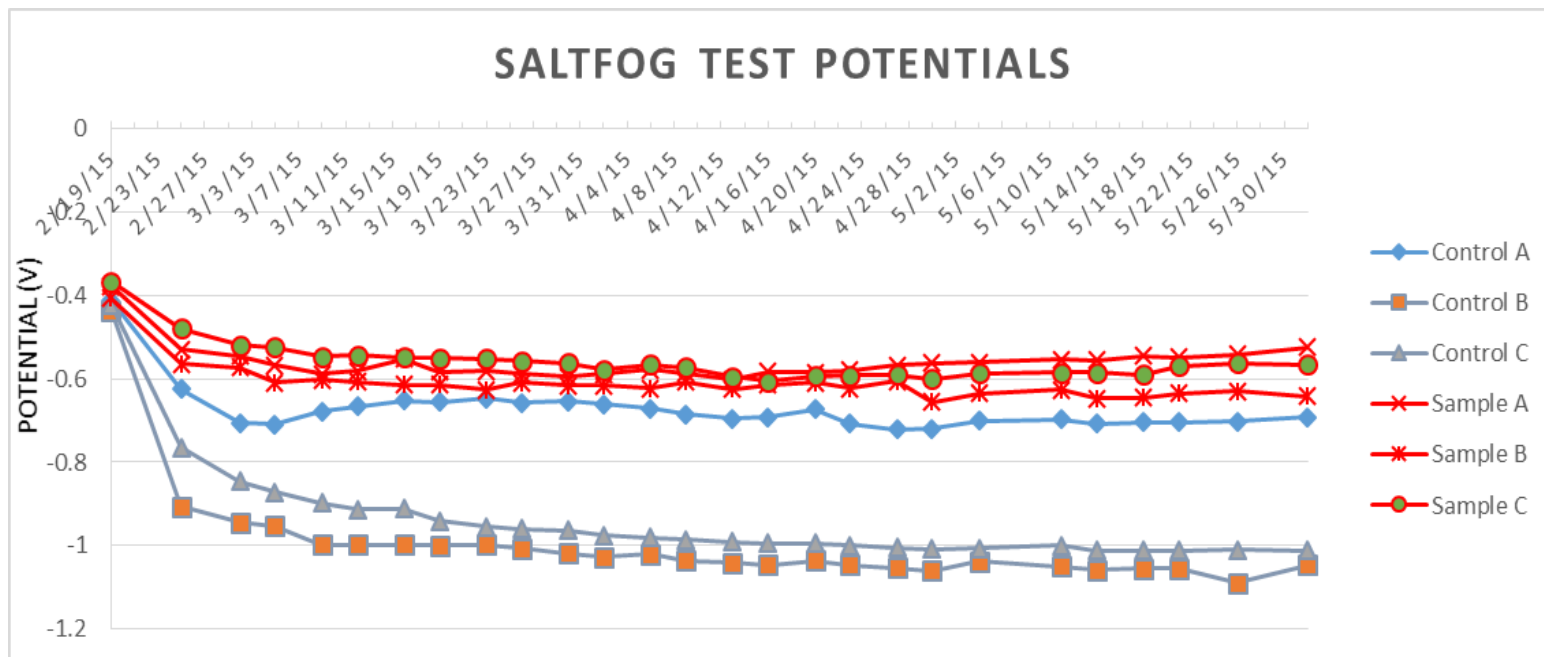
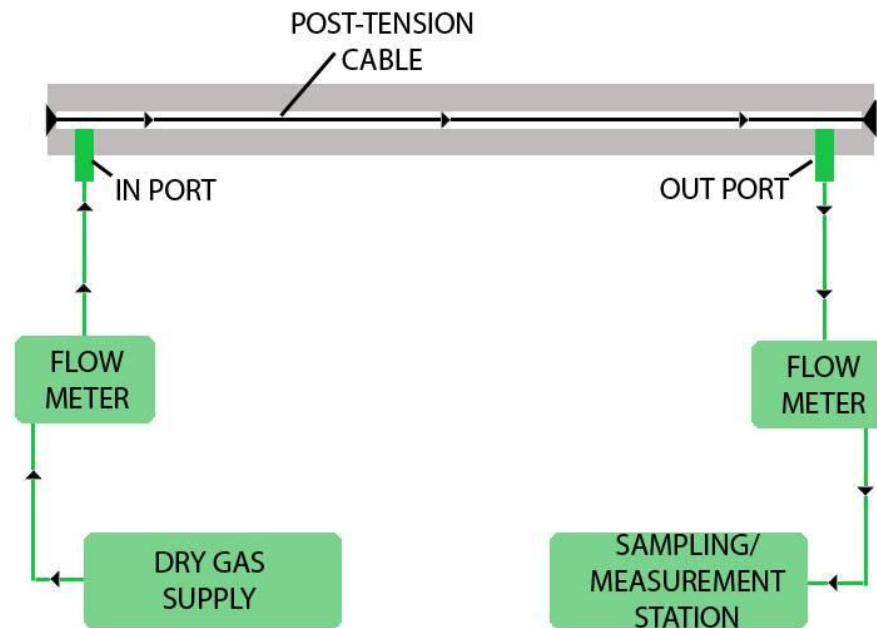


Figure 2: Two of the control specimens exhibited corrosion initiation after around 15 days of exposure. After 90 days of exposure the impregnated tendons stabilized as a corrosion free state. The third control specimen has stabilized a voltage potential close to that of the impregnated specimens but it is uncertain if corrosion has initiated.

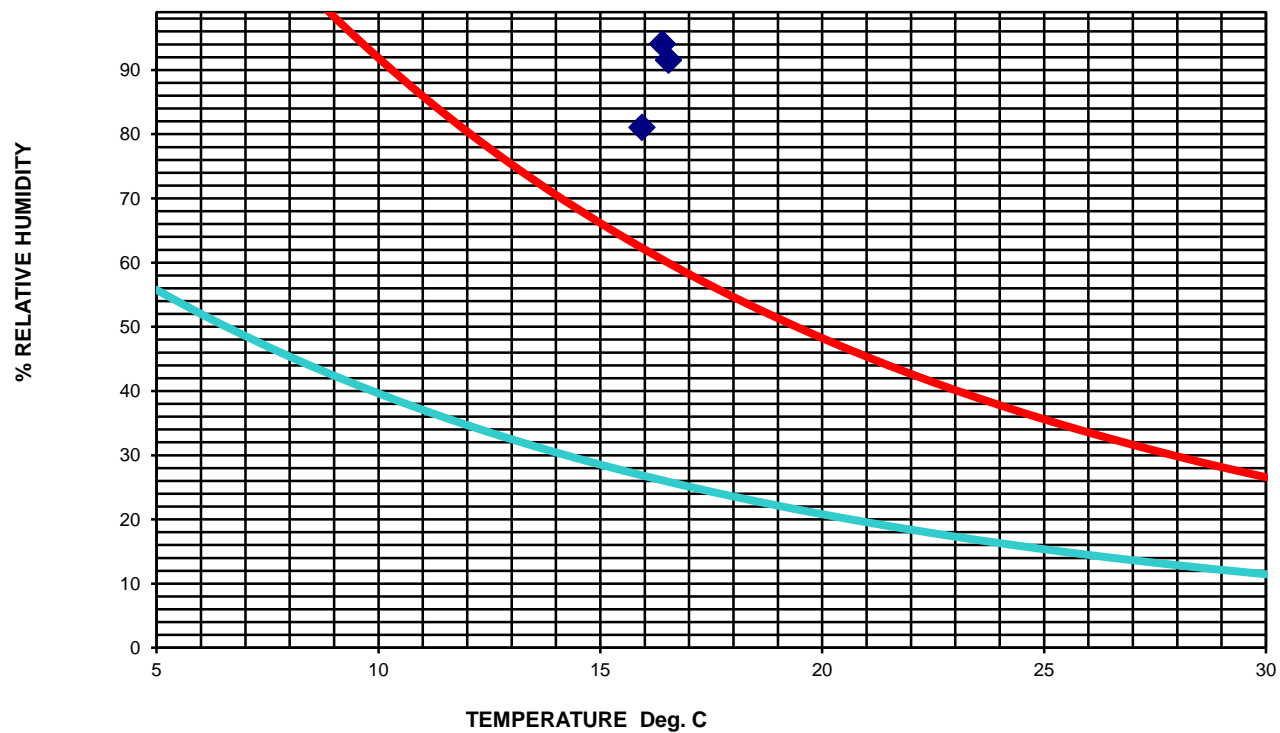
PT Corrosion Evaluation (Moisture Testing)



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PT Corrosion Evaluation (Moisture Testing)



◆ PPL Data

— CE M.C.=0.003k

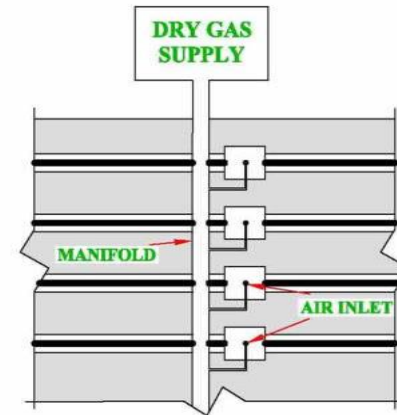
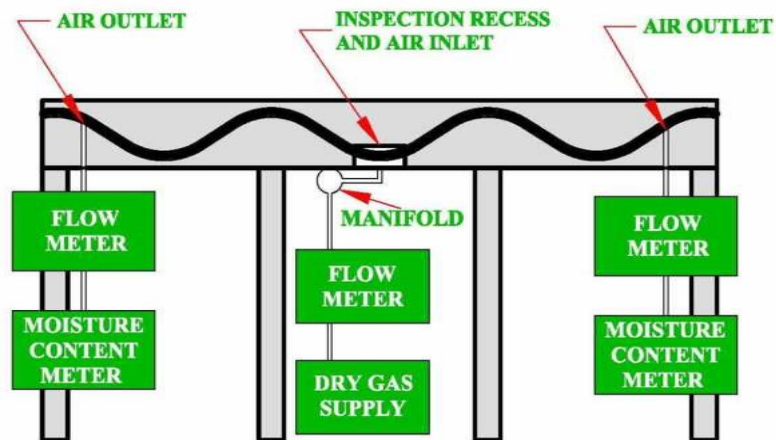
— CE M.C.=0.007k





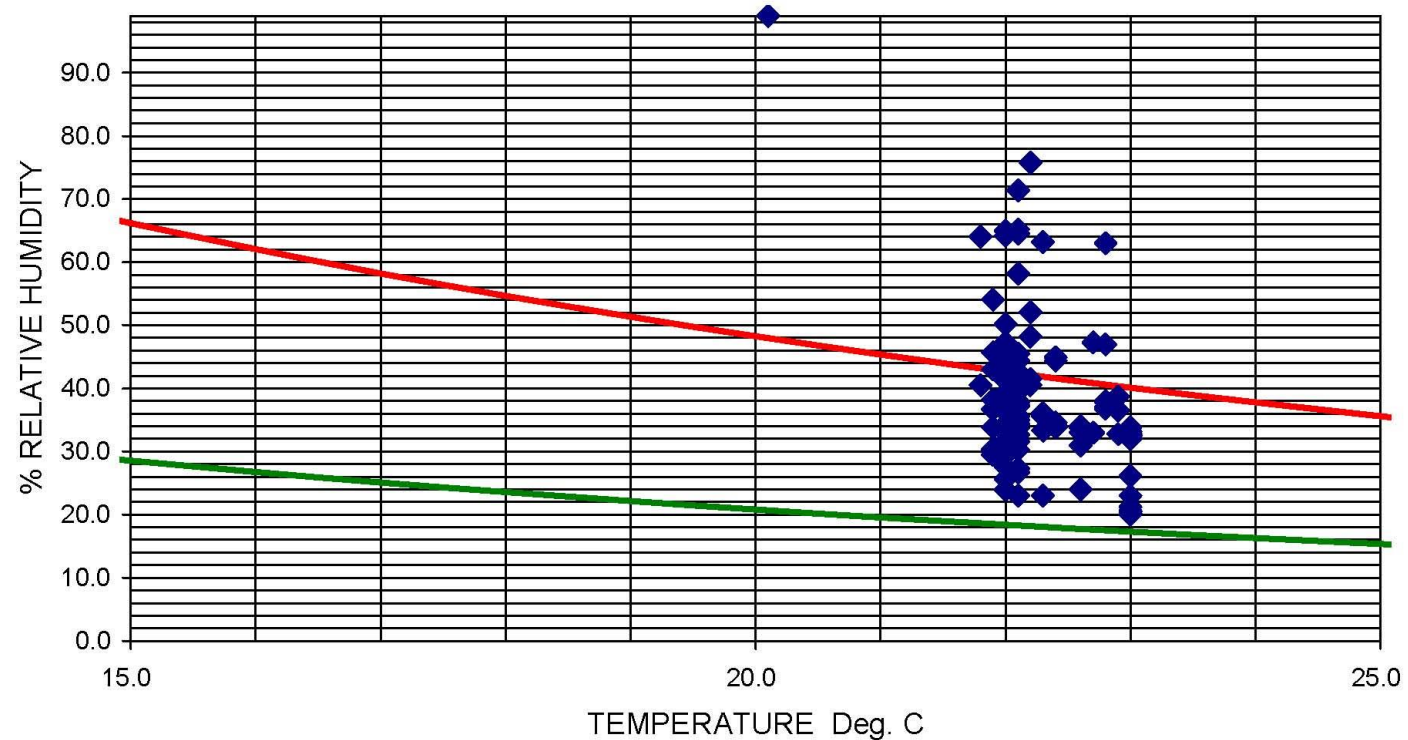


PT Cable Drying



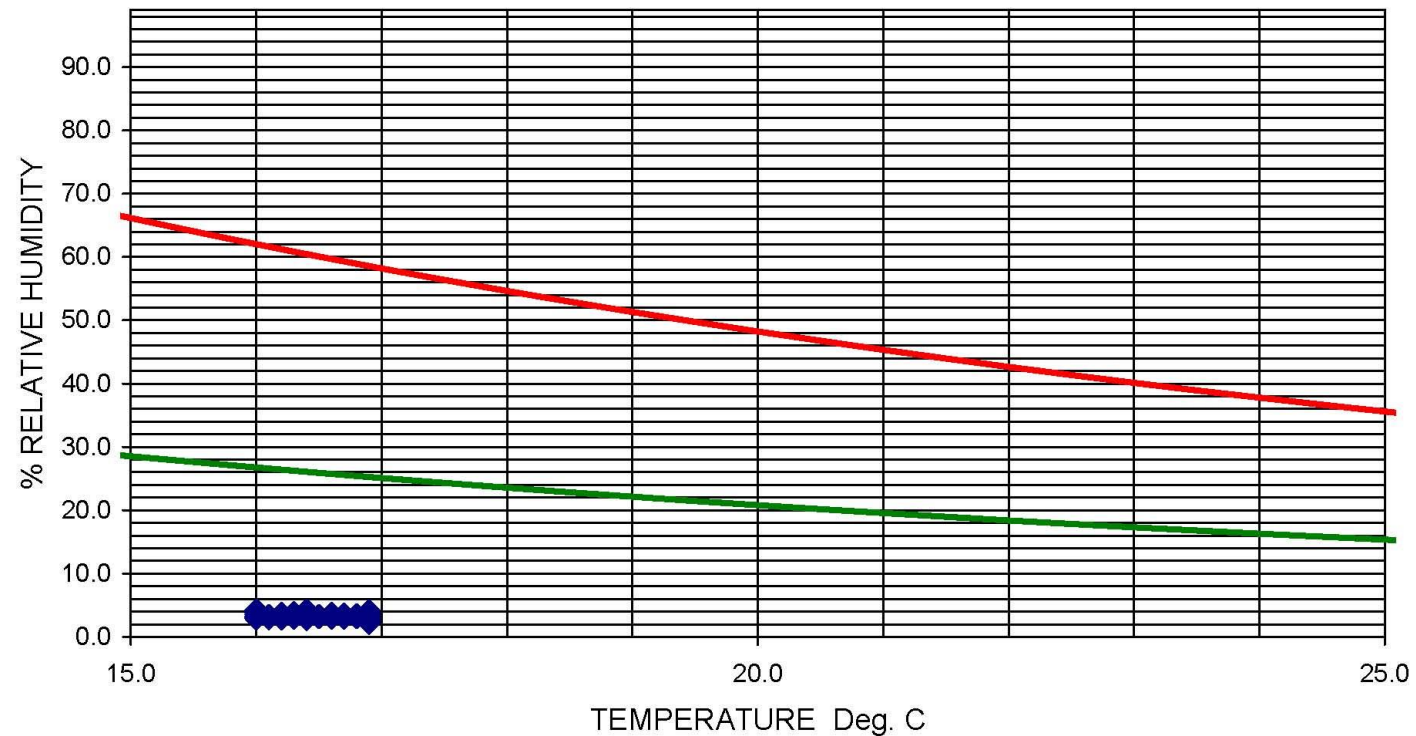


Standard Life Building Initial Measurements
Post-Tech CE* Test Results



◆ Data — CE M.C.=0.003k — CE M.C.=0.007k

Standard Life Bldg. Final Measurements
Post-Tech CE* Test



◆ Data — CE M.C.=0.003k — CE M.C.=0.007k

Varina Enon Segmental Bridge External Cables





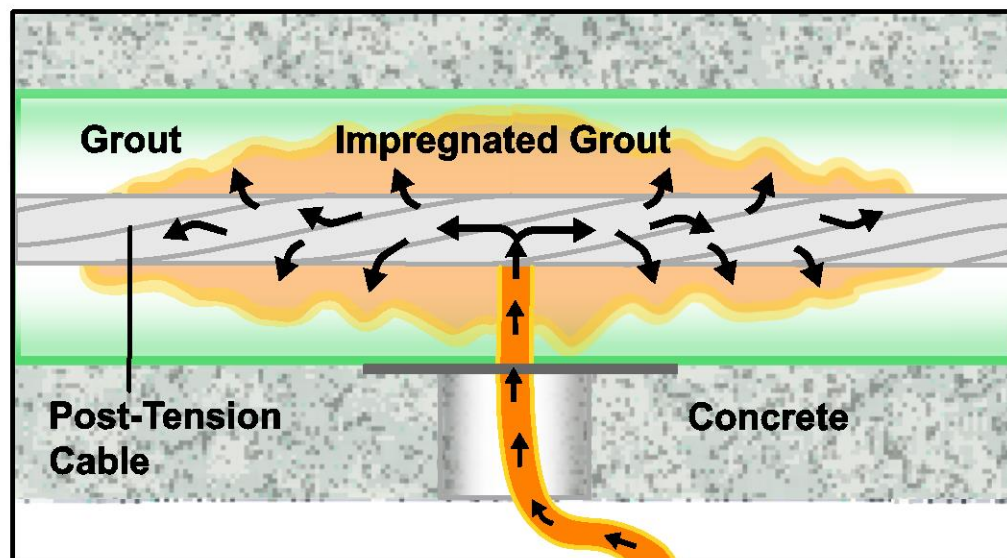
















PT Impregnation of Internal Tendons











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

