Cathodic Protection of Concrete in Harsh Saltwater Environments

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VECTOR CORROSION TECHNOLOGIES

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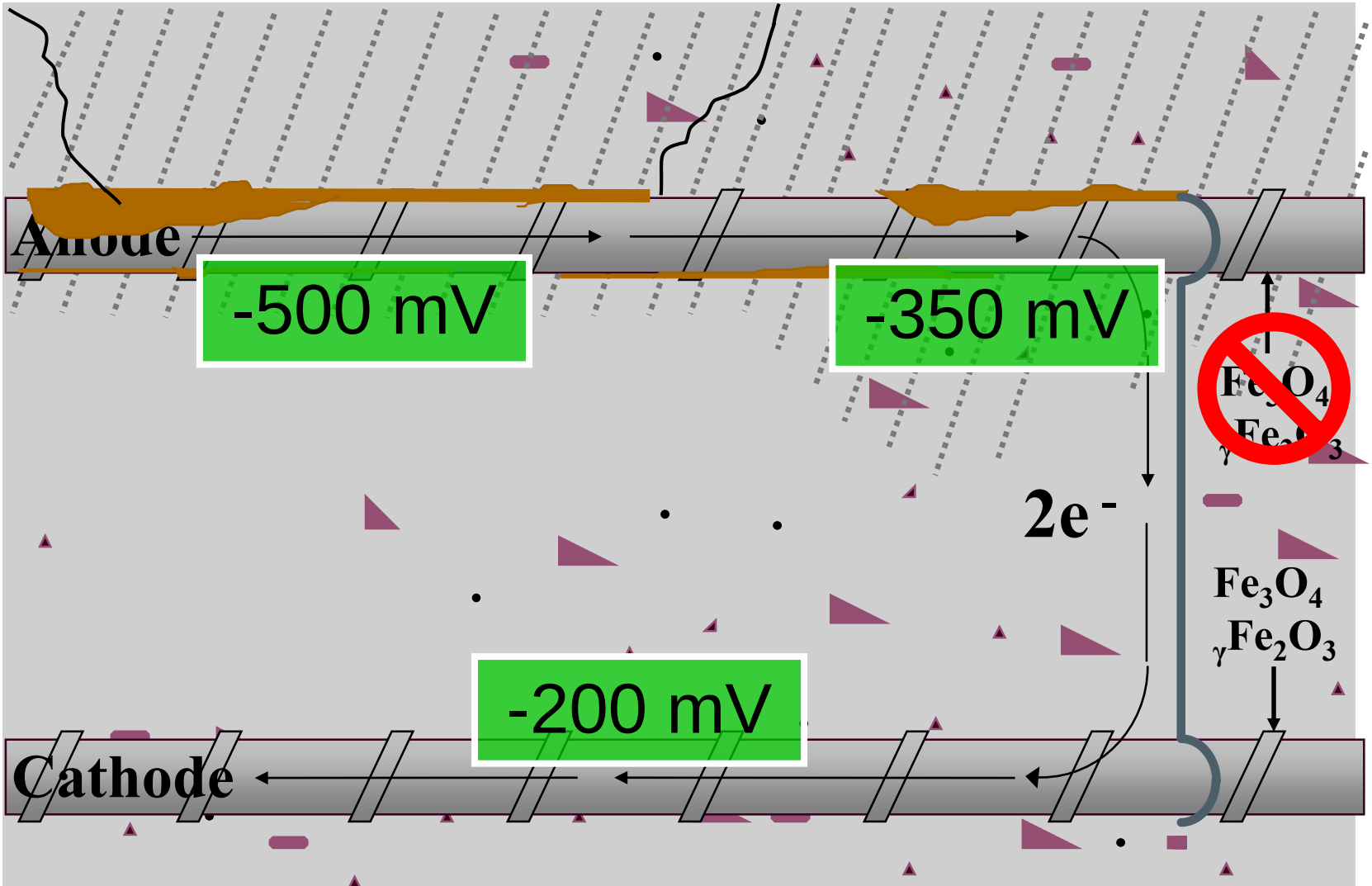
Overview

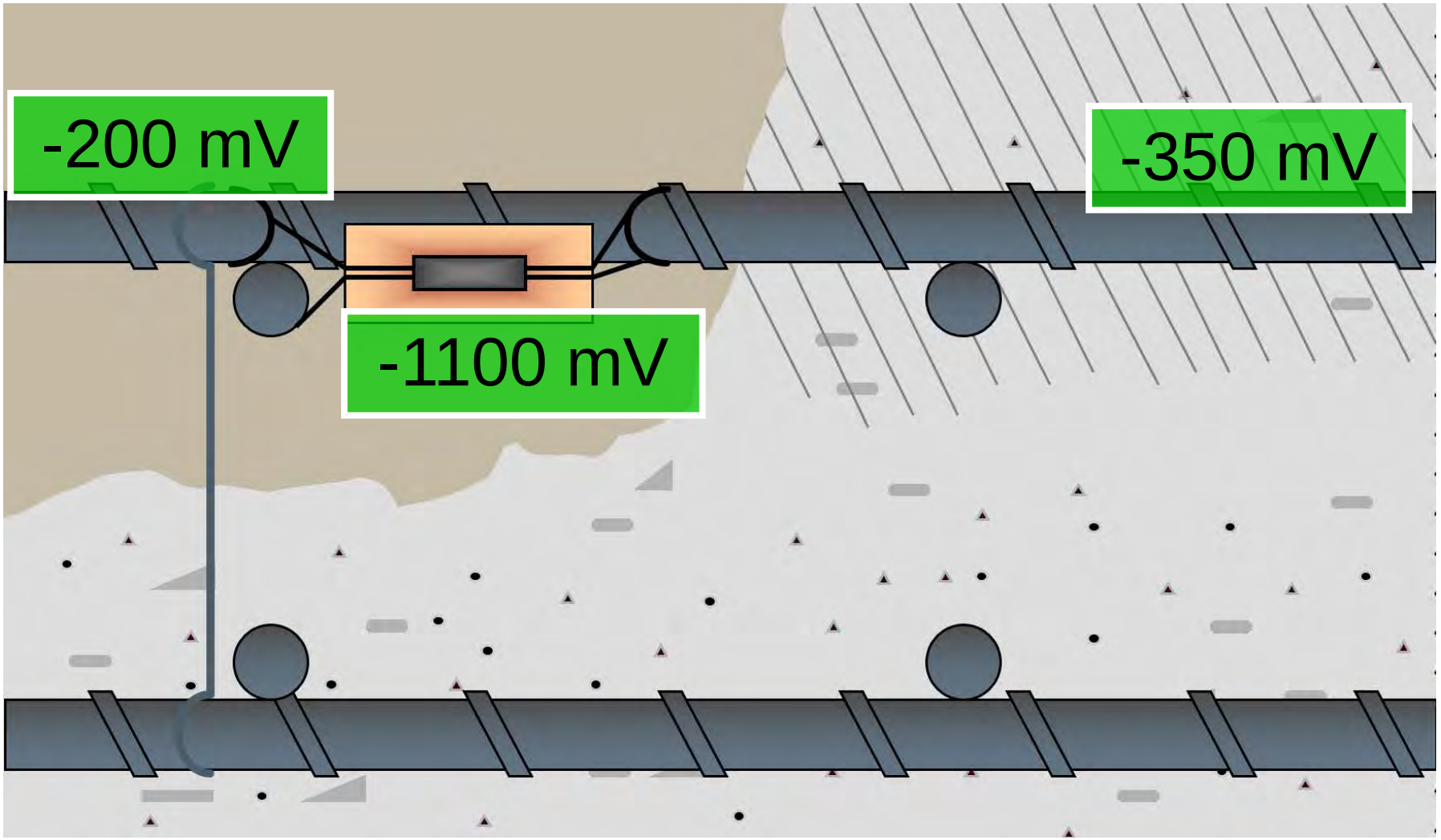
- Corrosion of Steel in Concrete
- What is Cathodic Protection
- Types of protection systems
  - Sacrificial (Galvanic) Cathodic Protection
  - Impressed Current Cathodic Protection
- Project Histories

Corrosion Cell Reinforced Concrete

Corrosion Cell in Concrete



Anode Galvanically Protects Surrounding Rebar



Types of Galvanic and Impressed Current Systems

Cathodic Protection Systems

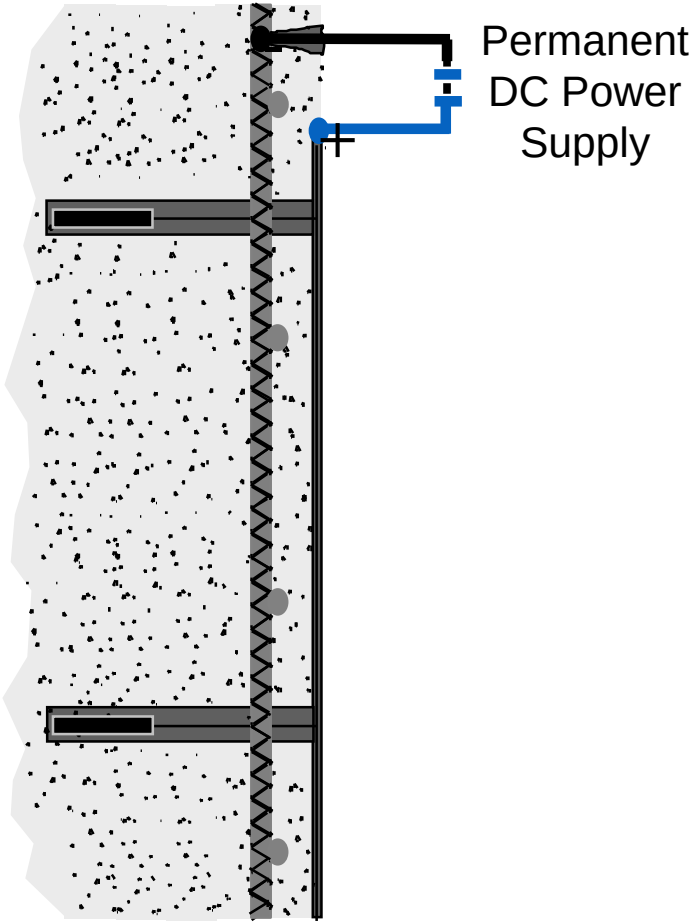
- Work by applying current to reinforcing steel to overcome the corrosion process
- Galvanic Systems
  - Sacrificial metal corrodes to provide electrons
- Impressed Current Systems
  - D.C. power makes electrons flow from anode to reinforcement (cathode)

Galvanic Protection Systems

- Anode has higher “electronegativity”, corrodes in preference to steel
- No outside source of electricity needed
  - No electrical components to maintain
- Lower driving voltage avoids hydrogen embrittlement of prestressed steels

Impressed Current CP

- Outside power source required
- High level of control
- System monitoring and maintenance required



Impressed Current CP


19 2:14PM

ICCP on Marine Bridge Footer

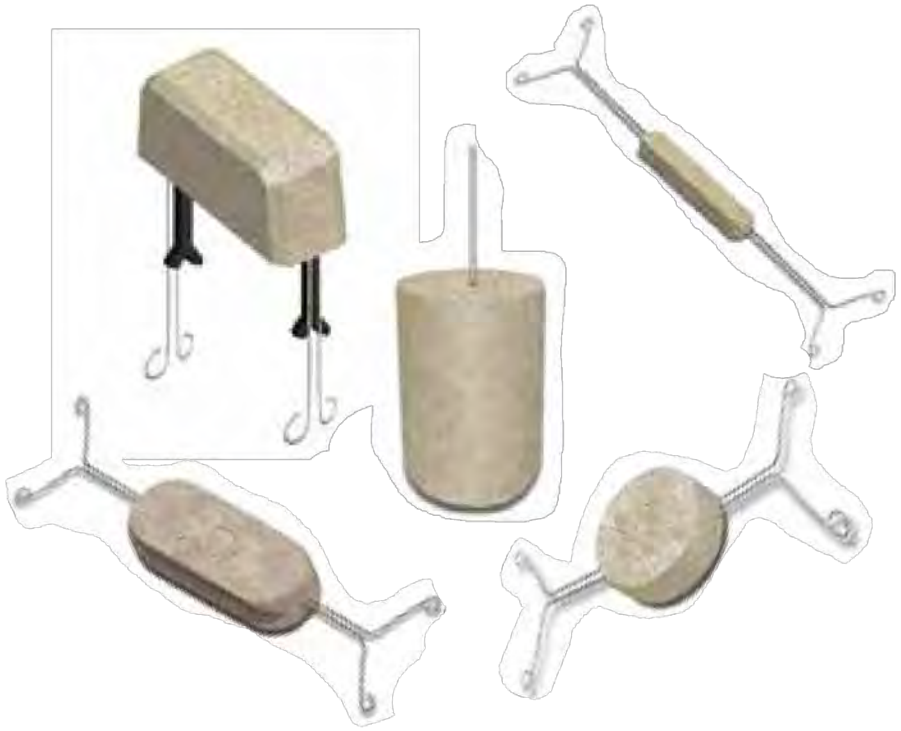
Surface Applied ICCP System

Copper Plant, Chile

- Copper concentrate filter plant and shipping built 1996 – 1999
- Corrosion due to cast in chlorides
- Tanks, support structures, and ship loading pier
- ICCP with various anode types
  - Ebonex conductive ceramic discrete anodes
  - Titanium mesh in concrete overlay
  - Impressed current and galvanic anodes in soil

Galvanic Systems

- Discrete Anodes



Discrete Anodes

Galvanic Systems

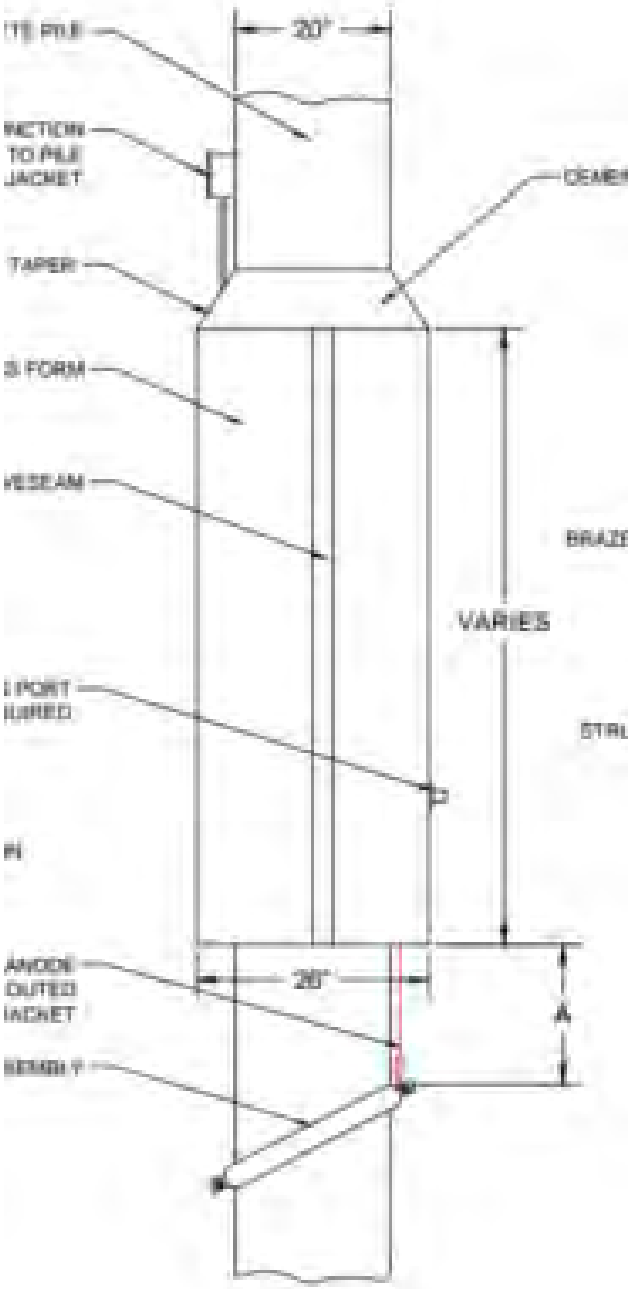
- Galvanic Jackets

Galvanic Jackets

Galvanic Systems

- Bulk Anodes

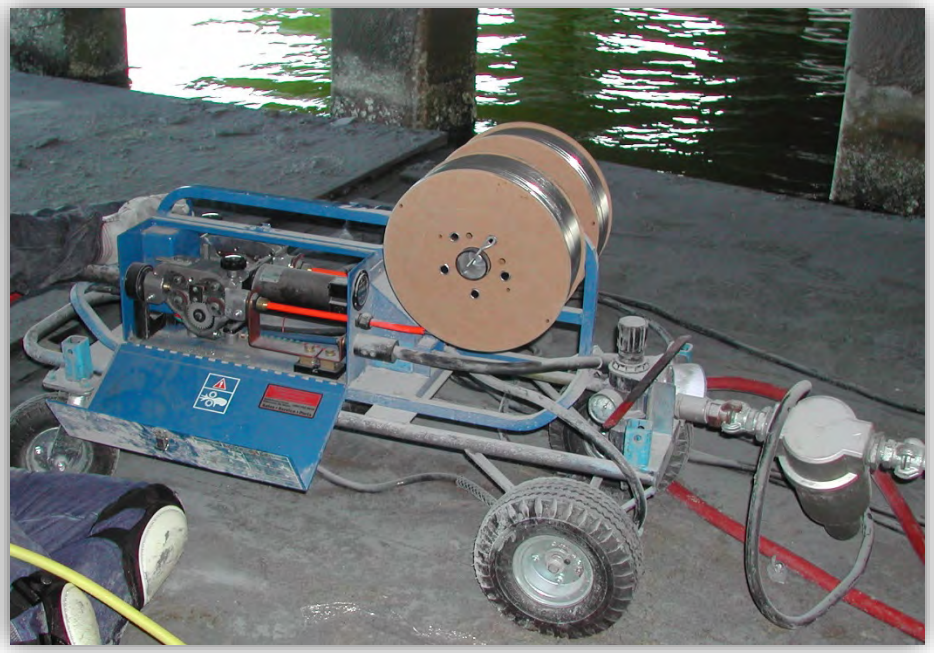
Bulk Anodes



Galvanic Systems

- Metalizing

Metalizing Spray

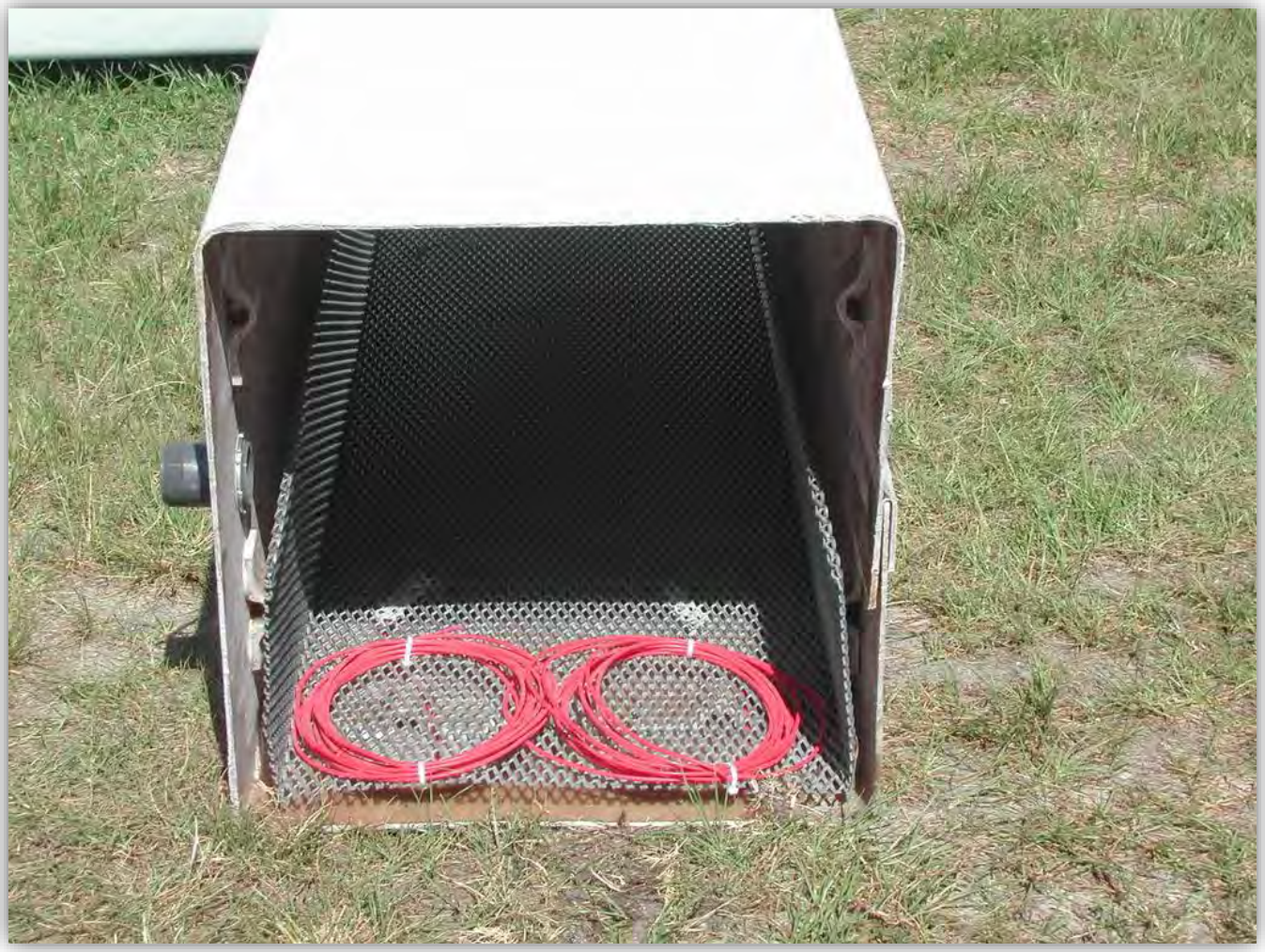


Port of Canaveral
North Cargo Pier Repairs

North Cargo Piers

- 700 - Galvanic Jackets, with bulk anodes
- 50,000sqft - Metalizing on Precast Deck Units
- 5000 ft - Strip Anodes in Pile Caps

Galvanic Jacket – Port Canveral



Galvanic Jacket – Port Canveral

Galvanic Jacket – Port Canveral

Bulk Zinc Anode - Port Canveral

Galvanic Jacket – Port Canveral

Galvanic Jacket – Port Canveral

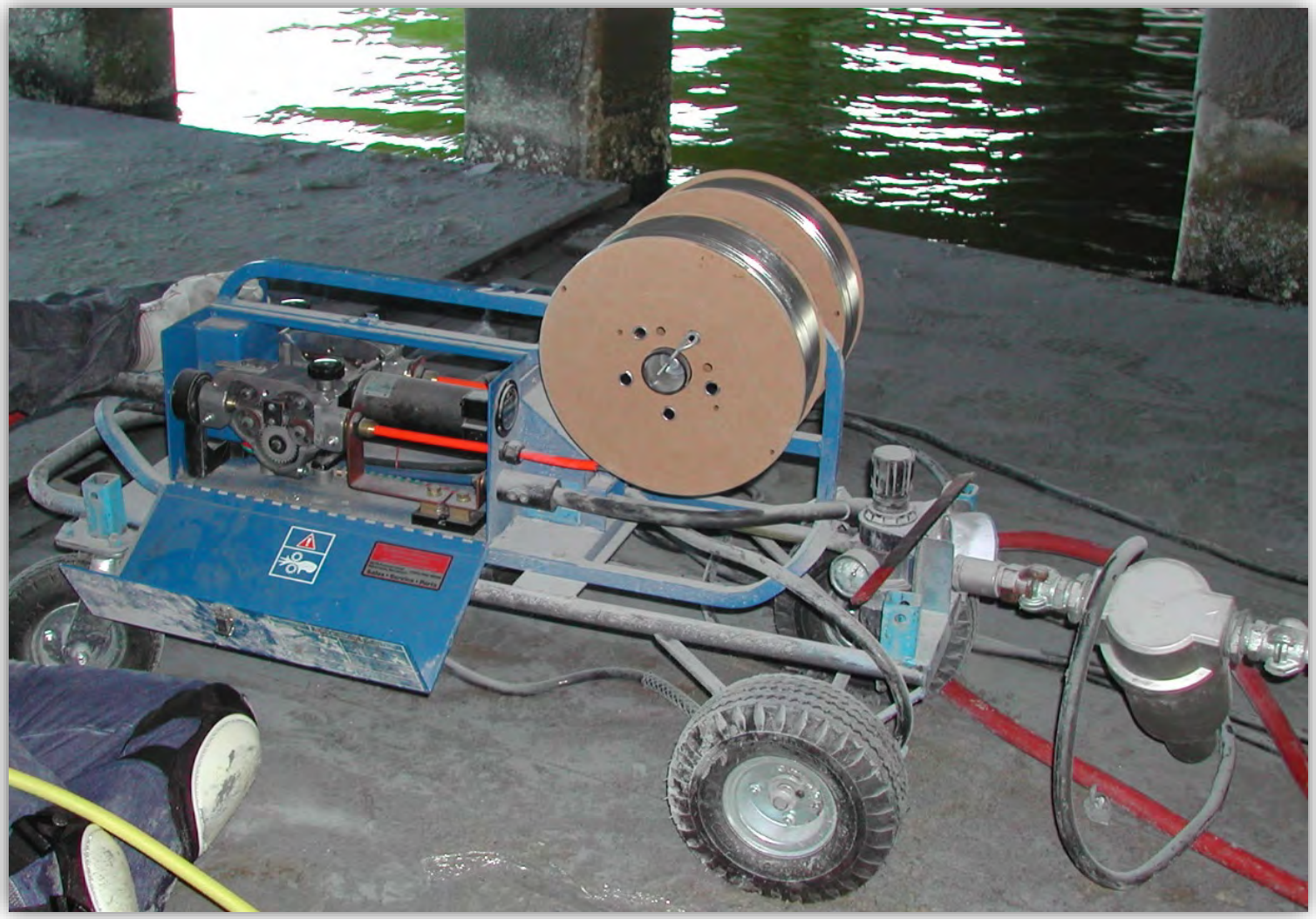
Strip Anodes – Port Canveral

Strip Anodes – Port Canveral

Strip Anodes – Port Canveral

Metalizing Spray – Port Canveral

Metalizing – Port Canveral



Metalizing – Port Canveral

Metalizing – Port Canveral

Metalizing – Port Canveral

Strip Anodes - Deck

- Elevated Slab
- Near Gulf Coast
- Chloride Contamination

New Construction
Cataño Ferry Terminal
San Juan

- Old Terminal was 35 years old
- New - 240 feet x 312 feet wide
- 4600 passengers a day
- Completed in 2012
- Met U.S. Green Building Council Requirements

Discrete Anodes New Construction


795
797
4250

Summary

- Galvanic or Impressed Current Systems
- Targeted or Global Protection
- Restoration and New Construction
- Service Life of system can be adjusted

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QUESTIONS

Thank You

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