Florida Department of
TRANSPORTATION

Corrosion and Materials Durability

Materials & Maintenance Meeting

Shannon Deese
State Materials Office (SMO)

March 2026

OFFICE OF MATERIALS MISSION

- Maintenance of Existing Cathodic Protection (CP) Systems
  - Performed by consultants and SMO personnel.
  - Consultant funding provided by each District.
  - Need is determined through inspection of existing systems.
- Upgrade/Replacement of CP Systems (Maintenance Activity)
  - Performed by consultants and SMO personnel.
  - Design of the system usually done in-house
  - Consultant funding provided by each District.
  - Notice of need varies from quick response to multi-year planning.

OFFICE OF MATERIALS MISSION

- Forensic Inspection of Structure to include Non-Destructive Evaluation
  - Ground penetrating radar (GPR).
  - Ultrasonic.
  - Rebar locators.
  - Surface resistivity.
  - Moisture content.
  - pH of the existing concrete.
- Developmental Research
  - Collaborate with industry to develop new technologies that will improve the longevity of the bridges.
  - Utilize the SMO lab facilities to test new technologies.

WHAT IS CORROSION ?

- Corrosion is a naturally occurring phenomenon commonly defined as the deterioration of a material (i.e. steel, zinc, aluminum) that results from a chemical or electrochemical reaction with its environment.
- In Florida, over 8,000 miles of tidal coastline and over 10,000 bridges are considered extremely corrosive.
- Bridge substructure is commonly affected by corrosion induced damage.

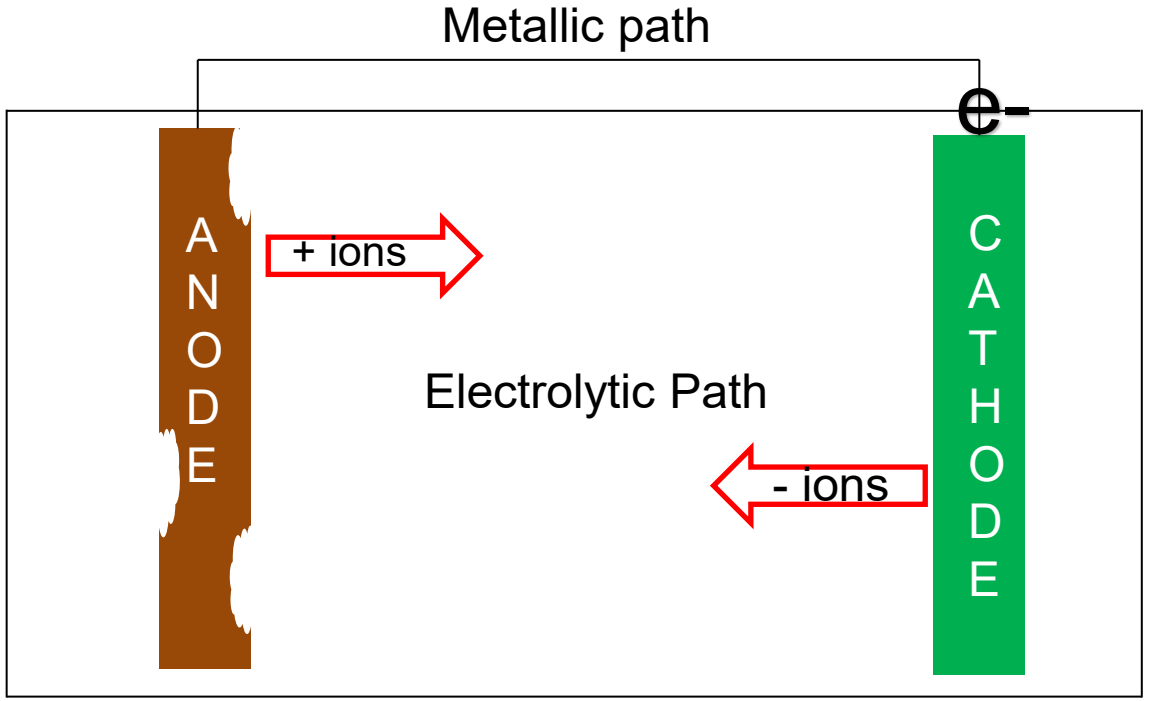
WHY DOES CORROSION CONTROL MATTER?

- Safety
- Service Life Reduction
- Structure Integrity
- Maintenance Costs
- Environmental Impact

Fern Hollow Bridge, Pittsburgh, Allegheny County, Pennsylvania January 28, 2022.

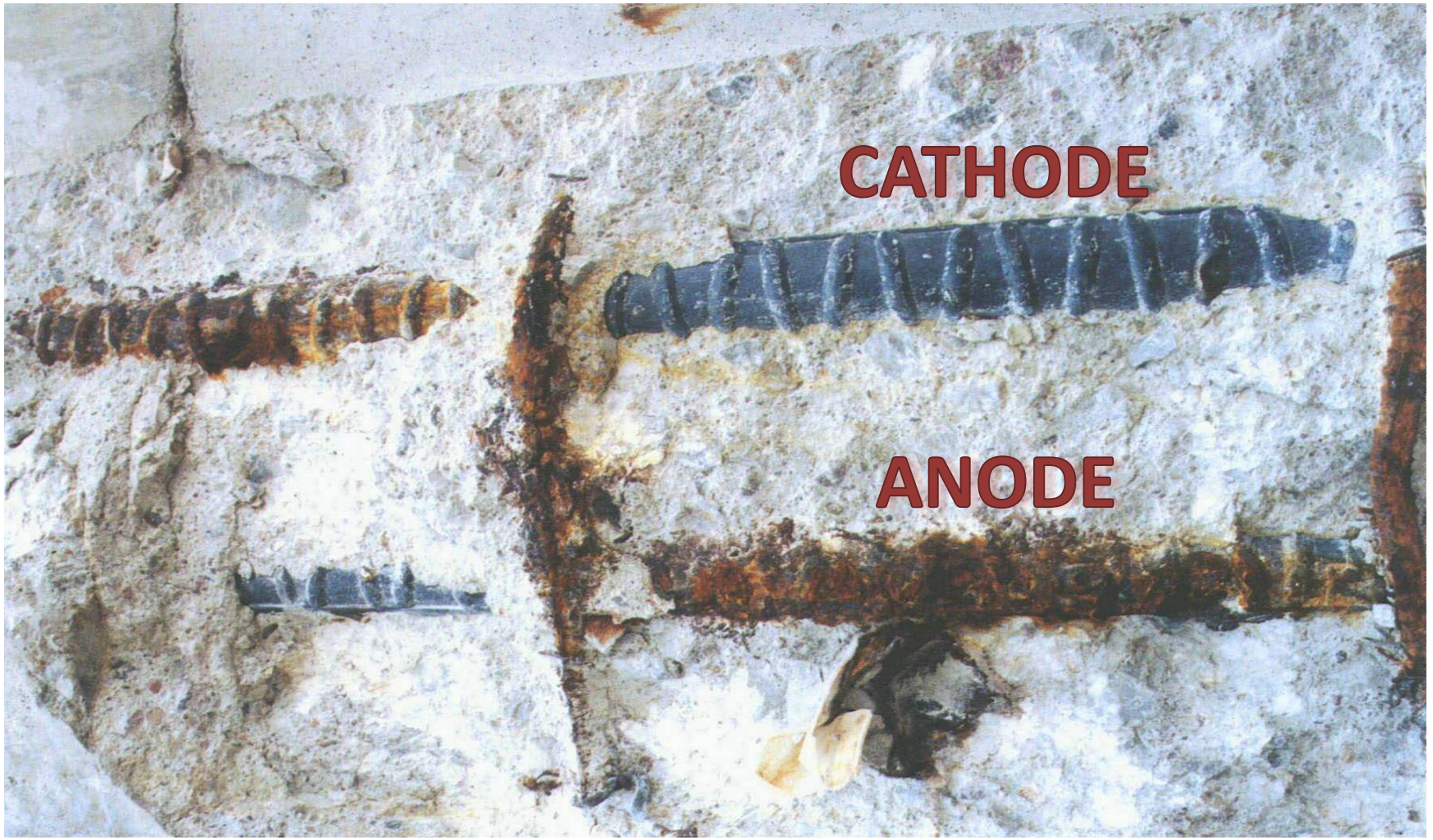
CATHODIC PROTECTION

- CP is an electrochemical method of corrosion control/protection that takes advantage of the electrochemical nature of corrosion by transforming a metal (anode) into a non-corroding cathode.
  - Types of CP
    - Galvanic cathodic protection (GCP)
    - Impressed current cathodic protection (ICCP)



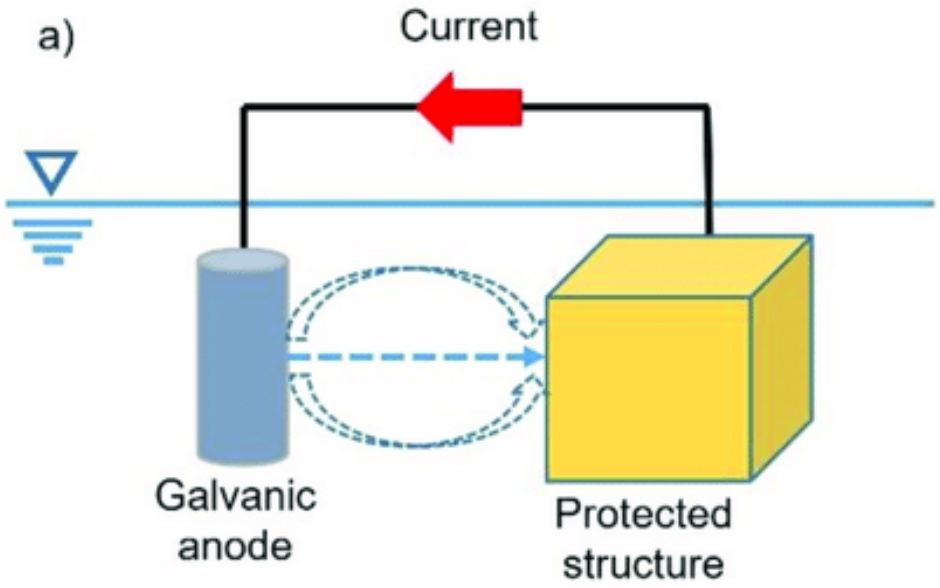
GOAL: To provide an extension of the service life as needed.

CORROSION MACRO-CELL

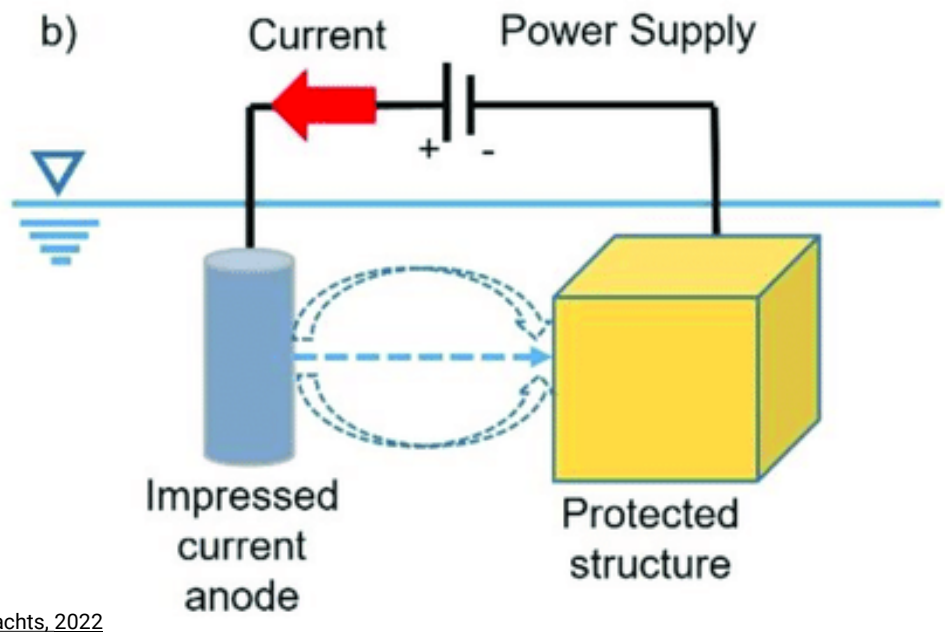


CORROSION MITIGATION

GCP



ICCP



Clematis D., etc, A Critical Analysis on the Current Design Criteria for Cathodic Protection of Ships and Superyachts, 2022

Which system should be designed?

Installation of GCP

This is a system negative connection for the CP system.

- Drill with steel drill bit
- Stainless steel self tapping screw
- Resistance Welded connection point
- Fully encapsulated in epoxy

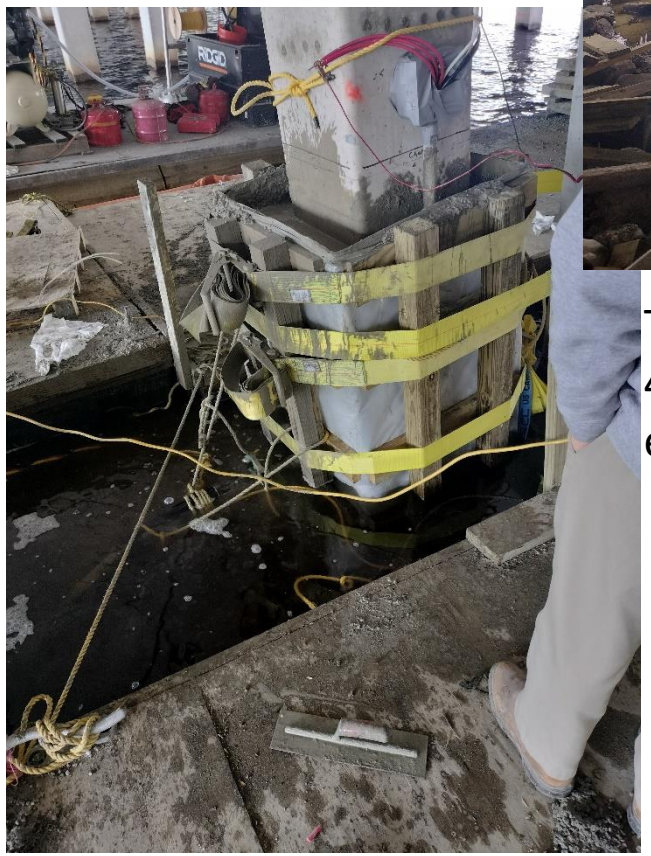
Installation of GCP

Goodbys Creek Project in Jacksonville

Before jacket install.
After continuity corrections.

Beginning of concrete filling.

Near end of concrete filling. Trying to push the last of the water out before filling from top.



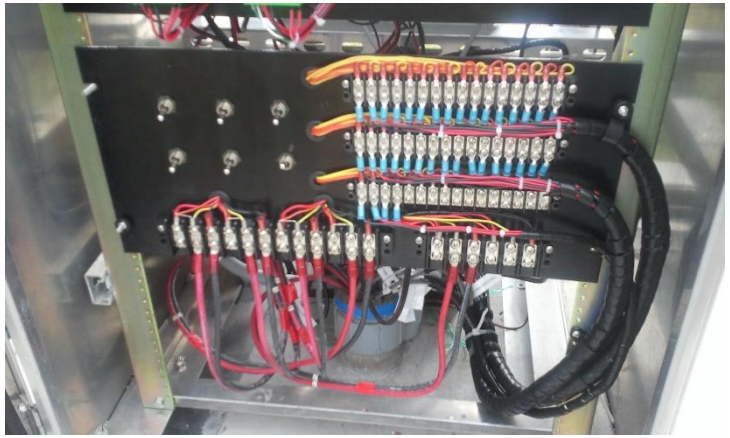
Three completed jackets with 45-degree chamfers and an energized CP system.

GCP BRIDGES STATUS

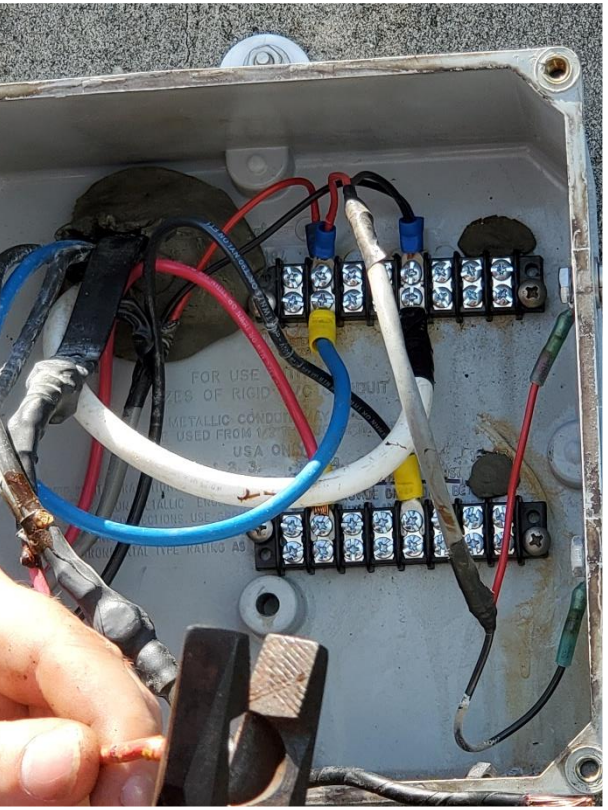
- There are 206 bridges with GCP. In all districts.
- About 100 inspections per year.
- They are inspected on a continuous 2-year cycle.
- GCP is not remotely monitored yet. The technology has been developed by SMO for this. The ability to fund a project of this scale has not been sourced yet.
- On average, five new galvanic systems are designed and built each year, adding to the total inspected every year.

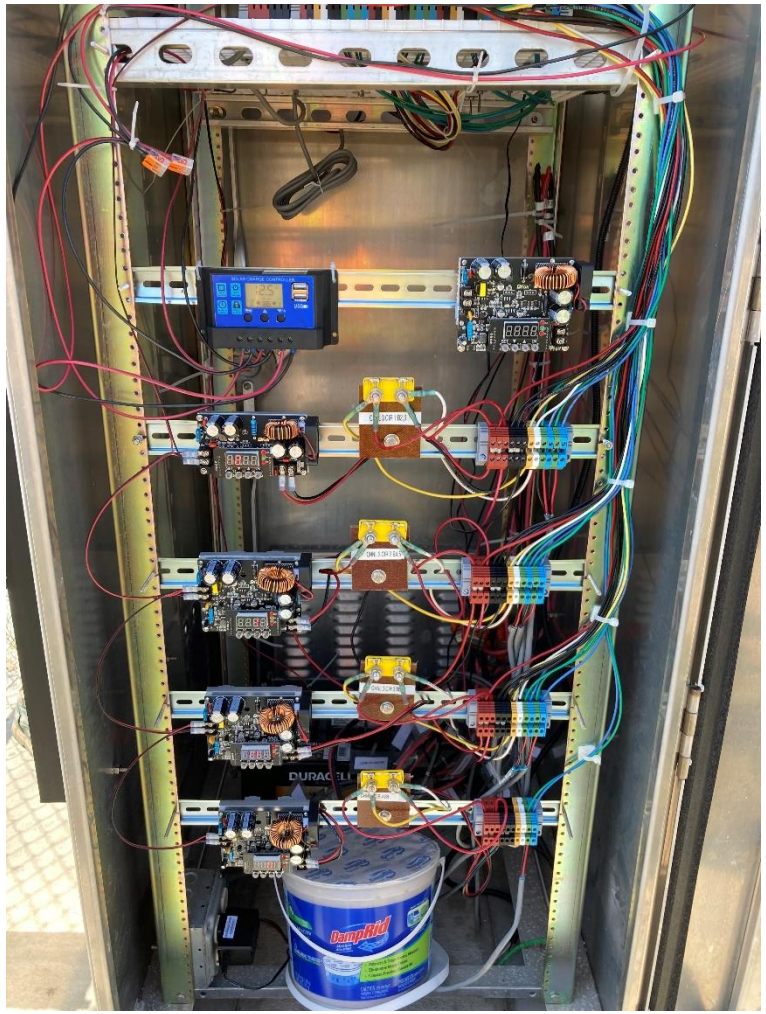
Installation of ICCP

Installation of ICCP system at Cedar Key with an anode ribbon



Inspection of ICCP





Solar Upgrade for ICCP System

US-192 Solar Upgrade for ICCP System

REMOTE MONITORING SYSTEM

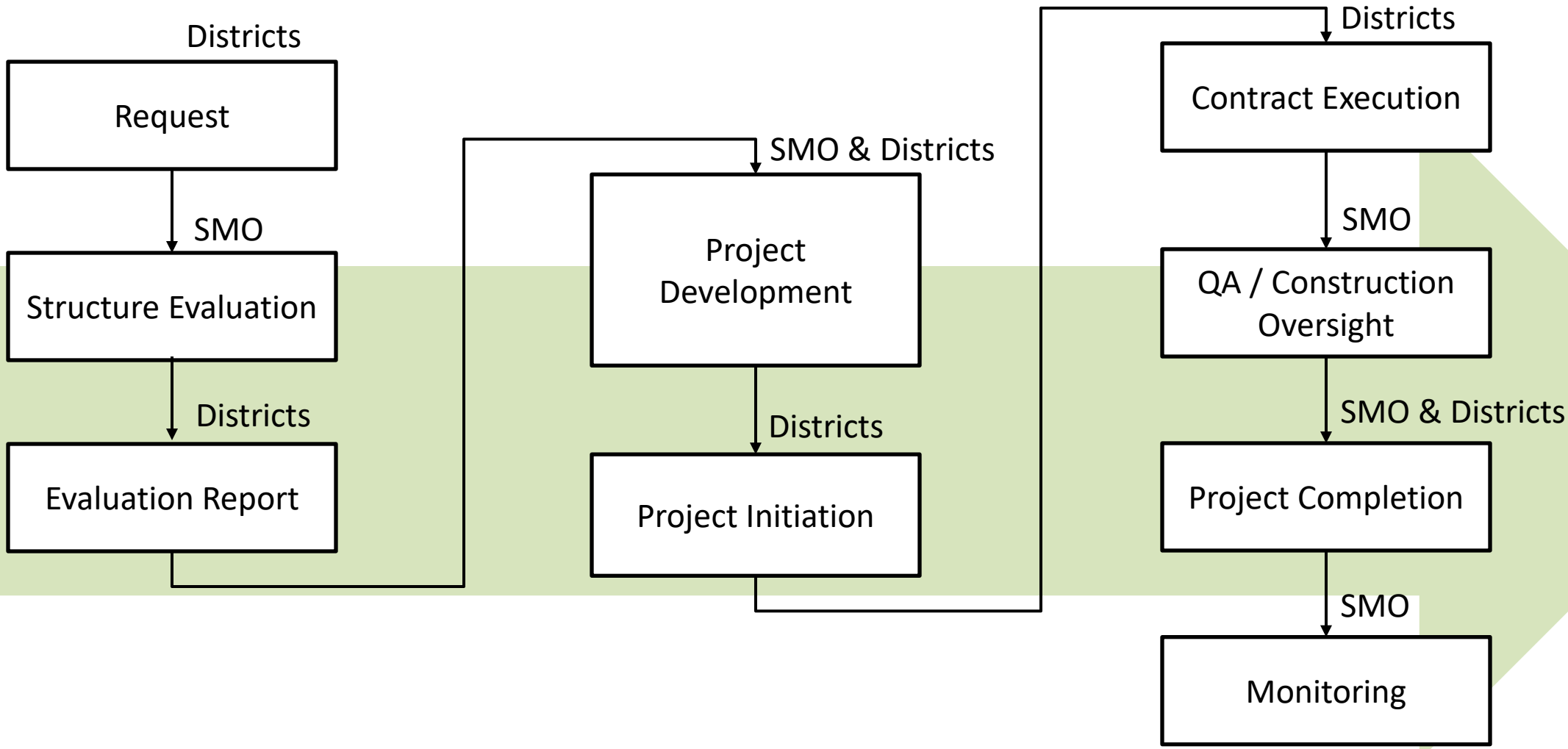
ICCP BRIDGES STATUS

- There are 37 bridges with ICCP. They are in Districts 2, 3, 4, 5, 6, and 7.
- 11 bridges with ICCP are solar powered.
- Six have remote monitoring capability and are inspected on a continuous 6-month cycle.
- 12 inspections per year.
- The remainder are inspected on a continuous 2.5-month cycle.
- 372 inspections per year.
- Seven more are scheduled for remote monitoring over the next two years.

GCP VS ICCP

Attribute	GCP	ICCP
Power	No external power required	External power required
Inspection Frequency	Two years (required by FHWA)	Six months (SMO frequency)
Current Control	Standard designs do not provide current control. Resistors can be added to reduce current in special situations.	Current output can be adjusted and controlled through the rectifier.
Current Capacity	Limited current capacity (depends on concrete condition, exposure, and circuit resistance)	Greater current capacity (typically project specific)
Annual Cost	Lower	Higher
Expected Service Life Before Rehabilitation	< 20 years	➢ 20years

CP SYSTEM PROJECT DEVELOPMENTS



Bridge Monitoring System

REMOTE MONITORING SYSTEM

- Data
  - Current output
  - Voltage output
  - Current and voltage input
  - Returning potentials (-800 mV)
  - Time & date

- Future Optional Upgrades
  - Weather station
  - Traffic camera
  - Scour monitoring system
  - Water Level

Bridge Monitoring System

CONCLUSION

- SMO supports the Districts by:
- Inspecting existing cathodic protection systems.
- Evaluating corrosion-related bridge needs.
- Developing and advancing CP systems that improve service life, reliability, and long term value.

OFFICE OF MATERIALS – CMD TEAM

Oliver Chung
Corrosion and Composite Materials Engineer
oliver.chung@dot.state.fl.us
352-955-2901

Shannon Deese
Corrosion Mitigation Technologist
shannon.deese@dot.state.fl.us
352-955-6697