Preservation of Prestressed Beams

Presented at

WBPP Meeting

by

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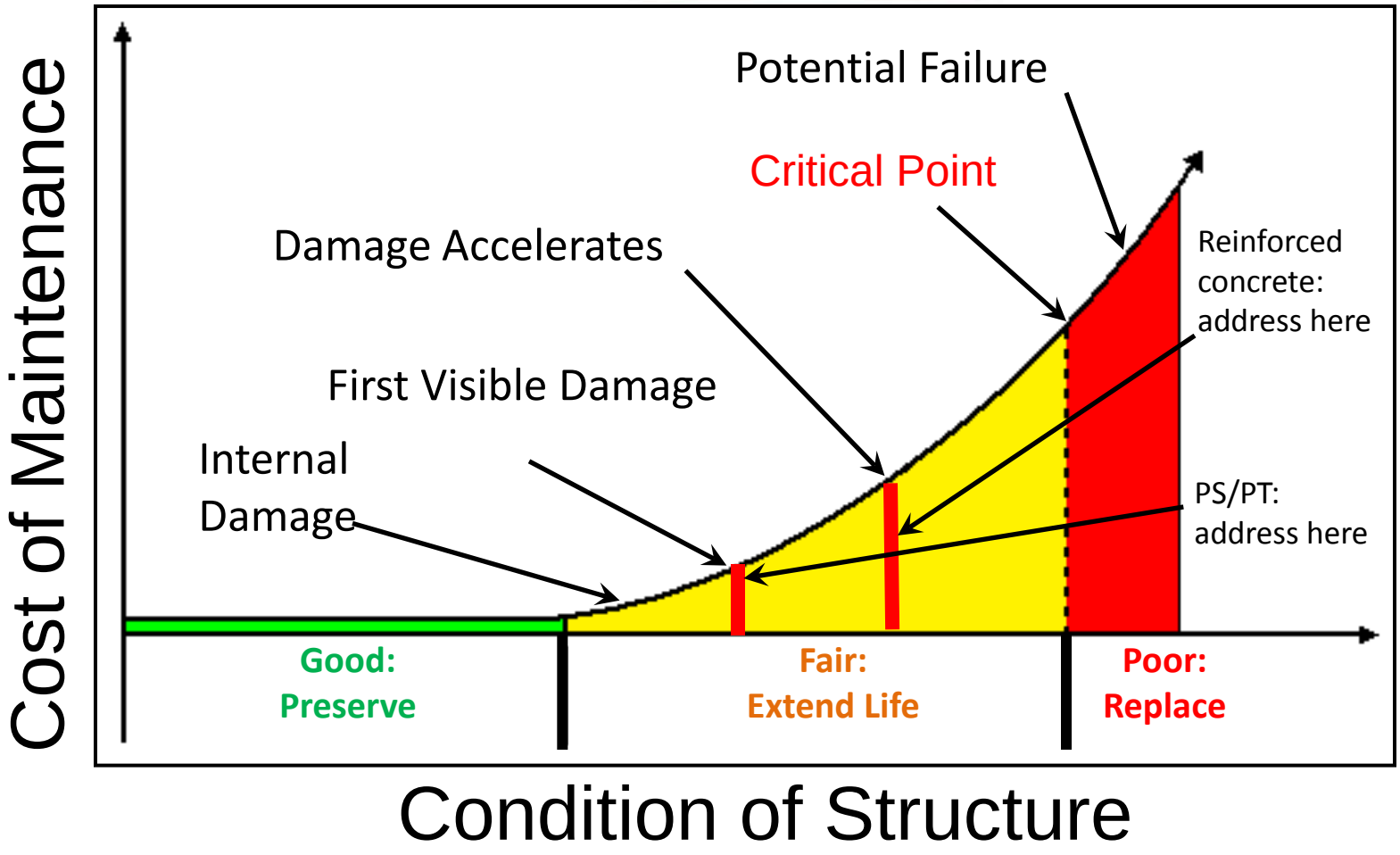
Corrosion Cost Progression



FHWA Preservation Guide

Bridge preservation is defined as actions or strategies that **prevent, delay or reduce deterioration of bridges or bridge elements**, restore the function of existing bridges, **keep bridges in good condition and extend their life**. Preservation actions may be preventive or condition-driven**.**

- Source: FHWA Bridge Preservation Expert Task Group, May 2011

Benefits of Bridge Preservation

- Keeps good bridges in good condition
- Improves the overall condition of infrastructure assets
- Longer service life
- Reduces the overall dollars spent per year for the actual life of the structure

Why Bridge Preservation?

- We want to answer questions such as:
  - **How bad is bad?**
  - **How to project future deterioration?**
  - **How do we cost effectively extend the life?**
- Develop a inspection strategy to quickly identify/quantify problems
- Identify repair schemes
- Schedule repair/rehabilitation in a timely manner
- Average preservation cost savings for owners **75 to 80%** compared to replacement

Assessment of Concrete Structures

1. Non-Destructive Evaluation (earlier identification)
   - Identify and quantify deterioration of concrete and steel
2. Electrochemical Testing
   - Quantify time-to-failure, corrosion rates, future section losses
3. Laboratory Testing
   - Required concrete and corrosion testing
4. Estimate Service Life
   - Recommend the cost effective solution

Non-Destructive Testing (NDT)

- Use NDT to identify hidden problems
- Minimize inspection time and damage to the structure
- Primary NDT tools:
  - Ground Penetrating Radar (GPR)
  - Infrared Thermography
  - Impact-Echo
  - Ultrasonic Thickness
  - Magnetic Particle

NDT Tools

Case Study 1
Prestressed Beam: US 12 - INDOT

Key Ingredients for Deterioration:

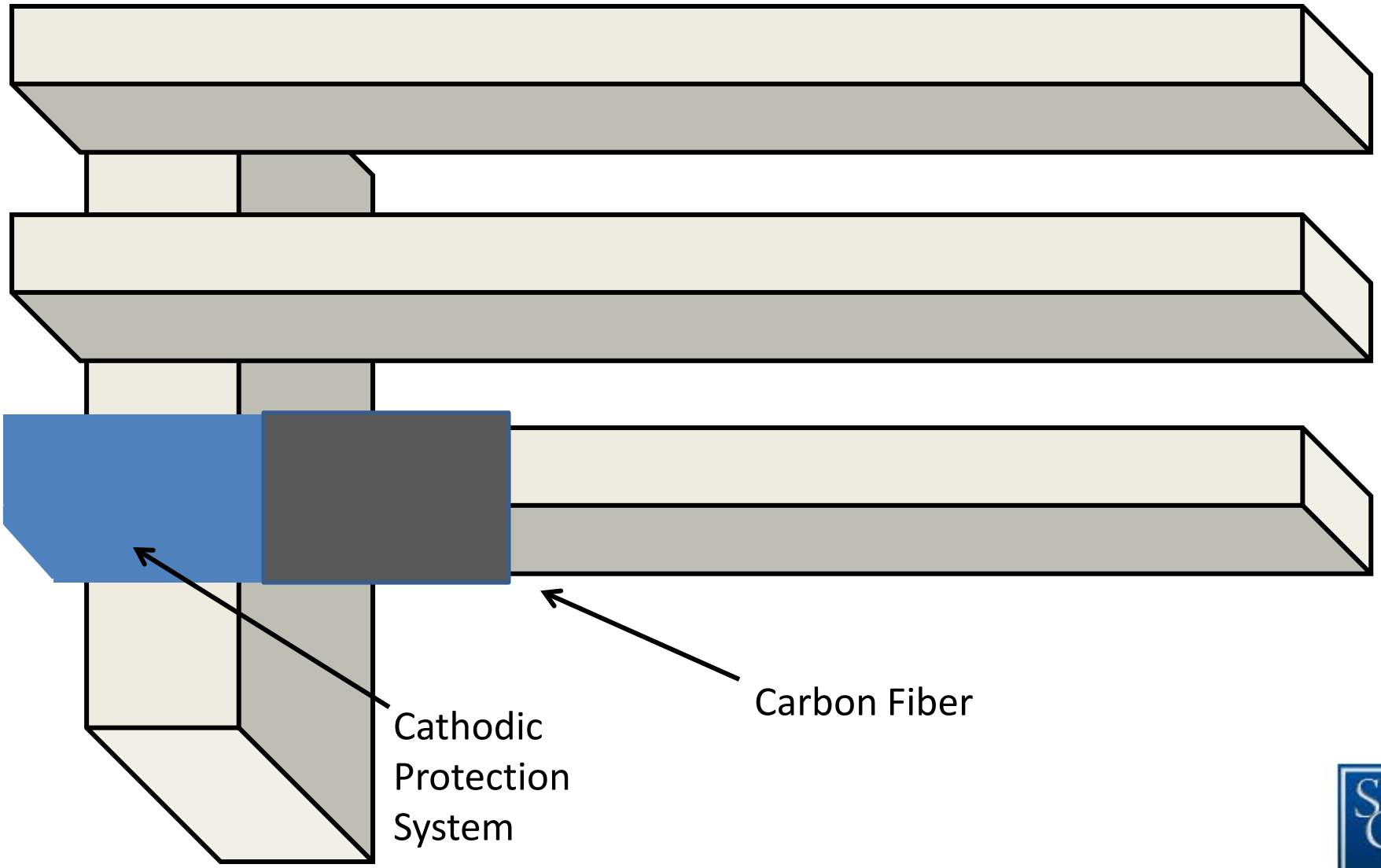
- Chloride
- Moisture
- Resistivity
- Temperature

Problem

- Visual inspection revealed deteriorated beams/beam ends and spalled concrete; main concern - additional cracking and shear failure
- How long before corroded beams resulted in structural failure or partial failure?

Solution

- Extent of beam/beam end deterioration was determined
- A corrosion protection system was designed – plans were developed to extend the lives of prestressed beams

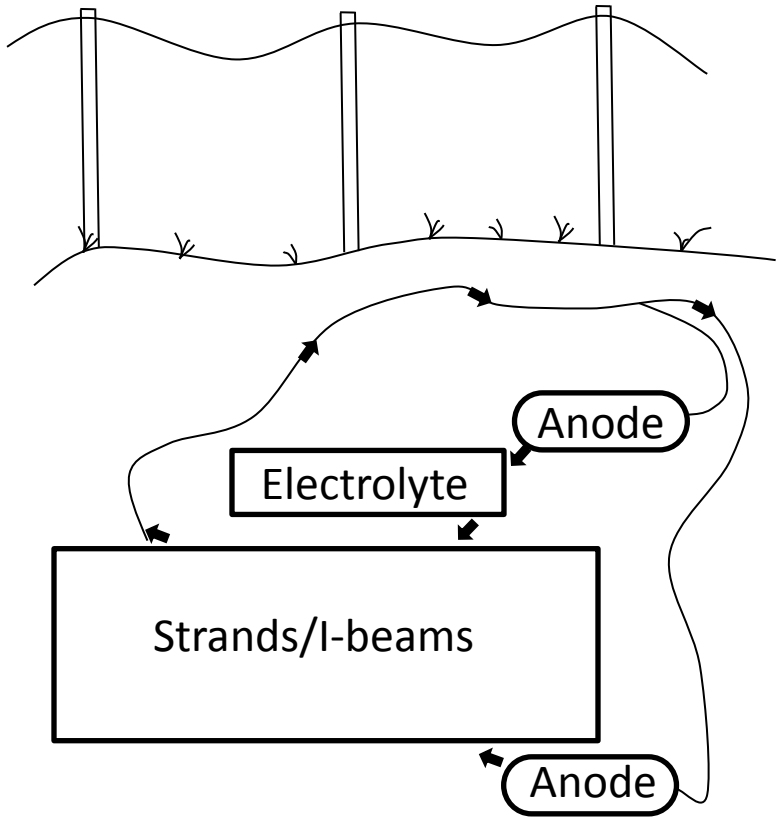

Cathodic
Protection
System
Carbon Fiber

Solution

Cathodic Protection Installed

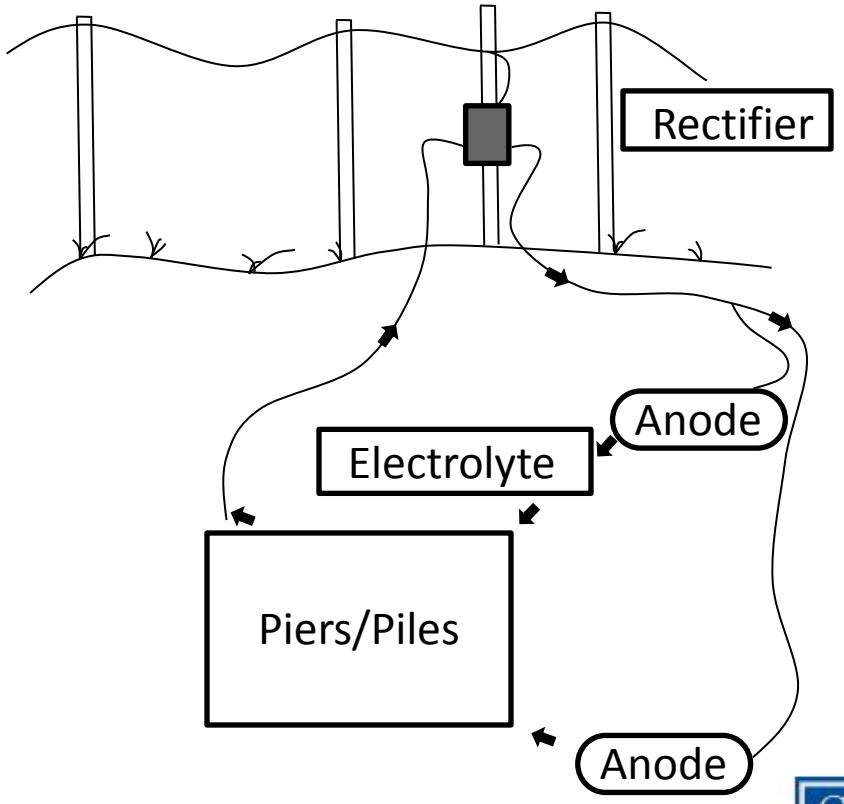
Galvanic CP

For strands/I-beams



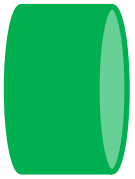
Impressed Current CP

For piers/piles



Benefit

Replacement = $10 million



Preservation = $2 million

$8 million savings

$21 million savings after cost of money in 20 years at 5%

Case Study 2
Prestressed Beam Bridge - NJTA

P/S Beam Bridge – Joint Leak

Problem
P/S Beam Corrosion Damage

Problem
P/S Beam Corrosion

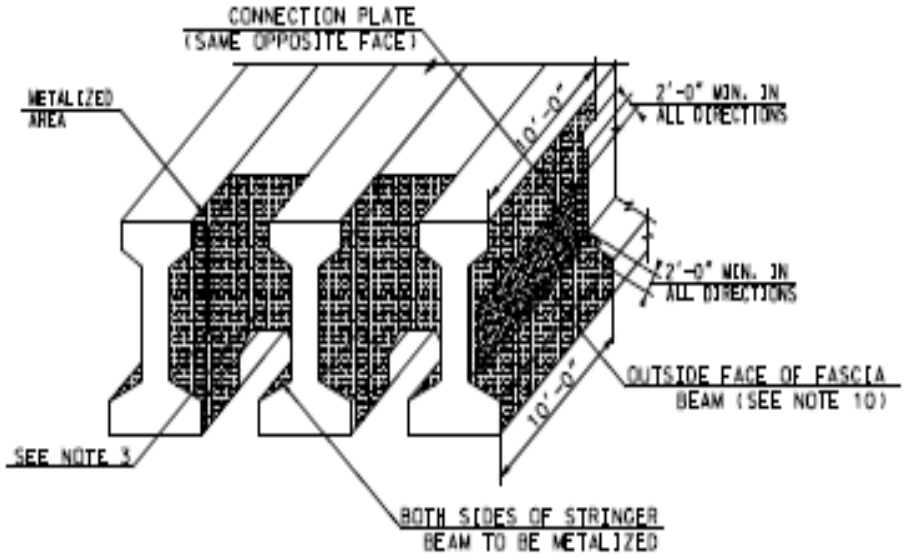
Problem
P/S Beam Corrosion Damage

Evaluation
P/S Beam Bridge

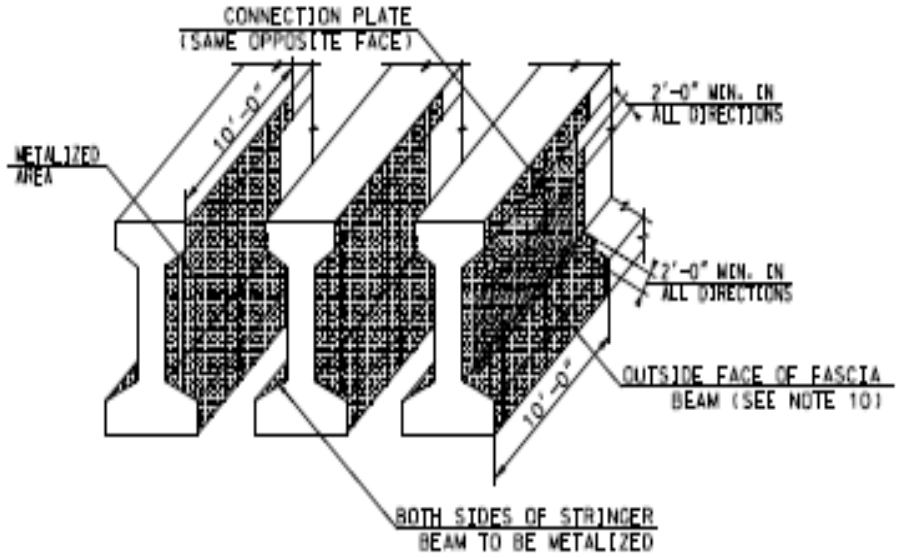
Recommendations

- Repair existing concrete damage
- Apply waterproof coating to girder ends, that are not chloride-contaminated
- Apply Galvanic Cathodic Protection (GCP) to the beam ends that are chloride contaminated
  - GCP system will prevent corrosion of the reinforcement, even if chlorides are present
  - Installation of GCP along with concrete repair will reduce future corrosion and increase time to future repairs

P/S Beam End Corrosion Protection



BEAM METALIZING FOR ALL PRESTRESSED
CONCRETE BEAMS (WITH DIAPHRAGM)



BEAM METALIZING FOR ALL PRESTRESSED
CONCRETE BEAMS (WITHOUT DIAPHRAGM)

Solution
Galvanic Cathodic Protection

Spraying Al-Zinc Anode Coating to Surface

Preservation Activities (GCP)

Benefits of Corrosion Protection

- Cathodic protection program has been **successful in extending the service life** of P/S beams.
- Cathodic protection program is **a cost effective** method of preserving the beam ends from corrosion related deterioration.

Questions?

Thank You!