City of Irving
48” MacArthur Line Repair
With Carbon Fiber Wrap Materials

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Thanks to Todd Reck and Steve Pettit (City of Irving) for assistance with project pictures and background details

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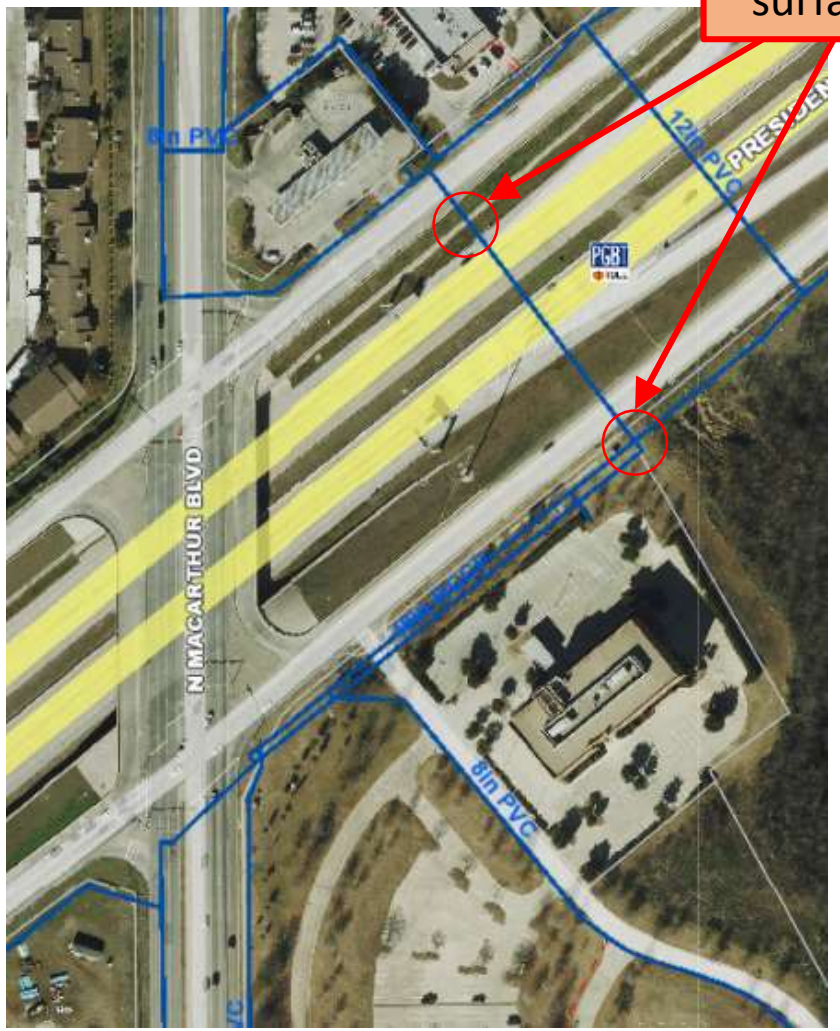
PROJECT BACKGROUND

- 48” PCCP Leak in January 2017
- Major crossing under George Bush Tollway (Hwy 161)
- Multiple water lines made it difficult to determine leak source
- Limited access to excavate
- Potential loss of water to businesses and restaurants
- Potential loss of power to Las Colinas Medical Center



PROJECT BACKGROUND

- Leak located by leak detection contractor in area of major underground utilities and access road
- Dewatered and manways constructed for forced air and ventilation.
- Pipe Segment (16 Feet Each) Identified with Wire Breaks and temporary weld repairs completed.

PROJECT LOCATION

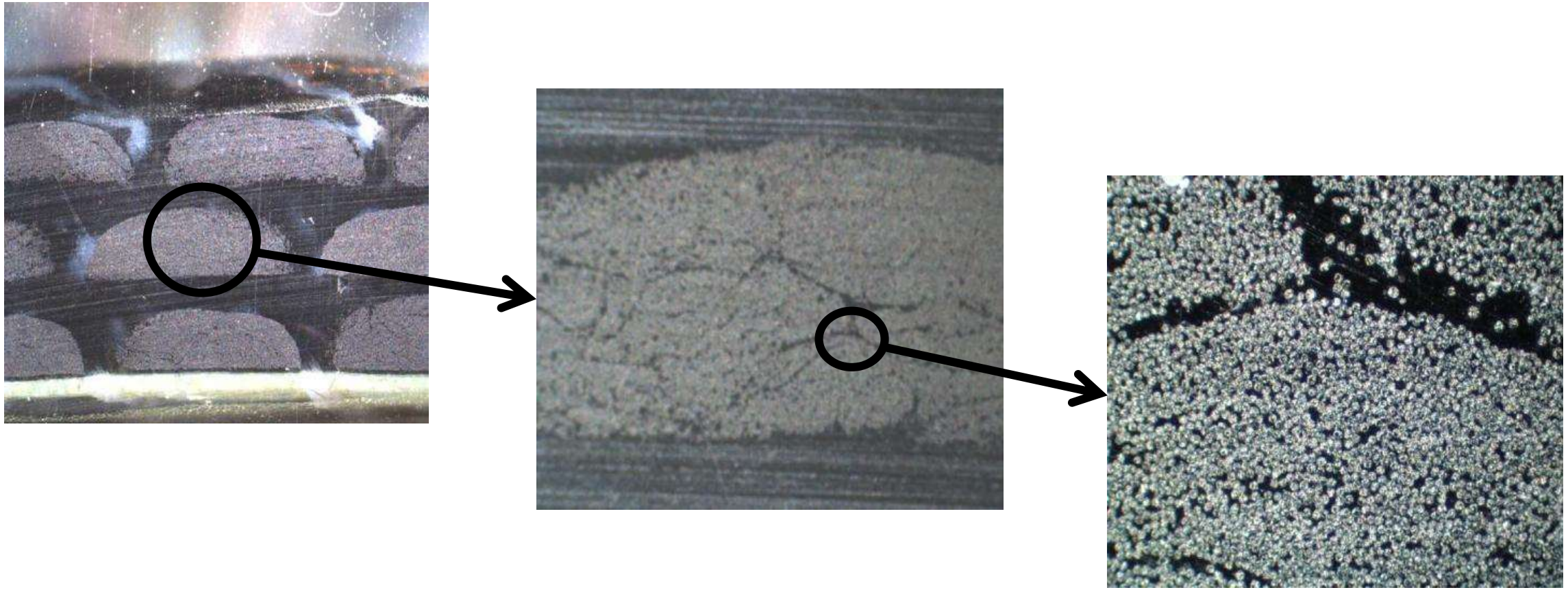
- Permanent repairs completed with CFRP
- Emergency mobilization for CFRP completed in 1 week to avoid additional shutdown
- Total repair time approximately 2 months

INTRODUCTION TO FRP

- Carbon Fiber Reinforced Polymers (CFRP)

- Glass Fiber Reinforced Polymers (GFRP)

CARBON FIBER REINFORCED POLYMER (CFRP): UP-CLOSE



TRADITIONAL APPLICATIONS

Column, Beam, Slab, Wall, and Tank Strengthening

PRESSURE PIPE REPAIR OPTIONS

External Repairs

CFRP Rehabilitation

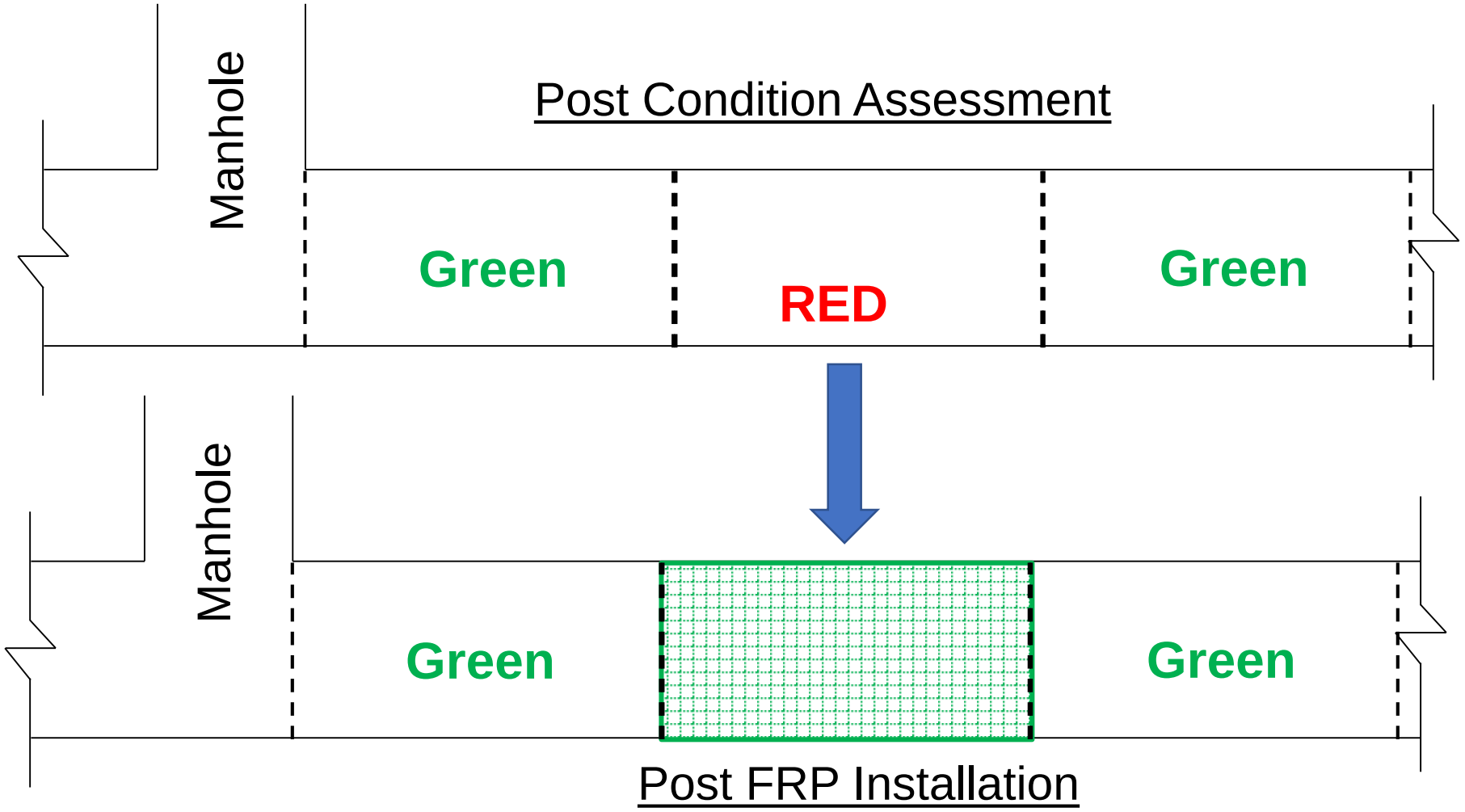
Replacement

TYPICAL CFRP ENVELOPE

Diameter Range:
Medium – Large
30” – 252” (Internal)

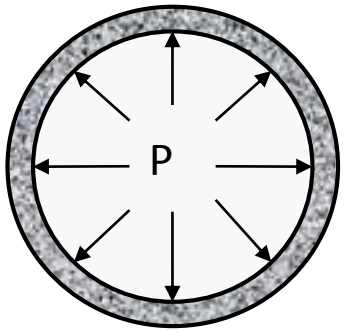
Pressure Range:
Up to 400+ psi
Vacuum Pressure (to 14.7 psi)

OVERVIEW OF PROJECT PROGRESSION

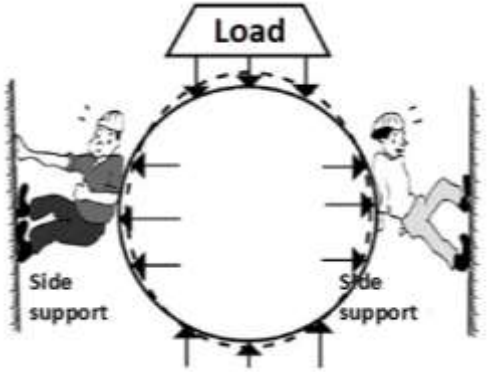


AWWA C305 DESIGN REQUIREMENTS

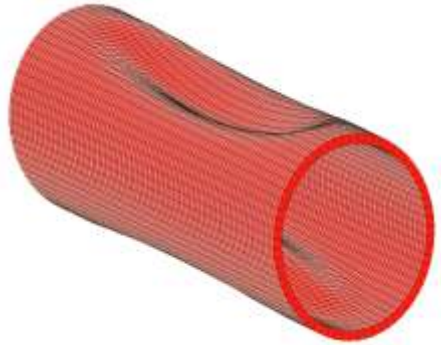
Hoop Direction



Burst Pressure

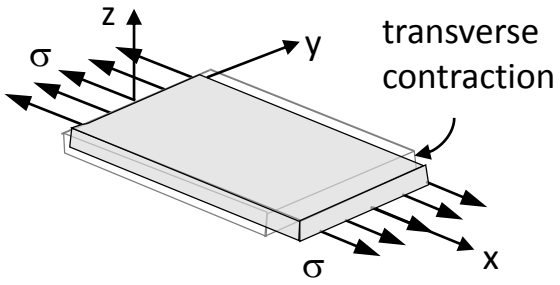


Pipe Deflection

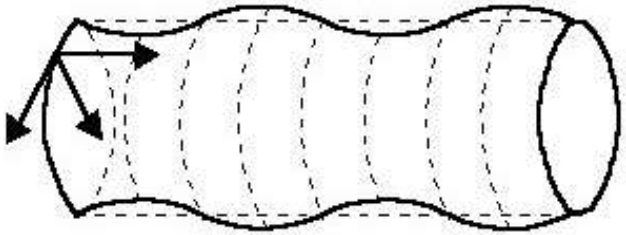


Constrained Buckling

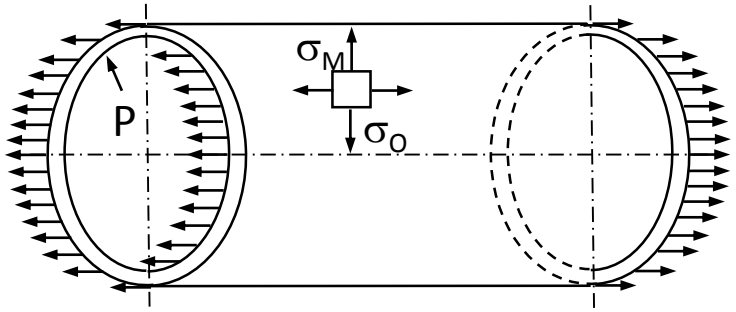
Longitudinal Direction



Poisson's Effect



Temperature Change



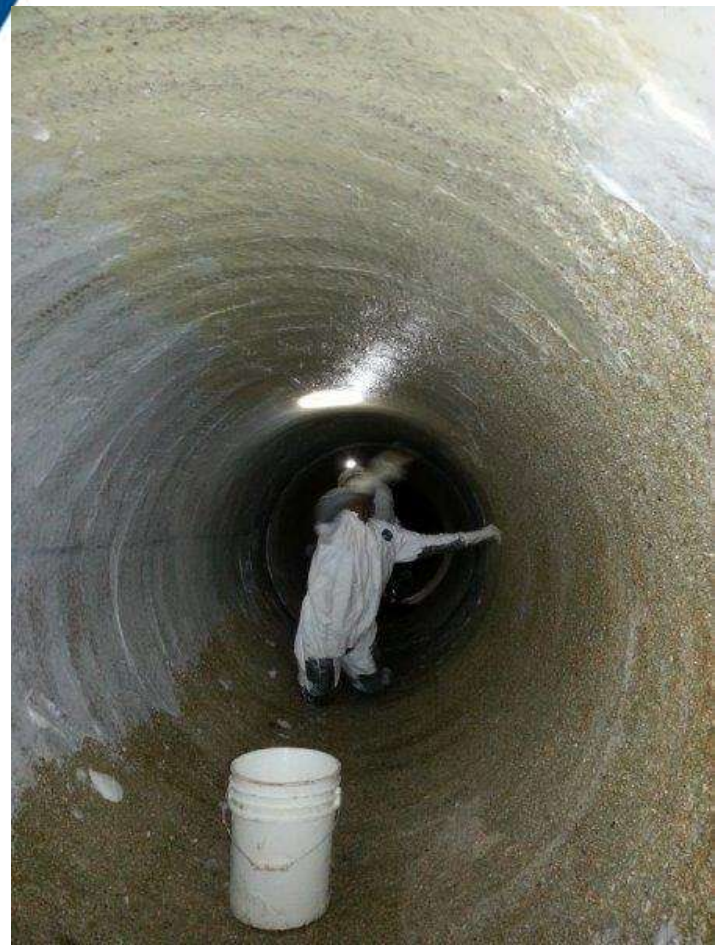
Thrust Loading

STEP 1: SURFACE PREPARATION

Sand Blasting Equipment

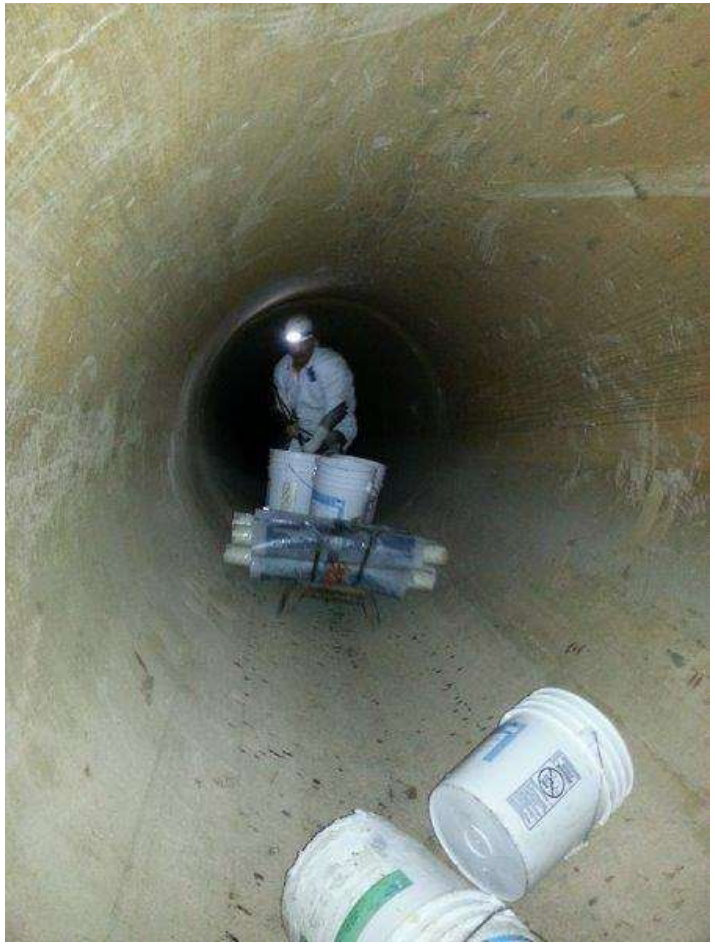
Finished Surface - Concrete

STEP 2: PRIMER / SATURATION



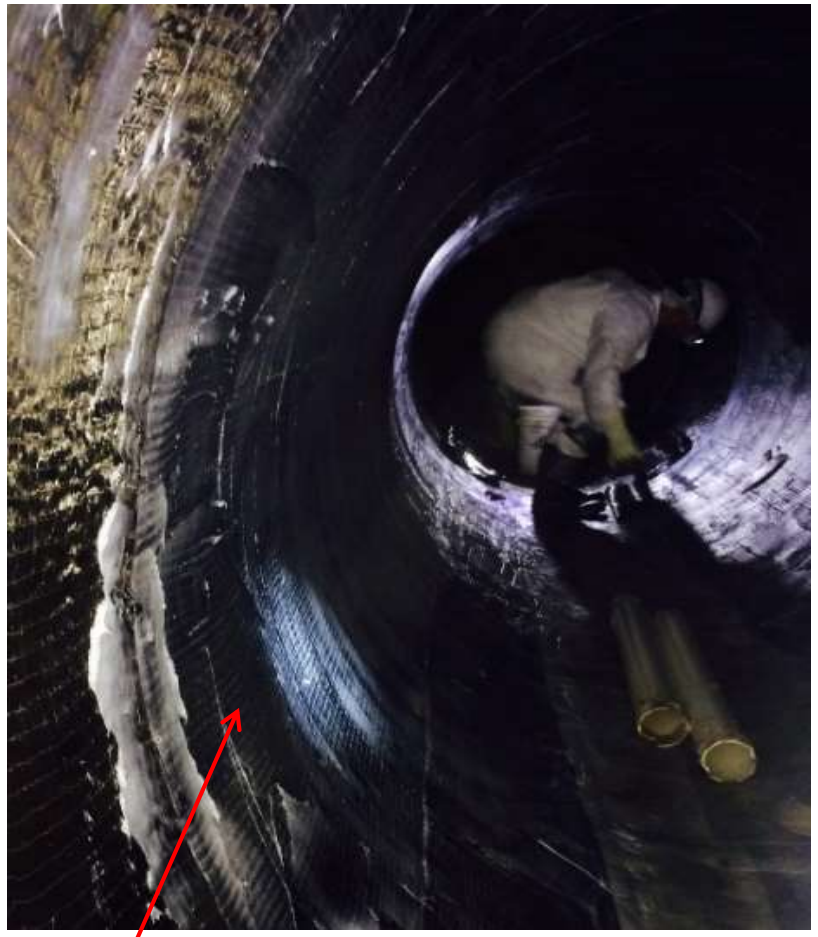
Surface Primer

CFRP Impregnation



Material Transport

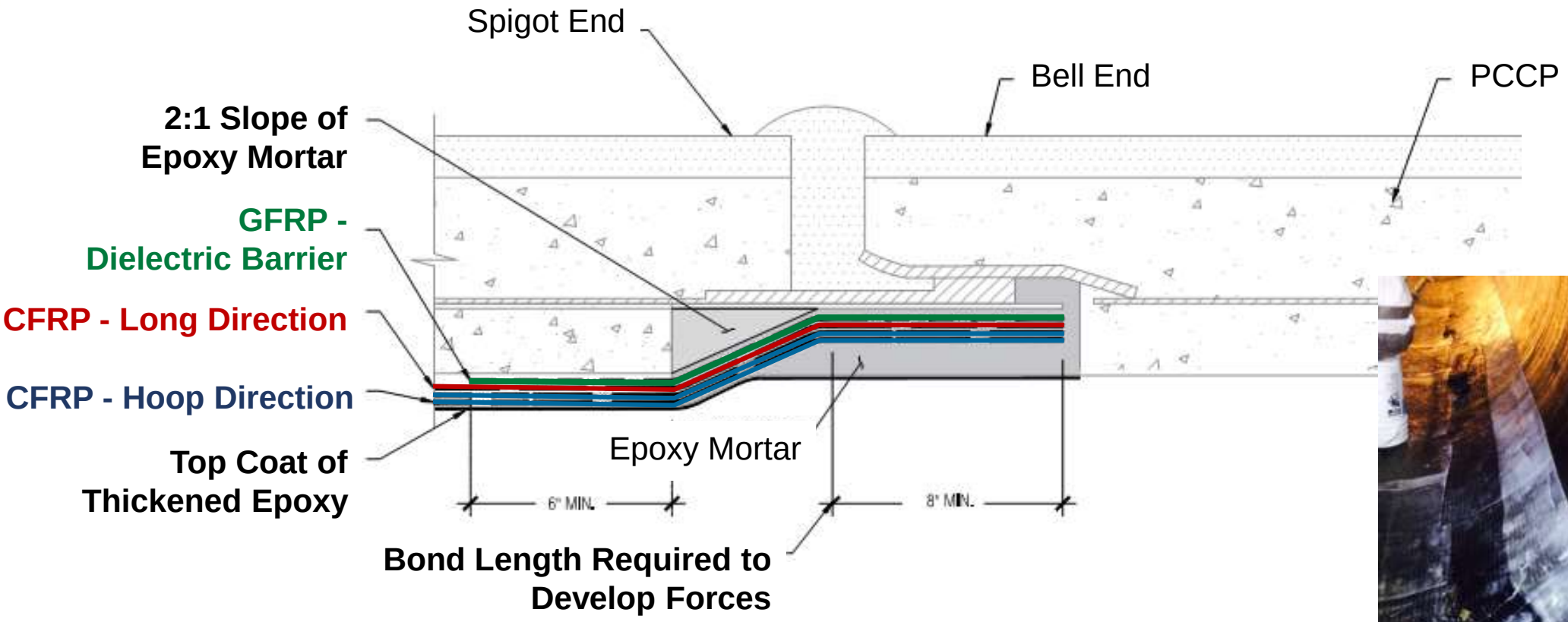
STEP 3: FRP SYSTEM INSTALLATION



Circumferential layer

Completely Installed
FRP System

STEP 4: TYPICAL TERMINATION DETAIL



FIELD QC – MOCK-UP PANEL TESTING

- Minimum (3) 2 ft. x 2 ft. panels on adjacent non-repair pipes
- Prepared and tested by Installer (ASTM D4541)
- Witnessed by Inspector
- >200 psi required for at least 3 tests per panel

TESTING OF WITNESS PANELS

- Prepared by the Installer, witnessed by the Inspector, tested by the Independent Testing Agency
- Typically two-panels per day per work shift
- Typically two-layers unless otherwise specified
- Preparation of panels spread throughout construction
- Mean tensile strength and modulus obtained per ASTM D3039 should be greater than the characteristic values used in design

QUESTIONS?

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