

Using StrongPIPE Hybrid FRP for PCCP Rehab in Miami-Dade System

Luis Aguiar

Miami-Dade Water & Sewer Department

Anna Pridmore, PhD

Structural Technologies

PROJECT BACKGROUND

Miami-Dade Water & Sewer Department (MDWASD):

- **7,900 miles of water mains from 2"-120" in diameter across 400 square miles**
- **1,400 miles of sanitary sewer mains**



PROJECT BACKGROUND

In response to a series of high profile catastrophic failures in 2010 & 2011:

MDWASD implemented a comprehensive asset management program, and established the **Infrastructure Assessment and Rehabilitation Program (IAARP)**



Ruptured 54-inch PCCP water transmission main

INFRASTRUCTURE ASSESSMENT & REHABILITATION PROGRAM (IAARP)

- Routine rotating inspections of pipeline
- Adoption of best industry practices
- Precision inspection
 - Replacement
 - Structural upgrade



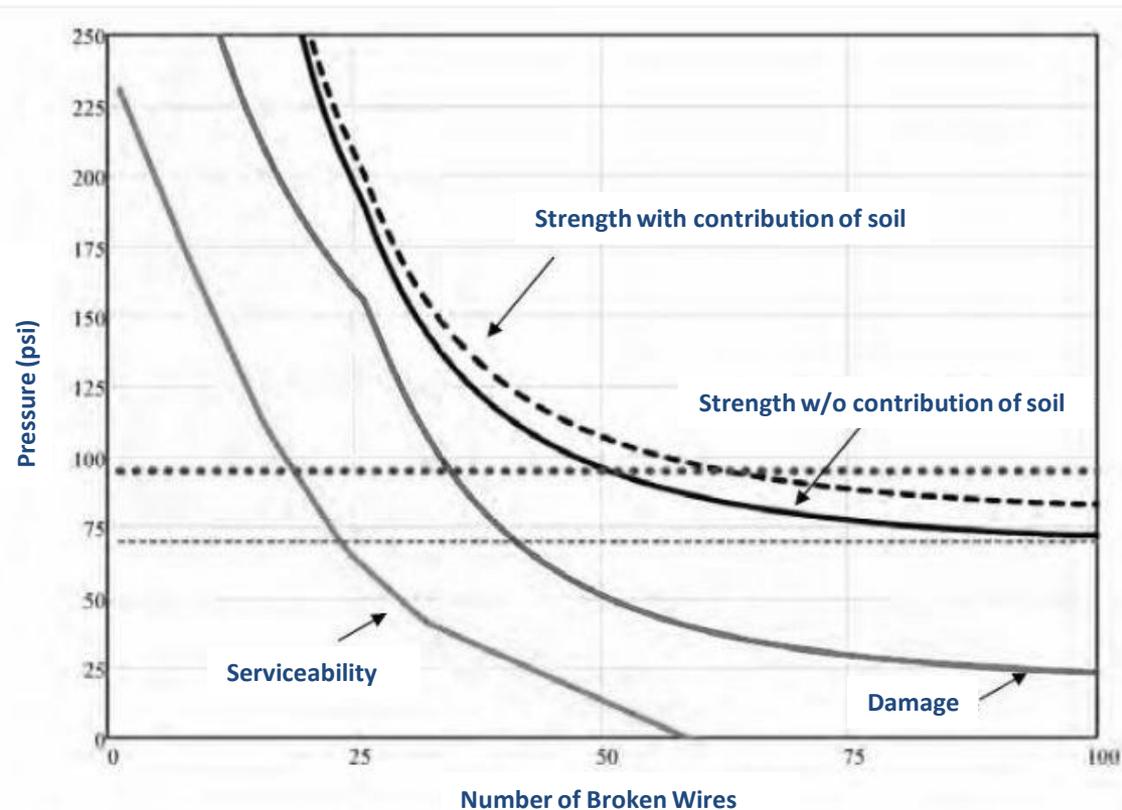
ELECTROMAGNETIC INSPECTION

Identifies pipe segments with
broken wires



FAILURE RISK ANALYSIS & REPAIR PRIORITIZATION

- Failure risk analysis performed
 - Prestressing wire pitch and spacing
 - Cylinder thickness
 - Concrete core thickness
 - Internal and external loads on pipe
- Facilitates prioritizing repairs or replacements before failures occur



OPTIONS ANALYSIS

Factors:

- Many MDWASD's pipelines are located underneath major roadways making trenchless rehabilitation advantageous.
- For 5 years MDWASD has used FRP for PCCP upgrades
- Established an on-call emergency response team of prequalified contractors



Construction alongside roadways

PROJECT SCOPE

13 Segments of 54 inch PCCP

- 10 Segments of FRP repair
- 3 Segments of Hybrid FRP

Constituents	CFRP System	Hybrid FRP System
Primer, saturating resin, intermediate filler, topcoat	2 part 100% solids epoxy	2 part 100% solids epoxy
Longitudinal reinforcement	Hand applied layers of GFRP & CFRP	Hand applied layers of GFRP & CFRP
Hoop reinforcement	Hand applied layers of GFRP & CFRP	Robotically installed continuous steel wire embedded in epoxy

DESIGN REQUIREMENTS

Both FRP and Hybrid FRP systems are stand alone systems designed to resist the following loads without reliance on the host pipe:

- Working pressure 150 psi
- Working plus transient pressure 225 psi
- Vacuum pressure -14.7 psi
- Soil Cover 5.5 ft
- Ground water height above crown 5.5 ft
- Surface live load HS-20

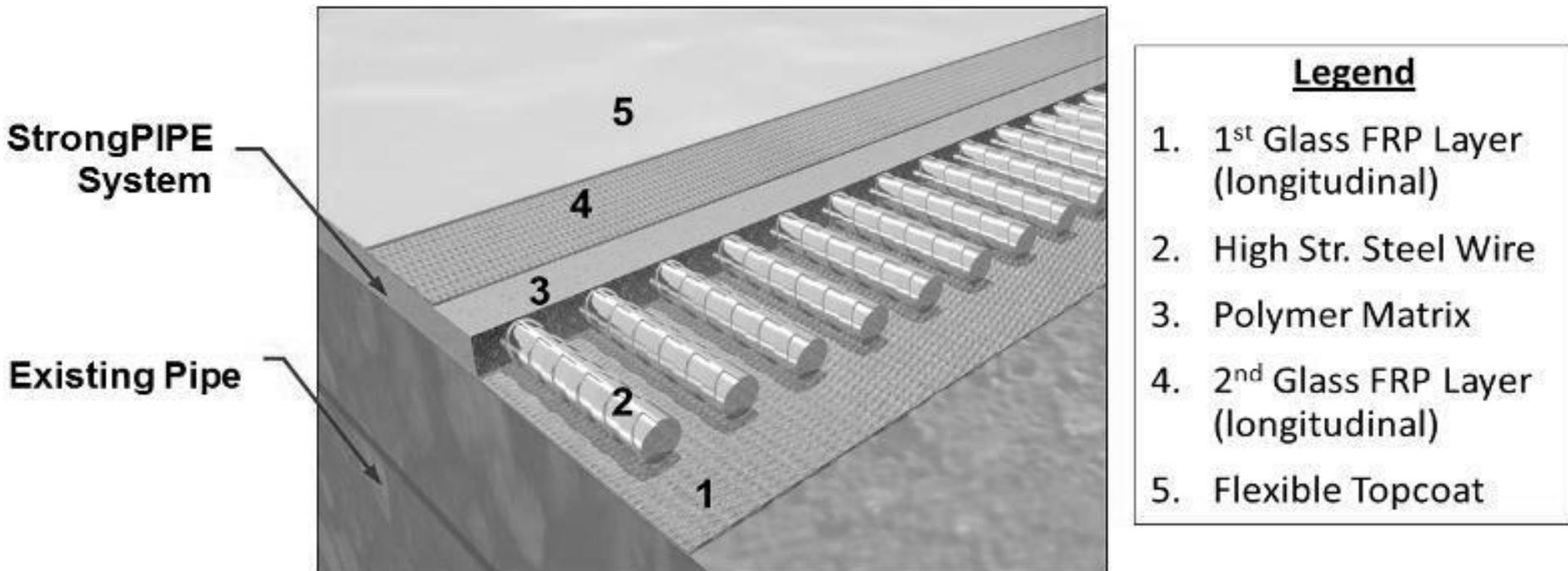
StrongPIPE® Hybrid FRP System Overview

- StrongPIPE® is fully structural repair system comparable to the use of carbon fiber reinforcement.
- Two (2) installations for Miami-Dade Water & Sewer completed in past 18 months. One installation was inspected after 10 months in service with no issues.
- Objective is to utilize for extended runs of pipe because it is more cost effective than other structural repair systems.



StrongPIPE® inspection @ Miami-Dade after 10 months in service

StrongPIPE® Hybrid FRP System Overview



Basic composition for Hybrid FRP system

HYBRID FRP INSTALLATION PROCESS

- Dewatering
- Surface preparation
- Adhesion testing verifying surface prep
- Installation of longitudinal FRP
- Application of thickened epoxy
- Installation of steel reinforcement
- Application of thickened epoxy
- Installation of longitudinal FRP
- Application of topcoat



Prepared concrete substrate –54-inch PCCP



Drilling the holes to set the test pucks for adhesion tests



Mechanical saturation equipment



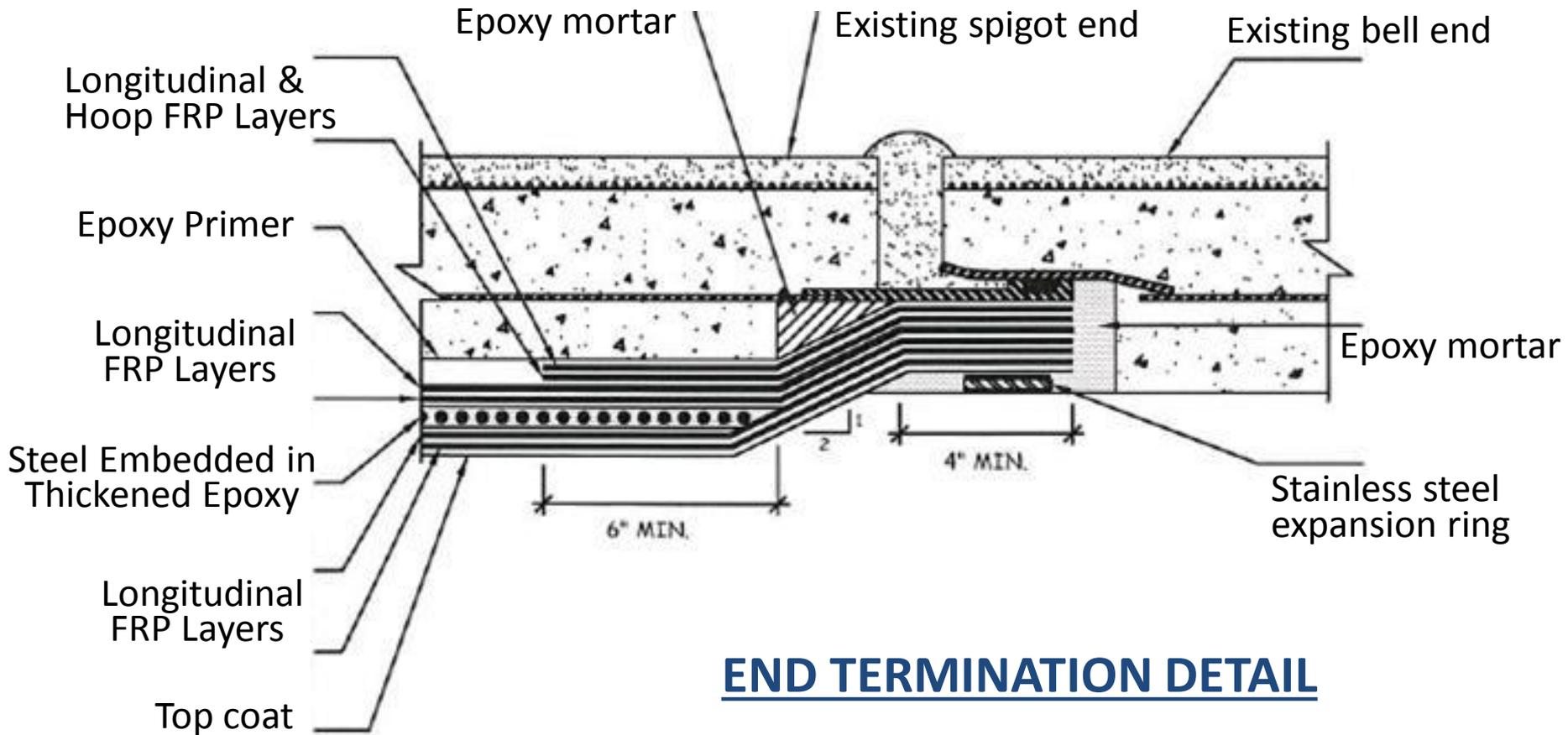
Installation of longitudinal layer of fiber reinforced polymer



Truck mounted unit for Hybrid FRP System



Hybrid FRP System – Steel reinforcement installation





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HYBRID FRP INSTALLATION VIDEO

MAJOR STEPS IN QA/QC PROCESS:

- Monitor temperature and humidity
- Verification of surface prep
- Calibration of mechanical saturator
- Adhesion testing
- Preparation of witness panels for tensile testing
- Verification of FRP alignment
- Verification of FRP overlaps
- Verification of spacing of steel reinforcement
- Verification of embedment of steel in epoxy



Verification of steel wire placement

QUESTIONS?

CONTACT INFORMATION

Luis Aguiar

Miami-Dade Water & Sewer Department

lagui@miamidade.gov

786.552.8185

Anna Pridmore, PhD

Structural Technologies

apridmore@structuraltec.com

714.869.8824