

**Armorock Is The Lowest Cost,
Longest Lasting Wastewater
Structure In The Industry,
Offering An Unprecedented
50-year Corrosion Warranty**



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Armorock Topics

- The Corrosion Problem
- Band-Aid Fixes
- Polymer concrete material properties & application
- Life Cycle Cost Analysis
- Polymer Concrete Specification
- Summary Q&A





Band-Aid Fixes

Coatings



Cast In Liners - PVC, HDPE



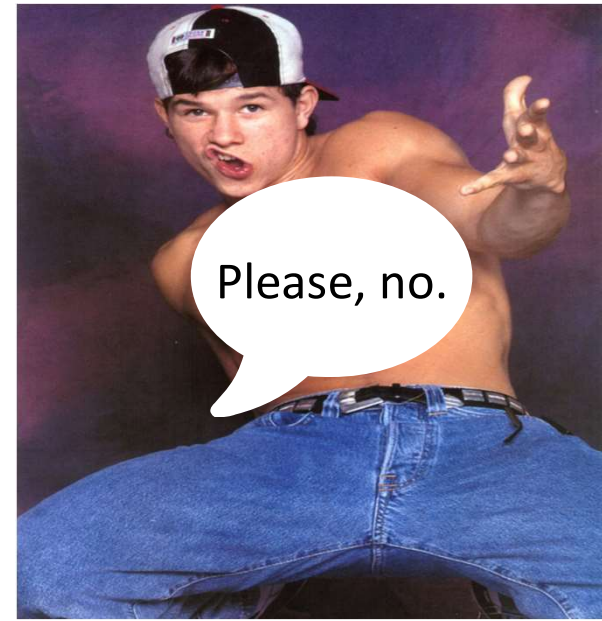
Admixtures



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What's the 'Corrosion Protection Du Jour?'

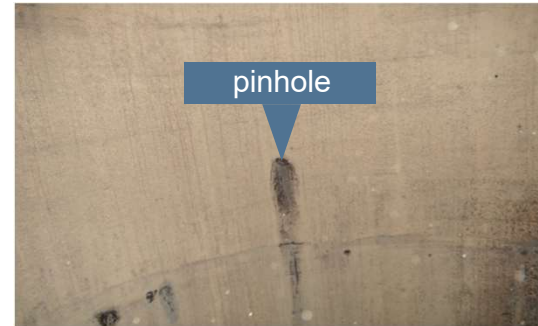
Every Few Years A New "Solution" Comes Out. People Rave About It For A Minute...Then We're Back Like This:



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Coating Failures

A large part of coating success is based on human application & substrate prep. The problem is adhering to a corrosive substrate.



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Coating/Liners Failures

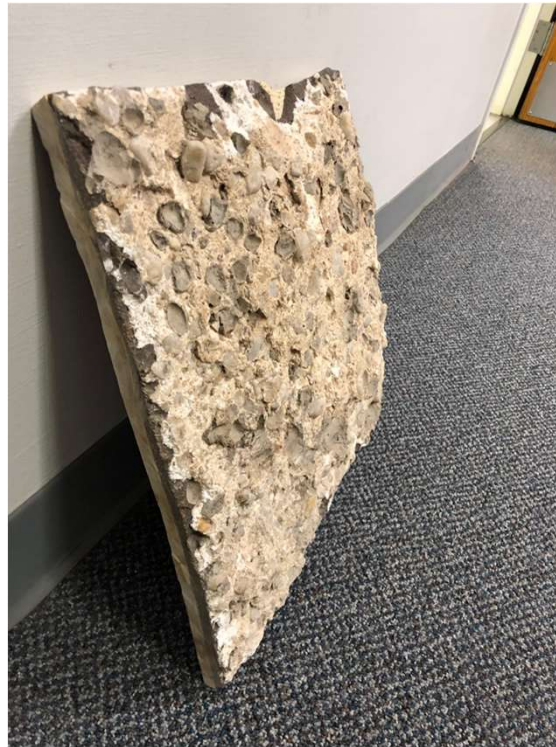


Water Infiltration, Delamination, Structural Integrity Lost



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Corrosion Behind the Coating & Liners



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Visual Inspection-Not Always Perfect

Water Infiltration Caused By Groundwater Pressure-It's Gonna Blow!



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Admixtures Are Not Corrosion Proof



Trunk line in OKC
after 3 years

VS.



Armorock after
3 years



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Corrosion Warranty – Questions to consider

- 1** | **Length of warranty?**
Average of 1-5 years
- 2** | **What is covered?**
Corrosion? Install? What conditions?
- 3** | **Who warrants and is ultimately responsible?**
Applicator? Contractor? Manufacturer?

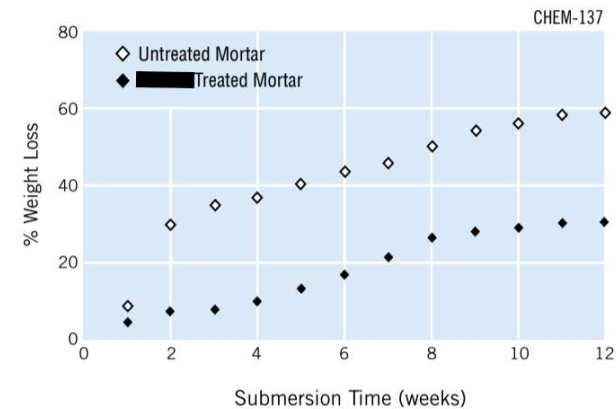


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Read the Warranty & Ask Questions

Warranty

The Manufacturer warrants that the products manufactured by it shall be free from material defects and will be consistent with its normal high quality. Should any of the products be proven defective, the liability to the Manufacturer shall be limited to replacement of the product ex factory. The Manufacturer makes no warranty as to merchantability or fitness for a particular purpose and this warranty is in lieu of all other warranties expressed or implied. The user shall determine the suitability of the product for his intended use and assume all risks and liability in connection therewith.



Cement mortar samples containing [REDACTED] were subjected to 5% sulphuric acid for up to 12 weeks. Compared to untreated control samples, the weight loss caused by acid attack was reduced by 48%. In a further test on a 30% fly-ash mortar, the weight loss was reduced to 53%.



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***Don't Design with
Band-Aid
"Solutions"!***



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Our Experience With Corrosion

We Saw a Problem

Ownership roots in concrete precast for over 50 years

There Wasn't a Solution

Twenty plus years trying every type of fix for concrete products on the market with no success

We Decided to Fix it

“Band-Aids” failed for sustainability. Decided to solve the problem at the source.



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What Is Polymer Concrete?



A Material Made From Non-Reactive Sand, Aggregate, and Resin



Resin Is The Binder (Glue) That Holds The Product Together



Resin Is Used In Lieu Of Portland Cement



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Polymer Concrete History

- Resins – 1936
- Polymer concrete Utility Structures In Europe – 1960's
- Introduced in the USA in the 1980's
- Used in Mining, Industrial, Food Processing, Paper Mills, Prior To Wastewater Structures



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Making Armorock - How'd We Do It



Made it Affordable

By Taking Advantage of
Material Properties



Designed and Sealed by
Professional Engineers

Traffic Rated Loading Out Of The
Box (HS-20, HL-93)



Corrosion Proof and
Sustainable

Every part of the mix is
inert (including
reinforcement)



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Polymer Concrete Material Strength Properties

- 1** | **Compressive Strength: 16,000 psi**
(Traditional Concrete Breaking at 4,000 psi)
- 2** | **Flexural Strength: 2,200 psi**
(Traditional Concrete Breaking at 400 psi)
- 3** | **FRP Rebar Used For Reinforcement**
(Following Guidelines In ACI 440,
ACI 548)



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Circular and Non-Circular Structures

- Diameters Range From 4 foot – 16 foot Cylindrical
- Solutions For Pump stations, Wetwells, Siphons, Junction Boxes And Custom Structures



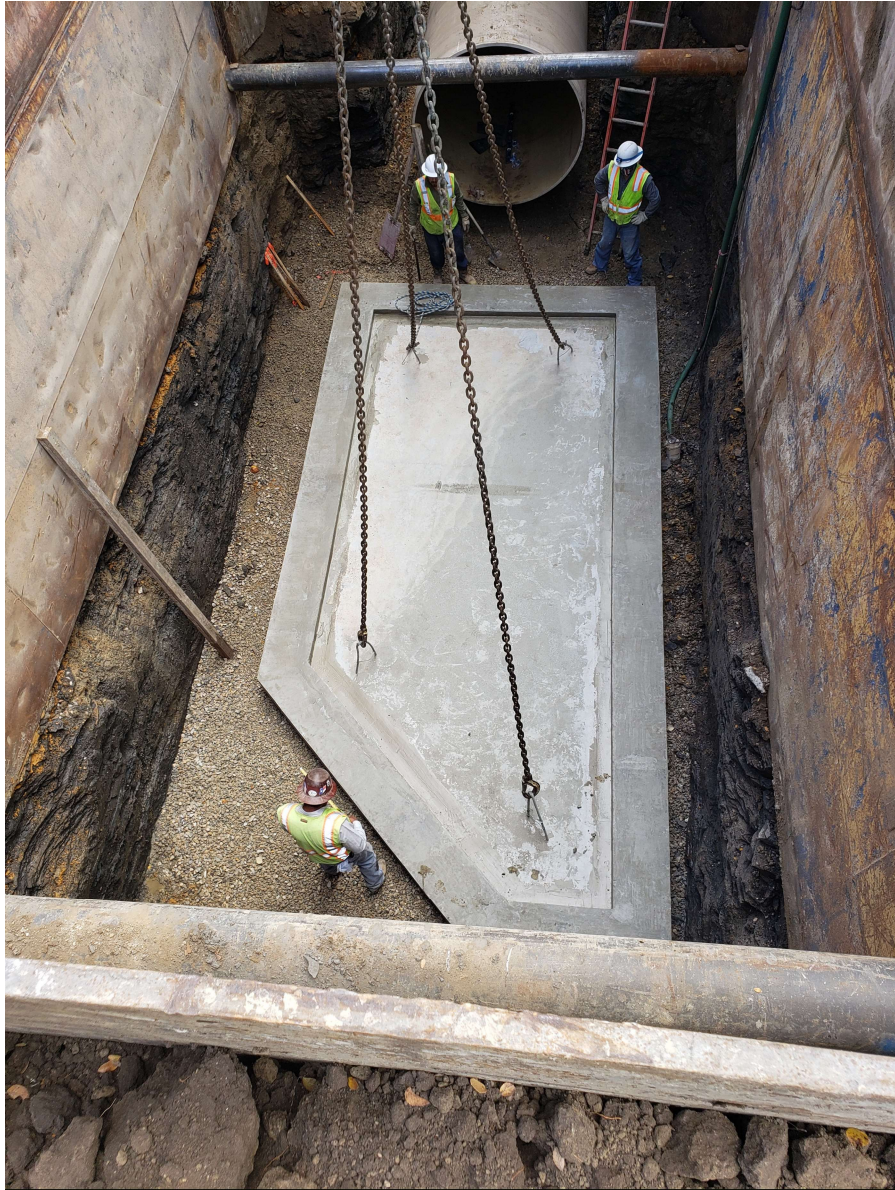
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Custom Structures



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Custom Structures

If you can design a structure in concrete you can design it with Armorock



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Custom Structures - Cast In Stop Log



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Deep Burial Depth

- Deepest Structures Are 120+ feet deep, 16' Diameter
- 5 Ft Diameter 80 Feet Deep



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Options for Connections & Joints

As Required by Owner



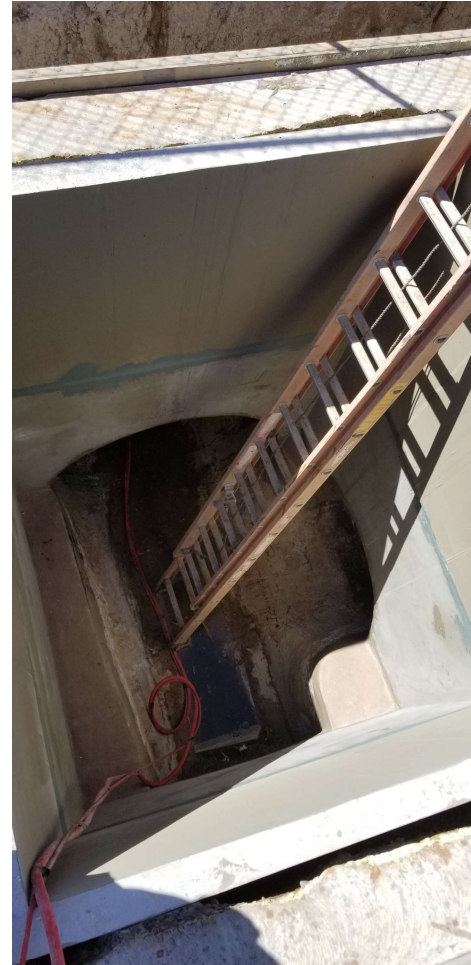
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Other Custom Structures – Box Insert



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Other Custom Structures – Box Insert



Benefits Of Polymer Concrete

- Corrosion Proof Structure With A 50 Year Warranty
- Completes A Corrosion Proof System For Your Wastewater Collection Line
- Superior Economic Value
- Non-porous – *No Weeping Walls!*
- Modular Construction – *Easy For Contractor!*
- Owner, Consultant, Contractor...*Satisfied!*



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Protection You Can Trust



POLYMER CONCRETE



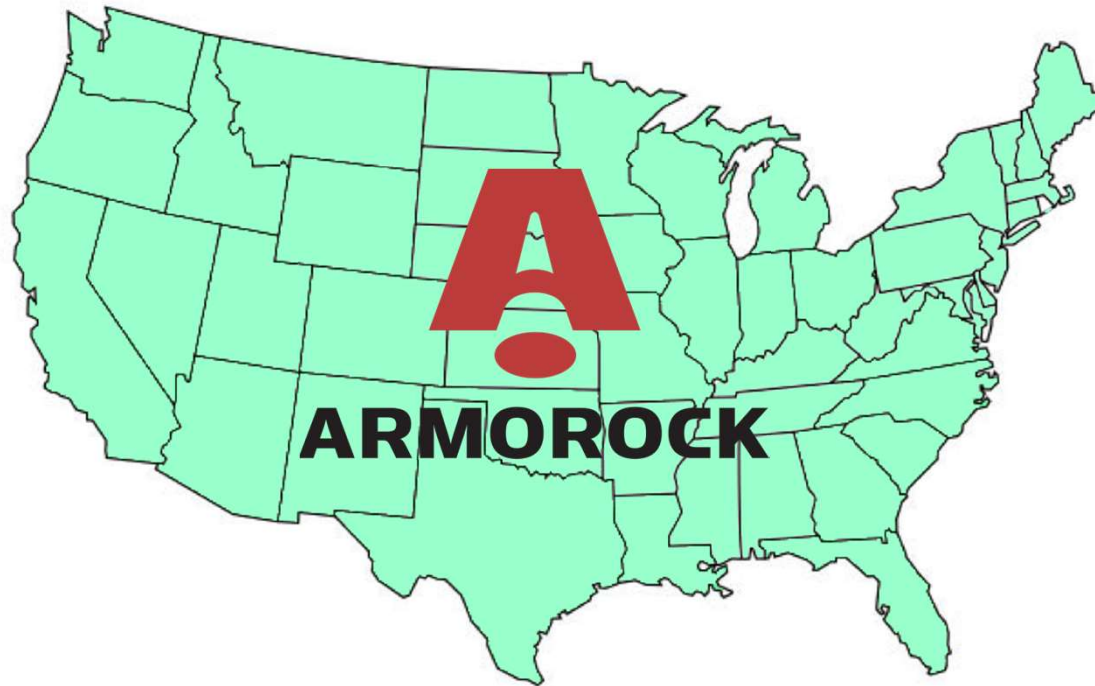
EVERYBODY ELSE



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Over 15,000 Structures in 15 Years

Reference Lists Available From Agencies, Consultants, & Contractors



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We are asking YOU for a Specification Change

- Polymer Concrete Structures Will Stop The Rehabilitation Cycle!
- Specify Polymer In All Corrosive Environments.



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ASTM Definition – Life Cycle Cost



An economic method of evaluating a project in which all costs arising from owning, operating, maintaining and disposing of the project are considered. These costs are added over the life of the project. All costs are converted to present values.

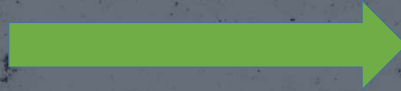
Life Cycle Cost Analysis or LCCA

- Whole cost accounting or total cost of ownership
- Balancing initial investment with the long-term expense of ownership & operation
- Explore trade-offs between alternative design solutions:
Low cost vs long-term cost
- Utilizing life cycle cost analysis is **CRITICAL** for designing a project with sustainability in mind



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Initial Cost



Future Rehab & Maintenance Cost?

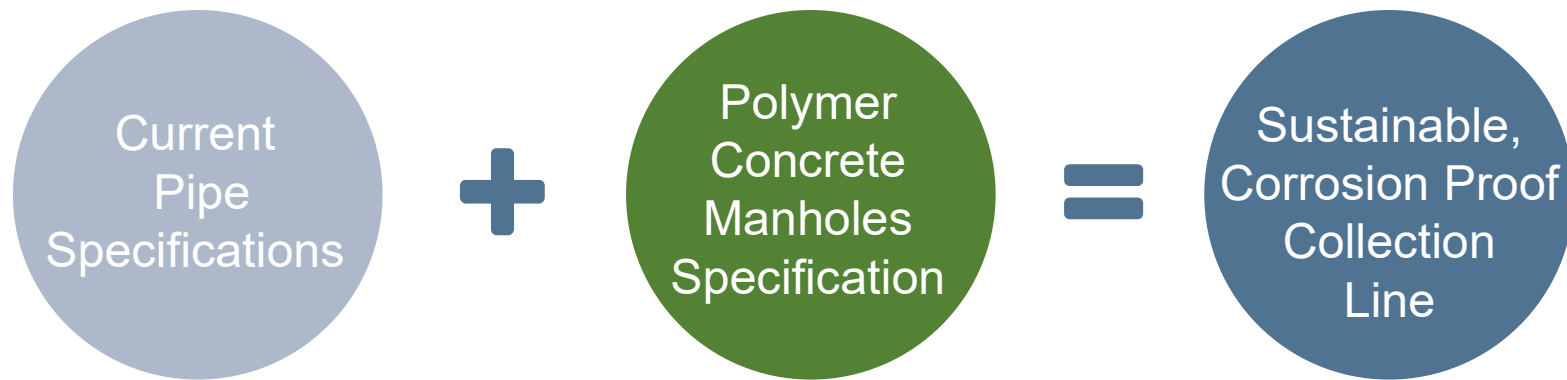


Life Cycle Cost Analysis Spreadsheet



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The Sustainable Solution



***No more future maintenance dollars required
for rehabilitation***



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QUESTIONS?

Upcoming webinars: armorock.com/webinars



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FAQs

- [Can you core into polymer concrete?](#)
- [Can you void the corrosion warranty?](#)
- [What size of structures can you make?](#)
- [What are the most common areas you see specified?](#)
- [Does this install similar to precast?](#)
- [Do contractors get scared off by a new material?](#)
- [Can you cast in hatches or frame & covers?](#)
- [What is your lead time?](#)
- [What codes govern the FRP rebar?](#)
- [What are your limitations on custom structures?](#)
- [Outside of wastewater where are you being used?](#)
- [Where are your manufacturing facilities?](#)
- [Is corrosion getting worse? Why?](#)
- [3rd party corrosion resistance tests?](#)
- [Quality? ISO 9001?](#)
- [What type of coatings have you seen fail?](#)
- [Comparison to fiberglass manholes?](#)
- [Do agencies specify only polymer?](#)
- [Ever had to warranty your product?](#)



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FAQ – Can you core into polymer concrete? Does it void the corrosion warranty?



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FAQ – What size of structures can you make?



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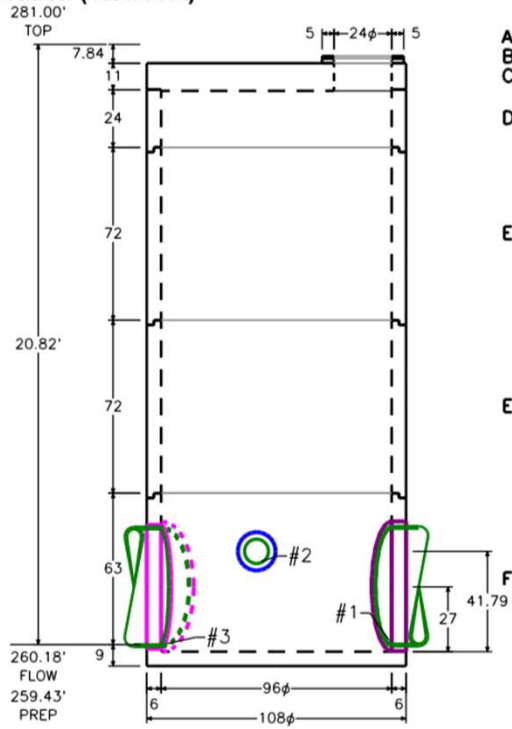
FAQ – Most common areas you see specified?



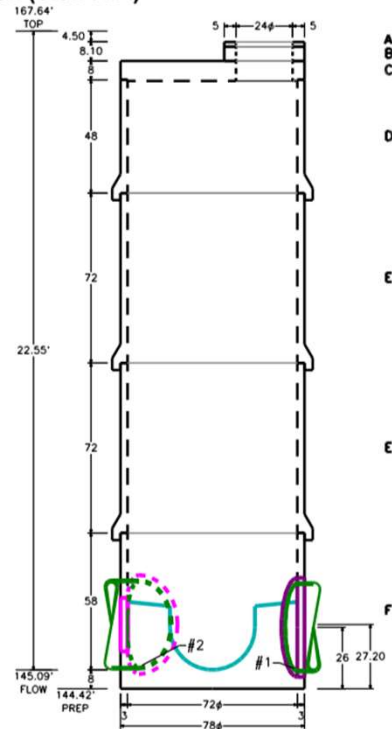
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FAQ – Does this install similar to precast?

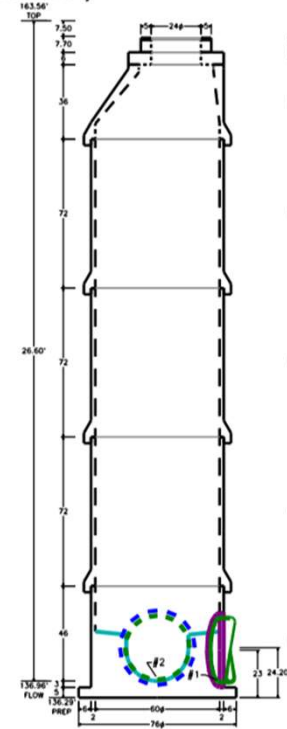
Elevation (View A-A)



Elevation (View A-A)



Elevation (View A-A)



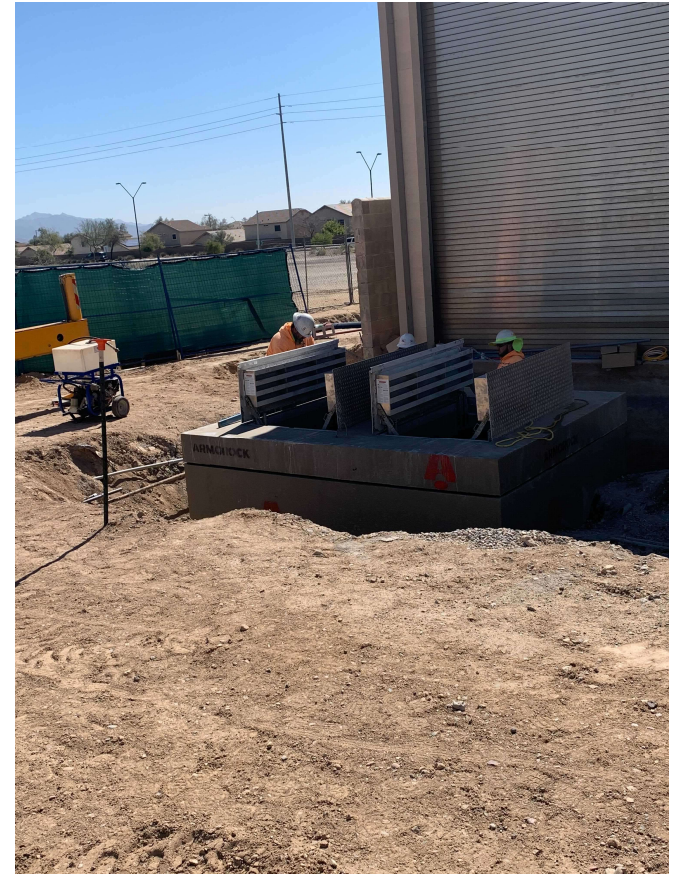
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FAQ – Do contractors get scared off by a new material like polymer concrete?



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FAQ – Can you cast in hatches?



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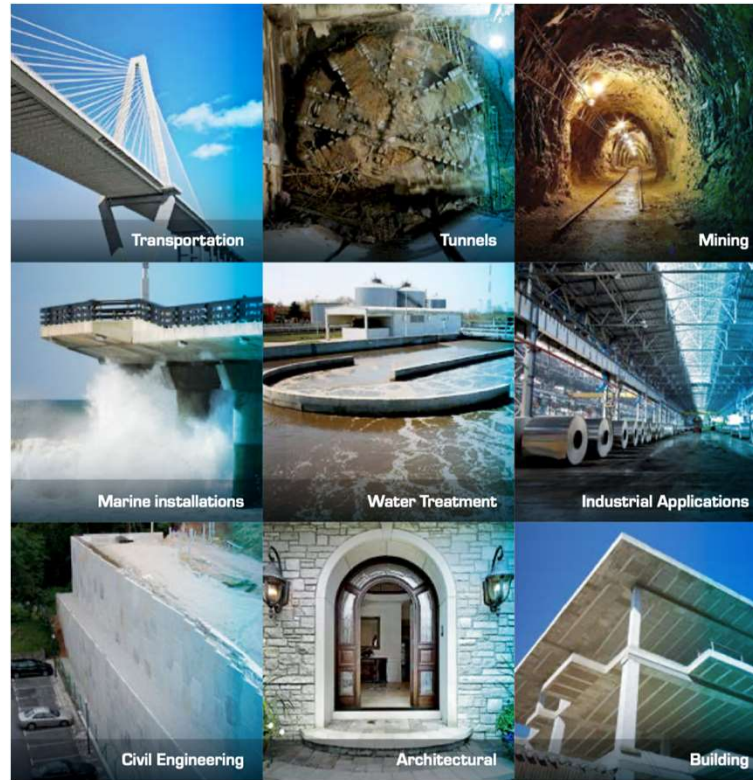
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FAQ – What is your lead time?



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FAQ – What codes govern the FRP Rebar?



Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer (FRP) Bars

Reported by ACI Committee 440

ACI 440.1R-15



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FAQ – What are your limitations on custom/boxes?



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FAQ – Outside of wastewater where are you being used?



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FAQ – Where are your manufacturing facilities?



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FAQ – Do you think corrosion is getting worse? Why?



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FAQ – Do you supply signed & sealed structural & buoyancy calcs?



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FAQ – What 3rd party corrosion tests do you have to show your structures hold up?

1 The identification of the test method used:

- 1.1 The Chemical Resistance test was conducted in general accordance with the Standard Specifications for Public Works Construction (Greenbook) Section 211-2
- 1.2 See Section 6 of this test report for the deviations from the prescribed test procedures with respect to the “Dimensional Attributes” of the test specimens.

A. Summary of Results

Chemical Solution	Concentration	28-day Results	56-day Results	84-day Results	112-day Results
Sulphuric Acid (H2SO4)	20%	0.15%	0.20%	0.28%	0.33%
Sodium Hydroxide (NaOH)	5%	0.18%	0.23%	0.30%	0.34%
Ammonium Hydroxide (NH4OH)	5%	0.02%	0.05%	0.08%	0.12%
Nitric Acid (HNO3)	1%	0.00%	0.01%	0.03%	0.05%
Ferric Chloride (FeCL3)	1%	0.03%	0.06%	0.09%	0.15%
Sodium Hypochloride (NaOCl)	1%	0.09%	0.12%	0.16%	0.20%
Soap	0.1%	0.00%	0.01%	0.02%	0.05%
Detergent (LAS)	0.1%	0.00%	0.00%	0.03%	0.05%
Bacteriological	BOD 700 ppm	0.02%	0.06%	0.08%	0.12%

- Note:**
- 1. The allowable weight change value for the 112-day test period for thicker specimens shall conform to the values in table 211-2 (B) of the Greenbook (0.38%)
 - 2. See Appendix for additional notes



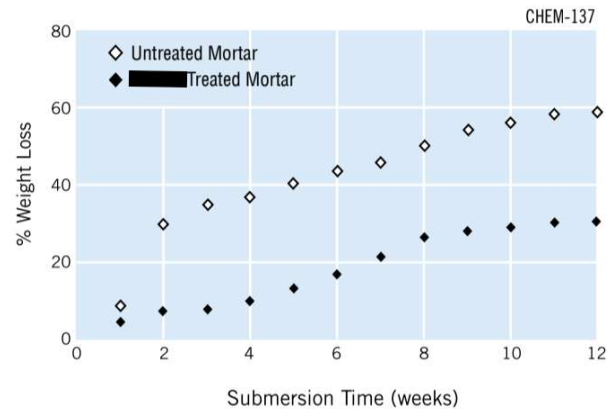
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FAQ – Are you ISO certified?



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FAQ – What type of coatings have you seen fail?



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FAQ – What is the advantage of polymer concrete vs fiberglass?

- 1 | Polymer Concrete is rigid & structural on it's own – everything HS-20
- 2 | Installing polymer concrete is the same as precast
- 3 | Future grade adjustments & general workability



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FAQ – Do you see agencies specifying only polymer concrete?



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FAQ – Ever had to warranty your product?



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