PCSA Precast Concrete Structures Association Of Florida, Inc.

Polymer Manhole Information & Question Sheet

I. What we know about Armorock

a. **Started in 2007**, only twelve years in market. No track record of product in service.

b. **Headquartered in Nevada**

   i. Operations in Texas serving a few markets in Texas

      1. Removed from City of Austin, TX specification due to quality and performance concerns

   ii. Plant being built in Jacksonville to serve JEA market

      1. Environmental concerns to Jacksonville community dealing with the manufacturing process of polymers.

c. **Manufacturer of Polymer Manholes**

   i. Manholes are produced with the Portland Cement removed and a Polyester Resin is substituted.

   ii. Armorock calls their product Polymer ***CONCRETE*** Manholes, this is misleading and not accurate. No cement in their design therefore can't be concrete.

      1. Oxford Dictionary definition of concrete: *A building material made from a mixture of broken stone or gravel, sand,* ***cement****, and water, which can be spread or poured into molds and forms a mass resembling stone on hardening.*

d. **Thin wall design** (48"+60"=2",72"=3", 84"=4", 96"=6", 144"=7")

   i. Brittle design that needs to be handled carefully (spreader bars, no slings) to avoid field damages. Walls not reinforced with steel or other materials to add structural support for handling.

   ii. Installation crews must be trained and certified by Armorock to install their product due to the thin wall design.

e. **No ASTM or National Standard for Polymer manholes**,

   i. Armorock improperly refers to ASTM C478, ACI 350-06, ACI 548.6R-96 national standards. No national standards exist to hold Armorock to.

   ii. No cementitious materials in Armorock product and no mention of allowable polymer substitutes or steel reinforcement in Armorock product disqualify it from ASTM C478 & ACI 350-06

      1. **ASTM C478** reads as follows:

         a. 4.1.1 Reinforced Concrete—Reinforced concrete shall consist of ***cementitious materials***, mineral aggregates, admixtures, if used, and water, in which steel reinforcement has been embedded in such a manner so that the steel reinforcement and concrete act together.

      2. **ACI 350-06** defined in that Code as: "Mixture of Portland cement or any other hydraulic cement, fine aggregate, coarse aggregate, and water, with or without admixtures." Chapter 3 of this Code addresses cementitious materials, meaning, the entirety of this Code is predicated on the use of the materials listed in previous chapters.

      3. **ACI 548.6R-96** is a spec reserved for PIC, Polymer Impregnated Concrete, not the polyester resin in the Armorock product.

II. Limitations and questions about the Armorock product

a. Approval Process by JEA
   i. Armorock approved as sole source material in January 2019.
      1. All disclosures from Kerry Lewis at JEA suggest approval was based on Armorock presentation. No independent studies or vetting of their product by a qualified third party. No National Standard to hold it to.
      2. What if any failures have occurred to lead to this specification change? Precast industry has not been made aware of any failures, especially in lined manholes and liftstations.
   ii. JEA requiring 50-year bonded warranty on corrosion from manufacturer to remove, replace and install new manholes. Has the bonding company and terms been vetted? This is unprecedented in this industry and will eliminate suppliers from supplying JEA manholes and liftstations.
   iii. JEA calls for iso-9001 compliance. ISO-9001 is not a quality standard other than to certify that a facility can replicate it's manufacturing procedures no matter how sound they are or not. Precast facilities are qualified by FDOT, NPCA and other third party agencies to independently verify quality compliance standards are being met. Armorock is unable to offer this.
   iv. Spec states that polymer product can't be produced at a cementitious facility.
      1. Why is JEA limiting possible future competition to the Armorock product? Stated twice in the same paragraph V.1.1.2.
   v. Has JEA reviewed Material Safety Data Sheets of this product. How safe is it to the people and environment it is exposed to?
   vi. Viable precast alternatives exist and have been in service for longer than Armorock has been in business. Why was this change put in without consulting suppliers that have served this community for 30+ years? PCSA stands ready to serve the industry to come up with product that meets or exceeds the Armorock alternative.

b. Cost of the product
   i. 2x-4x more expensive than comparable precast w/ liner
   ii. Hidden costs to contractors in training of crews, handling requirements, availability, etc.
   iii. Questionable warranty costs passed onto the owners/developers

c. Availability
   i. Armorock has had difficulty with supplying material in a timely manner in other markets. Questionable on ability to serve JEA as a sole source supplier.

d. Load handling
   i. Claim HS-20 or HL-93 loading
      1. Fiber reinforced
      2. Fiberglass rebar for base slab
   ii. Handling and installation concerns with thin wall

e. Boot limitations
      1. Boots design is predicated on 5" wall minimum or larger to allow the internal band to seat against the curvature of the wall for the hole.
      2. Due to Armorock thin wall design, this will require larger diameter structures for larger pipe sizes. This will cause higher installation and material costs.

f. Joint concerns
   i. Armororck has difficulty in passing ASTM C1244 vacuum test or similar. Removed from specs in other municipalities due to this.

g. Toxic manufacturing materials from polymer resins
   i. Styrene is primary toxic component of the polymer resin.
      1. Listed as a group 2B carcinogen
   ii. Contains cancer and birth defect causing chemicals Benzene, Catechol, Methanol, Tolune

h. Buoyancy concerns

i. The 2019 JEA spec now allows for a lower Factor of Safety against uplift of 1.2. Industry standard in FL is 1.5. Some engineers require 2.0 on some projects. Past JEA projects in 2018 being managed by a large PMO firm that required a F.S. of 2.0. The F.S. was not previously specified in the 2018 JEA spec; it was left to the reviewing engineer / EOR to specify.

ii. Polymer density appears to be less than R/C. (~10%) Polymer is approx. 135lbs/cuft., Precast is approx. 150 lbs/cu.ft.

iii. Friction factor between soil and polymer materials is reported to be less than precast and soil by as much as 23%, meaning, less sliding resistance to hold the structure in the ground.

iv. JEA does not have a 144ID structure listed on the table for floatation. Does that mean 144ID structures are no longer permitted?

Buoyancy Table of Polymer Structures

F.S. values in RED fall below the lower 2019 JEA value of 1.2
F.S. values in BLUE fall below in industry standard of 1.5, but pass the new JEA value of 1.2
F.S. values in BLACK are ≥ 1.5

ID	Wall (in)	Top (in)	Base (in)	Base Ext (in)	Depth (top of base slab), ft	F.S.		Notes:
48	2	8	9	2	5	1.17	JEA SPEC **	1. F.S. > 1.5 for most spec, some engineers require 2.0
48	2	8	9	2	6	1.21		** JEA SPEC only requires F.S. > 1.2
48	2	8	9	2	10	1.33		2. Friction between soil & MH assumed to be 0.30 (concrete)
48	2	8	9	0	11	1.18		3. Current research on soil friction interaction between
48	2	8	9	0	15	1.38		soil and fiber reinforced polymer piles indicates a reduced
48	2	8	9	0	16	1.42		friction factor by a range of 12% - 23% less than that
48	2	8	9	0	20	1.62		of concrete.
48	2	6	6	0	5	0.88		
48	2	6	6	0	8	0.98		
48	2	6	6	0	12	1.18		
48	2	6	6	0	19	1.53		
48	2	6	6	4	6	1.32		
48	2	6	6	4	10	1.47		
48	2	6	6	4	12	1.57		
48	2	6	6	4	19	1.92		
48	2	6	6	6	6	1.52		
48	2	6	6	6	12	1.78		
48	2	6	6	6	17	2.04		
60	2	8	9	2	5	1.08	JEA SPEC **	Notes:
60	2	8	9	2	10	1.15		1. F.S. > 1.5 for most spec, some engineers require 2.0
60	2	8	9	1	11	1.10		** JEA SPEC only requires F.S. > 1.2
60	2	8	9	1	15	1.24		2. Friction between soil & MH assumed to be 0.30 (concrete)
60	2	8	9	0	16	1.20		3. Current research on soil friction interaction between
60	2	8	9	0	20	1.35		soil and fiber reinforced polymer piles indicates a reduced
60	2	8	8	0	6	0.91		friction factor by a range of 12% - 23% less than that
60	2	8	8	0	8	0.92		of concrete.
60	2	8	8	0	12	1.05		
60	2	8	8	0	18	1.27		
60	2	8	8	0	24	1.51		
60	2	8	8	4	8	1.24		
60	2	8	8	4	12	1.36		
60	2	8	8	4	16	1.50		
60	2	8	8	8	8	1.57		
60	2	8	8	8	16	1.84		
60	2	8	8	8	20	2.00		

Buoyancy Table of Polymer Structures (cont'd)

72	3	8	9	3	**5**	1.14		Notes:
72	3	8	9	3	**10**	1.17	JEA SPEC **	1. F.S. > 1.5 for most spec, some engineers require 2.0
72	3	8	9	3	**11**	1.19		** JEA SPEC only requires F.S. > 1.2
72	3	8	9	3	**15**	1.30		2. Friction between soil & MH assumed to be 0.30 (concrete)
72	3	8	9	1	**16**	1.20		3. Current research on soil friction interaction between
72	3	8	9	1	**20**	1.32		soil and fiber reinforced polymer piles indicates a reduced
72	3	8	8	0	**8**	0.93		friction factor by a range of 12% - 23% less than that
72	3	8	8	0	**12**	1.02		of concrete.
72	3	8	8	0	**28**	1.52		
72	3	8	8	4	**8**	1.18		
72	3	8	8	4	**14**	1.32		
72	3	8	8	4	**20**	1.50		
72	3	8	8	8	**8**	1.45		
72	3	8	8	8	**10**	1.50		
72	3	8	8	8	**27**	2.02		
84	4	10	9	3	**5**	0.97		Notes:
84	4	10	9	3	**10**	1.12	JEA SPEC **	1. F.S. > 1.5 for most spec, some engineers require 2.0
84	4	10	9	3	**11**	1.13		** JEA SPEC only requires F.S. > 1.2
84	4	10	9	3	**15**	1.19		2. Friction between soil & MH assumed to be 0.30 (concrete)
84	4	10	9	2	**16**	1.16		3. Current research on soil friction interaction between
84	4	10	9	2	**20**	1.25		soil and fiber reinforced polymer piles indicates a reduced
84	4	10	10	0	**8**	0.97		friction factor by a range of 12% - 23% less than that
84	4	10	10	0	**20**	1.16		of concrete.
84	4	10	10	0	**33**	1.51		
84	4	10	10	4	**8**	1.18		
84	4	10	10	4	**12**	1.21		
84	4	10	10	4	**25**	1.50		
96	6	10	9	3	**5**	1.19		Notes:
96	6	10	9	3	**10**	1.11	JEA SPEC **	1. F.S. > 1.5 for most spec, some engineers require 2.0
96	6	10	9	3	**11**	1.12		** JEA SPEC only requires F.S. > 1.2
96	6	10	9	3	**15**	1.17		2. Friction between soil & MH assumed to be 0.30 (concrete)
96	6	10	9	2	**16**	1.14		3. Current research on soil friction interaction between
96	6	10	9	2	**20**	1.22		soil and fiber reinforced polymer piles indicates a reduced
96	6	10	10	0	**8**	1.00		friction factor by a range of 12% - 23% less than that
96	6	12	12	0	**8**	1.05		of concrete.
96	6	10	10	4	**8**	1.18		
96	6	12	12	4	**8**	1.23		
96	6	10	10	4	**10**	1.17		
96	6	12	12	4	**10**	1.22		
96	6	10	10	4	**12**	1.19		
96	6	12	12	4	**12**	1.23		
96	6	10	10	4	**28**	1.50		
144	-	-	-	-	**-**	-	NO JEA	Notes:
144	7	10	10	0	**8**	0.86		1. JEA Spec does not list 144ID
144	7	10	10	0	**10**	0.83		2. Friction between soil & MH assumed to be 0.30 (concrete)
144	7	10	10	0	**12**	0.83		3. Current research on soil friction interaction between
144	7	10	10	0	**14**	0.83		soil and fiber reinforced polymer piles indicates a reduced
144	7	10	10	0	**19**	0.88		friction factor by a range of 12% - 23% less than that
144	7	10	10	0	**29**	1.01		of concrete.
144	7	10	10	0	**42**	1.21		
144	7	10	10	4	**8**	0.98		
144	7	10	10	4	**10**	0.96		
144	7	10	10	4	**12**	0.95		
144	7	10	10	4	**19**	1.00		
144	7	10	10	4	**34**	1.21		
144	7	10	10	4	**52**	1.51		