January 18, 2015

Mr. Mac Krauss
Allied Construction Technologies, Inc.
3302 Croft Street
Norfolk, VA 23513

Phone: 770-855-5100
Cell: 757-615-1814
Email: mkrauss@actamerican.net

Subject: **Report of Test Results – ASTM C1315**
Product: 2170 FC Epoxy Coating
TEC Services Project No. TEC PRO 14-1128
TEC Lab No. 14-331-2

Dear Mr. Krauss:

Testing, Engineering and Consulting Services, Inc. (TEC Services) is an AASTHO R18, ANS/ISO/IEC 17025:2005 and Army Corp of Engineers accredited laboratory. TEC Services is pleased to present this report of our testing on the submitted epoxy designated as AC Tech's 2170 FC. The product was received in July of 2014 and tested at our Lawrenceville, GA facility. It is our understanding that the curing compound is designated as a Type I liquid membrane forming compound.

Testing was performed in accordance ASTM C1315-11 *Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete* and the most recent ASTM standards referenced by the specification. Our services were performed in accordance with the terms and conditions of our Service Agreement (TEC 14-1128). The test results presented only pertain to the samples tested.

Summary test results are reported in Table 1. ASTM G154 testing was subcontracted to Applied Technical Services. Testing was performed in accordance with the following standards:

- ASTM C 156 *Test Method for Water Retention by Liquid Membrane- Forming Curing Compounds for Concrete*
- ASTM D 869 *Test Method for Evaluating Degree of Settling of Paint*
- ASTM D 1309 *Test Method for Settling Properties of Traffic Paints During Storage*
- ASTM D 2369 *Test Method for Volatile Content of Coating*
- ASTM D7234 *Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers*
- ASTM G154 *Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials*

ASTM D2369 Volatile Solids Content
Testing for volatile content was not performed as the product was a 100% solids epoxy resin.

ASTM C156 Water Retention
This test method determines the efficiency of the liquid membrane-forming compound for curing concrete, as measured by their ability to reduce moisture loss during the early hardening period. Samples were made used a standard mortar proportioned according to ASTM C156. Upon reaching initial set (determined by disappearance of bleed water) samples were coated with the curing compounds at an application rate of 150 sq ft/gal as recommended by the manufacturer. Initial weights were taken and the samples were placed in a chamber at 100 ± 2 °F and a relative humidity of 32 ± 2 % for a period of 72 hrs. Weight readings were taken at 24 hrs and 72 hrs.

ASTM G154 – UV Resistance
The subject epoxy resin was coated on three 4" x 4" x 0.5" mortar panels. The panels tested for a duration of 336 h (2 weeks) in accordance with Practice G154 with a test cycle consisting of alternating periods of 8 h UV radiation at 60 °C (140 °F) and 4 h condensation at 50 °C (122 °F). Testing was performed by Applied Technical Services and results are attached to this report.

ASTM C1315 – Section 8.7.7 Alkali and Acid Resistance
The subject epoxy resin was coated on two 4" x 4" x 0.5" mortar panels and tested using the covered spot test method per ASTM D1308. The panels were exposed to both a 5 % aqueous sodium hydroxide solution on and a 10 % aqueous hydrochloric acid solution. The panels were covered with watch glasses to prevent evaporation and allow to stand for a duration of 48 hours. At the conclusion of the test period the panels were observed for signs of pinholes, disintegration, blistering, or discolor.

ASTM C1315 - Section 8.3 Drying Time
The membrane-forming compound was applied to fresh mortar specimens at the specified rate of application and exposed to air at 73.4 ± 3.6 °F, 50 ± 10 % relative humidity, and at an air velocity of approximately 183 m/min (600 ft/min) horizontally across the surface of the test specimen. The film was tested with the finger using moderate pressure. The film was considered to be dry when the soft tacky condition no longer existed and the film felt firm to the touch.

ASTM C1315 - Section 5.5 Deleterious Reactions
Deleterious reactions are detected by scratching the surface of a mortar specimen (used for the water-retention test) with a knife or screwdriver, not less than 72 h after application, and comparing with the surface hardness of a similar specimen that has been moist-cured for approximately half as long. Any softening of the liquid membrane-forming compound-treated surface indicated by such a comparison shall be considered sufficient cause for rejection of the compound.

ASTM D7234 – Bond Strength
A concrete slab with dimensions of 12" x 12" x 4" was cast using a mix design representative of a 4,000 -5,000 psi floor slab design as reported in Table 1. After reaching initial set the concrete slab received a broom finish. The epoxy resin components were mixed and applied to the concrete slab after finishing in accordance with the manufacturer's recommendations. The test specimens were dry cored at an age of 6 days and bond test fixtures adhered to the cored areas and allowed to cure for 24 hours prior to testing. The specimens were tested in accordance with ASTM D7234 to determine the tensile bond strength when the concrete had reached an age of 7 days using a 2.5 ton hydraulic center pull ram.

ASTM D869 – Testing for Degree of Settlement

The specimens that were tested for settling were placed in a 500-mL (1-pt) container, filled to within 13 mm (1⁄2 in.) of the top. The cans were sealed tightly and placed on a shelf for a duration of 6 months. At the conclusion of testing the degree of settlement was rated on the below listed basis per ASTM D869.

Rating Description of Paint Condition

- **10** Perfect suspension. No change from the original condition of the paint.
- **8** A definite feel of settling and a slight deposit brought up on spatula. No significant resistance to sidewise movement of spatula.
- **6** Definite cake of settled pigment. Spatula drops through cake to bottom of container under its own weight. Definite resistance to sidewise motion of spatula. Coherent portions of cake may be removed on spatula.
- **4** Spatula does not fall to bottom of container under its own weight. Difficult to move spatula through cake sidewise and slight edgewise resistance. Paint can be remixed readily to a homogeneous state.
- **2** When spatula has been forced through the settled layer it is very difficult to move spatula sidewise. Definite edgewise resistance to movement of spatula. Paint can be remixed to a homogeneous state.
- **0** Very firm cake that cannot be reincorporated with the liquid to form a smooth paint by stirring manually.

Table 1 – Summary Test Results

Test Method	Property	2170 FC Epoxy Resin	ASTM C1315 Specification Requirements
ASTM D2369	Solids Content (%)	NA (100%)	NA
ASTM C156	Water Retention at 24 hrs (kg/m^2)	0.02	NA
	Water Retention at 72 hrs (kg/m^2)	0.06	< 0.40
ASTM G154	UV Resistance	See Attached	NA
ASTM D7234	Bond Strength to Concrete 7 days	295 psi	70 psi
ASTM C1315 Section 8.7.7	Covered Spot Test 5% NaOH – 48 hrs	Pass	No Pinholes, Disintegration, or Discoloring
ASTM C1315 Section 8.7.7	Covered Spot Test 10% HCL – 48 hrs	Slight Yellowing	No Pinholes, Disintegration, or Discoloring
ASTM D869	Settling Rating (Qualitative)	10	> 4
ASTM C1315 Section 5.5	Deleterious Effects to Concrete (Qualitative)	No	No Deleterious Effects
ASTM C309 Section 8.3	Drying Time Less than 4 hours (Qualitative)	Yes (~47 minutes)	Less than 4 hours

Table 2 – Product Information

Product:	AC Tech 2170 FC Epoxy Resin
Lot Number A	21091507
Lot Number B	25101505
Component A (g)	400.0
Component B (g)	152.1
Mix Ratio (wt. %) A : B	2.63 : 1.00
Mixer Type:	Drill Paddle
Mixing Time:	2.5 minutes
Ambient Temperature	73ºF
Humidity	52%

Table 3 – ASTM C156 Test Conditions & Mix Proportions

Buzzi Cement	720g
C778 Sand	1800g
Water	288g
Flow (10 drops)	38
Mixer Type	Hobart
Applied Compound Weight	3.58 g
Compound SG	1.1
Compound % Volatile	0.00
Application Rate (sq ft/gal)	150
Sample Area (sq in)	18.6
Chamber Humidity	32%
Chamber Temperature	100°F

Table 4 – ASTM C156 Test Results - Water Retention

Sample ID	Age	Area (in^2)	Coated Weight (g)	Final Weight (g)	Corrected Loss (kg/sq m.)
1	24 hrs	18.6	3036.9	3036.6	**0.02**
2		18.6	3079.6	3079.4	**0.02**
3		18.6	3047.5	3047.1	**0.03**
				Average	**0.02**
1	72 hrs	18.6	3036.9	3036.2	**0.05**
2		18.6	3079.6	3078.9	**0.06**
3		18.6	3047.5	3046.7	**0.06**
				Average	**0.06**

Table 5 – Concrete Mix Proportions for Bond Strength Testing

ASTM Designation	Classification	Source	Volume (ft^3)	Mix 1 (pcy)
C150	Type I/II Cement	Lehigh - Leeds, AL	3.18	625
C33	Natural Sand	Lambert Sand Co.	7.92	1300
C33	#57 Stone - Granite	Vulcan - Lithonia, GA	10.39	1700
C94	Water - Potable	Lawrenceville, GA	4.97	310 (0.496 w/c)
C192	Designed Air Content	2.00%	0.54	NA
Totals			**27.00**	**3935**
Fresh/Hardened Properties				
C143	Slump (in.)		4.00	
C231	Air Content (%)		1.4	
C29	Unit Weight (pcf)		146.4	
C1064	Concrete Temperature °F		72.0	
C1064	Air Temperature °F		74.0	
C39	Compressive Strength (psi) 4" x 8" Cylinders at 7 days	Specimen 1	3,950	
		Specimen 2	4,000	
		Specimen 3	4,050	
		Average Result	**4,000**	

Table 6 – ASTM D7234 – Bond Strength Test Results – 7 days

Age of Concrete when coating was applied	Concrete Age at Time of Testing	Gage Reading (psi)	Peak Pull Off Load (lbs)	Sample Diameter (in.)	Bond Area (in^2)	Bond Strength (psi)	Material where Failure Occurred	Average Bond Strength (psi)
After Initial Set	7 days	3,785	2,028	2.75	5.94	340	Substrate	**295**
		3,897	2,089	2.75	5.94	350	Substrate	
		2,244	1,190	2.75	5.94	200	Substrate	

Testing, Engineering and Consulting Services, Inc. appreciates the opportunity to provide our professional services for this important project. If you have any questions regarding this report, or if we can be of further assistance please contact us at 770-995-8000.

Sincerely,

TESTING, ENGINEERING & CONSULTING SERVICES, INC.

James G. McCants III
Laboratory Manager, Chemist

Shawn P. McCormick
Laboratory Principal, President

Attachment: ASTM G154 – UV Resistance Test Results

APPLIED TECHNICAL SERVICES, INCORPORATED

1049 Triad Court, Marietta, Georgia 30062 • (770) 423-1400 Fax (770) 424-6415

ACCELERATED ENVIRONMENTAL TEST REPORT

Ref. D216787-1 **Date** June 19, 2014 **Page** 1 **of** 1

James G. McCants III
TEC Services, inc.
235 Buford Drive
Lawrenceville, GA 30046

Purchase Order #: 2014138

Procedure

Test Performed
Accelerated Weathering

Method
ASTM G154-12 Cycle 1

Test Material
Epoxy Coated Mortar Tiles

Equipment Used
Ultra Scan XE; D65/10°, ATS 1419
Calibration before use
Tile Calibration Date 6-30-14

Exposure Period
336 Hours

Results

Test Material	Sample #	Exposure Period	L*	a*	b*	ΔE	ΔYI
2170 Epoxy	14-331-1-1	Pre	38.79	0.26	4.21	11.49	36.66
		336 Hrs	41.02	2.53	15.25		
	14-331-1-2	Pre	39.21	0.19	4.33	14.62	14.05
		336 Hrs	52.51	0.49	10.41		
	14-331-1-3	Pre	38.34	0.21	3.91	10.85	35.63
		336 Hrs	40.12	2.19	14.43		
2170FC Epoxy	14-331-2-1	Pre	37.47	0.43	3.83	12.12	37.14
		336 Hrs	40.39	1.54	15.54		
	14-331-2-2	Pre	38.03	0.51	4.83	10.64	29.67
		336 Hrs	42.1	1.47	14.62		
	14-331-2-3	Pre	38.28	0.43	3.81	11.64	34.82
		336 Hrs	41.72	1.70	14.86		

ISO 9001

Prepared by: C. Tippens
Materials Testing

Approved by: F. Lopez
Supervisor