June 25, 2024

Rebotec USA
621 E. Princeton Dr.
Princeton, TX 75407

Attn: Ms. Melissa Kanjiravilyil

RE: **Interim Compliance Report: Rebotec Admix Powder, Type S**
ASTM C494/C494M – 19$^{\varepsilon 1}$, "Standard Specification for Chemical Admixtures for Concrete"
AASHTO M194/M194 – 13(2021), "Standard Specification for Chemical Admixtures for Concrete"
AET Project No. P-0030708

Dear Ms. Kanjiravilyil:

American Engineering Testing, Inc. (AET) is pleased to present this report of our compliance verification testing of Rebotec Admix Powder. The attached report presents the interim test results of the referenced admixture. Three 4x8-in. cylinder molds of the admixture were received at AET on February 27, 2024.

All sample preparation and testing were performed in accordance with the applicable sections of AASHTO M194M/M194M – 13(2021), ASTM C494/C494M – 19$^{\varepsilon 1}$, "Standard Specification for Chemical Admixtures for Concrete" and all referenced documents. Based on our results through 90 days, Rebotec Admix Powder, Type S complies with the requirements in AASHTO M194/M194 and Table 1 of ASTM C494 for a Type S, specific performance admixture.

Concrete batching and test specimen fabrication was conducted on three separate days. One control mixture and one test mixture containing Rebotec Admix Powder, both meeting the requirements of AASHTO M194 and ASTM C494 for fresh concrete properties, were produced each day. A commercially available vinsol resin air-entraining admixture was used for the concrete mixtures. Drake Type I/II/V cement from the Drake plant in Paulden, AZ was used for all concrete mixtures.

Product information and cement chemical and physical properties are presented in Tables 1 and 2. Aggregate properties and gradations are presented in Tables 3 and 4. Mixture proportions and results of testing are given in Tables 5 and 6.

If there are any questions with regard to this report, please contact me.

Sincerely,

American Engineering Testing
An AASHTO Accredited Laboratory – Aggregates, Cement & Concrete

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TABLE 1. ADMIXTURE INFORMATION

	Reference Admixture	Test Admixture
Manufacturer	GCP Applied Technologies	Rebotec USA
Brand Name	Daravair M Vinsol Resin	Rebotec Admix Powder
Lot Number	Not Provided	Not Provided
Quantity Supplied	3-1/2 Gallons	Three 4x8-in. Cylinder Molds
Total Solids, %	14.1	99.6
Specific Gravity	1.039	Not Applicable
pH	11.8	12.6
Chloride, %	0.003	0.005

TABLE 2. PORTLAND CEMENT ANALYSIS – CHEMICAL AND PHYSICAL

ASTM C150 Type I/II/V Cement

Brand Name: Paulden, AZ — Manufacturer: Drake Cement

Chemical Analysis, Mass %

Calcium oxide (CaO)	64.8	Tricalcium silicate (C_3S) (%)	53
Silicon dioxide (SiO_2)	21.1	Dicalcium silicate (C_2S) (%)	20
Aluminum oxide (Al_2O_3)	4.4	Tricalcium aluminate (C_3A) (%)	4
Iron oxide (Fe_2O_3)	4.5	Tetracalcium alumino ferrite (C_4AF) (%)	14
Magnesium oxide (MgO)	1.1	$C_3S + 4.75C_3A$ (%)	22
Sulfur trioxide (SO_3)	3.1	Loss on Ignition (%)	1.7
Alkalies as Na_2O_{eq} (%)	0.43	Insoluble Residue (%)	0.82

Physical Analysis

Fineness, Blaine (cm^2/g)	4,330	Air Content (%)	6
Vicat Time of Set Initial, hr:min	1:36	Autoclave Expansion (%)	0.05
Mortar expansion (%) (C1038)	0.013	Mortar expansion (%) (C1038)	0.010
Compressive Strength (psi)	3-day 3,750	7-day 4,690	28-day 6,400

TABLE 3. PROPERTIES OF FINE AND COARSE AGREGATES

	Fine Aggregate	Coarse Aggregate
Manufacturer	Aggregate Industries	Martin Marietta
Aggregate type, ID	Natural Sand, Elk River	#57 Crushed Granite
Specific gravity, SSD	2.667	2.698
Absorption %	0.7	0.3

TABLE 4. GRADATIONS OF FINE AND COARSE AGGREGATES, ACCORDING TO ASTM C136

Fine Aggregate		
	Percent passing	**ASTM C260/AASHTO M 154 Requirements**
No. 4 [4.75 mm]	100	100
No. 16 [1.18 mm]	72	65 to 75
No. 50 [300 µm]	17	12 to 20
No. 100 [150 µm]	2	2 to 5

Coarse Aggregate		
	Percent passing	**ASTM C260/AASHTO M 154 Requirements**
1.5 in. [37.5 mm]	100	100
1.0 [25.0 mm]	96	95 to 100
0.50 in. [12.5 mm]	44	25 to 60
No. 4 [4.75 mm]	6	0 to 10
No. 8 [2.36 mm]	3	0 to 5

TABLE 5. Test Results for Concrete Made with Rebotec Admix Powder, Type S, Using 20.7 pcy

		Control Mixtures				Test Mixtures				ASTM C494/AASHTO
Mix Number		**1**	**2**	**3**	**Average**	**1**	**2**	**3**	**Average**	**M 194 Requirements,**
Cast Date		3/18/2024	3/19/2024	3/20/2024		3/18/2024	3/19/2024	3/20/2024		**Type S**
Mixture Proportions	Cement, pcy	517	517	517	**517**	517	517	517	**517**	**517 ± 5**
	Fine Aggregate, pcy	1,278	1,278	1,278	**1,278**	1,263	1,263	1,263	**1,263**	
	Coarse Aggregate, pcy	1,765	1,765	1,765	**1,765**	1,745	1,745	1,745	**1,745**	
	Water, pcy	286	286	286	**286**	283	283	283	**283**	
		Water Content, % of Control				99	99	99	**99**	
	AEA (Vinsol Resin)	Master Builders Daravair M				Master Builders Daravair M				
	AEA dose, oz/cwt	1.4	1.3	1.5	**1.4**	1.6	1.6	1.8	**1.6**	
	Test Admixture	--	--	--	**--**	Rebotec Admix Powder				
	Admixture dose, pcy	--	--	--	**--**	20.7	20.7	20.7	**20.7**	
	Water-to-Cement Ratio	0.55	0.55	0.55	**0.55**	0.55	0.55	0.55	**0.55**	
Plastic Properties	Slump, inches	4.00	3.75	3.50	**3.75**	3.75	3.50	4.00	**3.75**	**3.50 ± 0.50**
	Air Content, %	6.2	6.5	6.1	**6.3**	6.4	5.9	6.8	**6.4**	**± 0.5**
	Density, pcf	145.2	144.8	145.6	**145.2**	145.2	145.6	143.6	**144.8**	
Setting Time	Initial, hr:min	4:19	4:18	4:19	**4:18**	4:23	4:01	4:26	**4:16**	
	Final, hr:min	6:05	6:10	6:04	**6:06**	6:10	5:47	6:16	**6:04**	
	Deviation from Reference				Initial, hr:min	0:04	-0:17	0:07	**-0:02**	**Not More than 1:00 Earlier nor 1:30 Later**
					Final, hr:min	0:05	-0:23	0:12	**-0:02**	**Not More than 1:00 Earlier nor 1:30 Later**
Compressive Strength	3 Days, psi	2,908	2,911	3,284	**3,030**	2,844	3,420	3,077	**3,110**	
	7 Days, psi	3,914	3,916	4,231	**4,020**	3,735	4,737	3,856	**4,110**	
	28 Days, psi	5,363	5,553	5,633	**5,520**	4,665	6,369	5,033	**5,360**	
	90 Days, psi	6,120	6,334	6,665	**6,370**	5,784	7,198	5,820	**6,270**	
	6 Months, psi									
	1 Year, psi									
	% Reference				3 Days	98	117	94	**103**	**≥ 90%**
					7 Days	95	121	91	**102**	**≥ 90%**
					28 Days	87	115	89	**97**	**≥ 90%**
					90 Days	95	114	87	**98**	**N/A**
					6 Months					**≥90%**
					1 Year					**≥ 90%**
Flexural Strength	3 Days, psi	580	590	605	**590**	600	625	635	**620**	
	7 Days, psi	610	675	725	**670**	635	680	660	**660**	
	28 Days, psi	695	740	820	**750**	730	690	750	**725**	
	% Reference				3 Days	103	106	105	**105**	**≥ 90%**
					7 Days	104	101	91	**99**	**≥ 90%**
					28 Days	105	93	91	**97**	**≥ 90%**
Length Change, %		-0.022	-0.024	-0.021	**-0.022**	-0.024	-0.023	-0.025	**-0.024**	
		Increase Over Control				0.002	-0.001	0.004	**0.002**	**≤ 0.010**[A]
Resistance to Freezing and Thawing	Relative Dynamic Modulus, % 0 cycles	100/100	100/100	100/100	100	100/100	100/100	100/100	100	
	36 cycles	99/99	99/99	98/98	99	98/98	98/99	98/98	98	
	48 cycles	99/98	99/99	98/97	98	98/99	99/99	98/96	98	
	84 cycles	98/99	98/98	98/97	98	98/98	98/97	98/98	98	
	120 cycles	98/99	98/98	99/98	98	98/98	98/98	99/99	98	
	156 cycles	98/98	98/99	97/97	98	96/96	99/98	98/96	97	
	192 cycles	98/99	98/98	98/98	98	95/96	98/98	98/98	97	
	228 cycles	97/98	99/99	97/97	98	96/96	98/98	98/98	97	
	264 cycles	98/98	99/99	97/97	98	96/96	98/98	96/96	97	
	300 cycles	98/99	98/98	97/97	98	95/96	95/95	96/96	96	
									98	**≥ 80%**

[A] Increased shrinkage over control.

TABLE 6. ASTM C494/AASHTO M 194 Test Results of Chemical Admixtures for Concrete
Rebotec Admix Powder, Type S, 20.7 pcy

Mixture Designation	Control	Rebotec Admix Powder	Change vs. Control	ASTM C494/AASHTO M 194 Requirements, Type S
Mixture Proportions				
Cement, pcy	517	517	0	**517 ± 5**
Fine Aggregate, pcy	1,278	1,263		
Coarse Aggregate, pcy	1,765	1,745		
Water, pcy	286	283		
AEA (Vinsol Resin), oz/cwt	1.4	1.6		
Test Admixture, pcy	--	20.7		
Ratio of Fine to Total Aggregate, %	42	42		
Water-to-Cement Ratio	0.55	0.55		
Plastic Properties				
Slump, inches	3.75	3.75	0.00	**3.50 ± 0.50**
Air Content, %	6.3	6.4	0.1	**± 0.5**
Density (Unit Weight), pcf	145.2	144.8		
Setting Time				
Initial, hr:min	4:18	4:16	-0:02	**Not More than 1:00 Earlier nor 1:30 Later**
Final, hr:min	6:06	6:04	-0:02	**Not More than 1:00 Earlier nor 1:30 Later**
Compressive Strength, psi				
3 Days, psi	3,030	3,110	103	**≥ 90%**
7 Days, psi	4,020	4,110	102	**≥ 90%**
28 Days, psi	5,520	5,360	97	**≥ 90%**
90 Days, psi	6,370	6,270	98	**N/A**
6 Months, psi				**≥90%**
1 Year, psi				**≥ 90%**
Flexural Strength, psi				
3 Days, psi	590	620	105	**≥ 90%**
7 Days, psi	670	660	99	**≥ 90%**
28 Days, psi	750	725	97	**≥ 90%**
Length Change by Drying Shrinkage				
Length Change, %	-0.022	-0.024	0.002	**≤ 0.010[A]**
Resistance to Freezing and Thawing, Procedure A				
Relative Durability Factor, %			98	**≥ 80%**

[A] Increased shrinkage over control.