TEC Services
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July 13, 2020

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Subject: **Final Report for Fritz-Pak Supercizer 7, Compliance Verification for Type F Admixture**
AASHTO M194-13 *Standard Specification for Chemical Admixtures for Concrete*
TEC Services Project No: TEC 13-1026
TEC Services Laboratory No: 19-480
NTPEP ID: CADD *2018-01-118*

Dear Mrs. Malusky:

Testing, Engineering and Consulting Services, Inc. (TEC Services) is an AASHTO R18, ANS/ISO/IEC 17025:2005 and Army Corps of Engineers accredited laboratory. TEC Services is pleased to present this report of our compliance verification testing of Supercizer 7, an ASTM C494-16 *Standard Specification for Chemical Admixtures for Concrete,* Type F (*High Range Water Reducing)* admixture. Our services were performed in accordance with our service agreement date August 30, 2013.

Sample preparation and testing was performed in accordance with applicable sections of AASHTO M194-13 (2017) *Standard Specifications for Chemical Admixtures for Concrete*, ASTM C494 and documents referenced therein. Material and procedures outlined in AASHTO M194 were used. Based on our results to date, Supercizer 7 complies with the requirements in AASHTO M194 and Table 1 of ASTM C494. These test results pertain only to the samples tested.

The compliance verification was performed by TEC Services in Lawrenceville, Georgia. Concrete batching was performed on three different days in May of 2019. One control mixture and one test mixture containing Supercizer 7, both meeting the requirements of AASHTO M194 and ASTM C494 for fresh concrete properties, were produced each day. A 6-pound sample of Supercizer 7 was supplied to TEC Services by Fritz-Pak Corporation (Fritz-Pak). The air-entraining agent used in this testing was a vinsol resin, meeting the requirements of AASHTO M154-12 *Standard Specification for Air-Entraining Admixtures for Concrete*.

Testing of the concrete's plastic properties, time of setting, compressive strengths, flexural strengths, length change, and freeze thaw resistance were performed by TEC Services. Mixture proportions and results of our testing are given in Tables 1 to 3. Information and test data on fine and coarse aggregates are listed in Tables 4 to 6. Table 7 contains information on Supercizer 7. Product information and test data on the Type I cement is included in Table 8. Test results for each of the six batches prepared for this report are included in Tables 9 thru 12.

Table 1: Supercizer 7 performance and ASTM C494 requirements for a Type F admixture

Test Results	Supercizer 7	Specification Requirements
Water content (percent of control)	87	88 (max)
Time of setting, deviation of control		
Initial (hr:min)	0:53	-1:00 to +1:30
Final (hr:min)	0:32	-1:00 to +1:30
Compressive strength (percent of control)		
1 days	244	140 (min)
3 days	195	125 (min)
7 days	181	115 (min)
28 days	162	110, 120* (min)
56 days	155	110 (min)
90 days	142	117* (min)
6 months	151	100, 113* (min)
1 year	144	100 (min)
Flexural strength (percent of control)		
3 days	141	110 (min)
7 days	120	100 (min)
28 days	114	100 (min)
56 days	115	100 (min)
Length change (increase over control)	0.007	0.010 (max)
Relative durability factor	94	80 (min)

*Provisional Requirement .

Table 2: Mixture proportions, fresh concrete properties, and ASTM C494 requirements for Type F admixture

Average of Three Separate Tests	Control Mixture	Supercizer 7	Specification Requirements
Cement factor (lb/yd^3)	517	516	517 ± 5
Water (lb/yd^3)	287	240	
Water-cement ratio	0.555	0.465	
Coarse aggregate	1846	1846	
Fine aggregate	1157	1285	
Fine aggregate-total aggregate ratio	0.39	0.41	
Supercizer 7 (%/cwt)	0.00	0.60	
Vinsol Resin (oz/cwt)	0.39	0.16	
Slump (in.)	4.00	3.25	3 ½ ± ½
Air content (%)	5.9	5.7	5-7 (± 0.5 of control)
Density (lb/ft^3)	141.0	144.0	
Time of setting			
Initial (hr:min)	5:05	5:58	
dev. of control (hr:min)		0:53	-1:00 to +1:30
Final (hr:min)	6:58	7:30	
dev. of control (hr:min)		0:32	-1:00 to +1:30

Table 3: Properties of hardened concrete

	Control Mixture	**Supercizer 7**
Compressive strength (psi)		
1 days	1310	3190
3 days	2420	4720
7 days	3050	5510
28 days	4160	6750
56 days	4310	6690
90 days	4650	6580
6 months	4720	7150
1 year	4850	6990
Flexural strength (psi)		
3 days	470	665
7 days	600	720
28 days	675	770
56 days	705	810
Length change (%)	-0.013	-0.020
Durability factor (%)	93	87

Table 4: Properties of fine and coarse aggregates

Aggregate Information	**Fine aggregate**	**Coarse aggregate**
Manufacturer	**Lambert Sand, Shorter**	**Vulcan, Lithonia**
Aggregate Type	Natural sand	Crushed Granite
Specific Gravity $_{SSD}$	2.64	2.62
Absorption (%)	0.58	0.60

Table 5: Gradation of fine aggregate and ASTM C494 requirements

Percent passing		
Sieve	**Fine Aggregate**	**Specifications Requirements**
No. 4 (4.75 mm)	100	100
No. 16 (1.18 mm)	73	65 to 75
No. 50 (300 µm)	17	12 to 20
No. 100 (150 µm)	4	2 to 5

Table 6: Gradation of coarse aggregate and ASTM C494 requirements

Percent passing		
Sieve	**Coarse Aggregate**	**Specifications Requirements**
1.5 in. (37.5 mm)	100	100
1.0 in. (25.4 mm)	97	95 to 100
0.5 in. (12.5 mm)	31	25 to 60
No. 4 (4.75 mm)	6	0 to 10
No. 8 (2.36 mm)	4	0 to 5

Table 7: Admixture information

Information	Admixture Information
Brand Name	Supercizer 7
Manufacturer	Fritz-Pak Corporation
Lot Size	2000 pounds
Solids content (%)	91.806
pH	6.96
Chloride Content (% per BS EN 480-10:2009)	0.037

Table 8: Cement information and test data

ASTM C 150 Type I/II cement			
Brand name		Portland Type I/II	
Manufacturer		Holcim Cement – Genevieve Plant	
Chemical Analyses by Mass (%)			
Silicon dioxide (SiO_2)	19.9	Sulfur trioxide (SO_3)	3.3
Aluminum oxide (Al_2O_3)	4.5	Loss on ignition (950ºC)	3.2
Iron oxide (Fe_2O_3)	3.2	Insoluble residue	0.39
Calcium oxide (CaO)	64.1	Alkalies as Na_2O	0.52
Magnesium oxide (MgO)	1.8		
Calculated Potential Compounds as per ASTM C 150-05 (%)			
Tricalcium silicate (C_3S)	59	Tricalcium aluminate (C_3A)	6
Dicalcium silicate (C_2S)	11	Tetracalcium aluminoferrite (C_4AF)	10
Physical Testing and Results			
Fineness Specific Surface (Blaine)	397 m^2/Kg	Air Content (%)	6.0
Setting Times (Vicat) Initial	91 minutes	Autoclave Expansion (%)	0.03
Compressive 3 Day Strength (psi)	4200	Compressive 7 Day Strength (psi)	5280
C1038 Expansion @ 3.3% SO_3 (%)	0.007	False Set (%)	83

*Information provided by Holcim

Table 9: Yield adjusted mixture proportions, fresh concrete properties, and time of set for three control batches

	Control 1	**Control 2**	**Control 3**	**Average**
Cement factor (lb/yd^3)	516	516	517	**516**
Water (lb/yd^3)	286	286	288	**287**
Water-cement ratio	0.554	0.554	0.557	**0.555**
Coarse aggregate (lb/yd^3)	1845	1845	1849	**1846**
Fine aggregate (lb/yd^3)	1158	1158	1156	**1157**
Fine aggregate-total aggregate ratio	0.386	0.386	0.385	**0.385**
Supercizer 7, (%/cwt)	0.00	0.00	0.00	**0.00**
Vinsol Resin (oz/cwt)	0.42	0.42	0.32	**0.39**
Slump (in.)	4.00	4.00	4.00	**4.00**
Air content (%)	5.8	5.9	6.1	**5.9**
Density (lb/ft^3)	140.9	140.9	141.1	**141.0**
Time of setting				
Initial (hr:min)	5:35	5:33	4:06	**5:05**
Final (hr:min)	8:00	7:30	5:25	**6:58**

Table 10: Yield adjusted mixture proportions, fresh concrete properties, and time of set for three test batches containing Supercizer 7

	Test 1	**Test 2**	**Test 3**	**Average**
Cement factor (lb/yd3)	514	516	517	**516**
Water (lb/yd3)	240	241	238	**240**
Water-cement ratio	0.467	0.467	0.461	**0.465**
Coarse aggregate (lb/yd3)	1841	1849	1849	**1846**
Fine aggregate (lb/yd3)	1279	1284	1293	**1285**
Fine aggregate-total aggregate ratio	0.410	0.410	0.411	**0.410**
Supercizer 7 (%/cwt)	0.55	0.55	0.70	**0.60**
Vinsol Resin (oz/cwt)	0.15	0.15	0.18	**0.16**
Slump (in.)	3.50	3.00	3.00	**3.25**
Air content (%)	6.0	5.6	5.6	**5.7**
Density (lb/ft3)	143.5	144.1	144.3	**144.0**
Time of setting				
Initial (hr:min)	6:44	6:11	5:00	**5:58**
Final (hr:min)	8:49	7:32	6:09	**7:30**

Table 11: Properties of hardened concrete from three control test batches

	Control 1	**Control 2**	**Control 3**	**Average**
Compressive strength (psi)				
1 days	1300	1010	1620	**1310**
3 days	2270	2220	2780	**2420**
7 days	3170	2850	3140	**3050**
28 days	4120	4100	4260	**4160**
56 days	4190	4450	4300	**4310**
90 days	4850	4820	4270	**4650**
6 months	5030	4710	4420	**4720**
1 year	5000	4930	4610	**4850**
Flexural strength (psi)				
3 days	395	470	550	**470**
7 days	585	625	595	**600**
28 days	660	685	675	**675**
56 days	710	725	675	**705**
Length change (%)	-0.014	-0.008	-0.016	**-0.013**
Durability Factor (%)	96	94	88	**93**

Approximate Total Cycles Completed	Fundamental Transverse Frequency, kHz			Relative Dynamic Modulus, (%) Average of 2 Beams per Mix			Average
	Control 1	Control 2	Control 3	Control 1	Control 2	Control 3	
0 cycles	1.953	1.973	2.031	NA	NA	NA	NA
32 cycles	1.914	1.914	1.914	96	94	89	93
66 cycles	1.914	1.914	1.905	96	94	88	93
96 cycles	1.914	1.914	1.905	96	94	88	93
128 cycles	1.914	1.914	1.905	96	94	88	93
162 cycles	1.914	1.914	1.905	96	94	88	93
192 cycles	1.914	1.914	1.905	96	94	88	93
220 cycles	1.914	1.914	1.905	96	94	88	93
253 cycles	1.914	1.914	1.905	96	94	88	93
287 cycles	1.914	1.914	1.905	96	94	88	93
300 cycles	1.914	1.914	1.905	96	94	88	93

Table 12: Properties of hardened concrete from three batches containing Supercizer 7

	Test 1	**Test 2**	**Test 3**	**Average**
Compressive strength (psi)				
1 days	2260	3710	3590	**3190**
3 days	4210	4710	5250	**4720**
7 days	5570	5390	5560	**5510**
28 days	6780	6820	6640	**6750**
56 days	6800	6410	6860	**6690**
90 days	6760	6630	6360	**6580**
6 months	6990	7380	7070	**7150**
1 year	7030	7030	6920	**6990**
Flexural strength (psi)				
3 days	695	620	685	**665**
7 days	725	740	695	**720**
28 days	790	735	780	**770**
56 days	770	850	815	**810**
Length change (%)	-0.019	-0.019	-0.021	**-0.020**
Durability Factor (%)	88	87	86	**87**

Approximate Total Cycles Completed	Fundamental Transverse Frequency, kHz			Relative Dynamic Modulus, (%) Average of 2 Beams per Mix			Average
	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3	
0 cycles	2.168	2.246	2.168	NA	NA	NA	NA
32 cycles	2.031	2.148	2.012	88	91	86	88
66 cycles	2.031	2.129	2.012	88	90	86	88
96 cycles	2.031	2.129	2.012	88	90	86	88
128 cycles	2.031	2.129	2.012	88	90	86	88
162 cycles	2.031	2.129	2.012	88	90	86	88
192 cycles	2.031	2.129	2.012	88	90	86	88
220 cycles	2.031	2.129	2.012	88	90	86	88
253 cycles	2.031	2.109	2.012	88	88	86	87
287 cycles	2.031	2.109	2.012	88	88	86	87
300 cycles	2.031	2.030	2.012	88	87	86	87

We appreciate the opportunity to provide our services to you on this project. Should you have any questions or comments regarding this report, please feel free to contact us at your convenience.

Sincerely,

Testing, Engineering, & Consulting Services, Inc.

Kimberly Pleasant
Administrator

Shawn P. McCormick
Laboratory Principal