July 16, 2024

Subject: Report of ASTM C881 (AASHTO M235) Testing
Product: SealBoss 4050 SLV
Lab No.: 24-1091

To Whom it May Concern:

SGS Testing Engineering & Consulting Services, Inc. (SGS TEC Services) is an AASHTO R18, ANS/IEC/ISO 17025:2017, and Army Corps of Engineers accredited laboratory. SGS TEC Services is pleased to present this report of testing on the subject product submitted to our laboratory in June of 2024. Testing was performed in accordance with the terms and conditions of our Service Agreement. These test results pertain only to the sample tested. The purpose of the testing was to evaluate the submitted product in accordance with the Standards referenced below:

The purpose of the testing was to evaluate the subject submitted product in accordance with ASTM C881-20 (AASHTO M235-13) Standard Specification for Epoxy-Resin Base Bonding Systems for Concrete. It is our understanding that the product is to be designated as Grade 1, Class C, Type IV epoxy-resin system. The epoxy was tested for compliance to the requirements listed in Table 1 of ASTM C881 (AASHTO M235). Information pertaining to the mixing procedures and product designation are reported in Table 1. Ambient conditions and curing procedures are reported in Table 2. Summary test results are reported in Table 3 & 4. Test results for each method are attached to this report. The testing was performed in accordance with the following test methods:

- ASTM C881-20 *Standard Specification for Epoxy-Resin Bonding Systems for Concrete*
- AASHTO M235-13 *Standard Specification for Epoxy-Resin Bonding Systems for Concrete*
- ASTM C882-20 *Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear*
- ASTM D570-18 *Standard Test Method for Water Absorption of Plastics*
- ASTM D638-22 *Standard Specification for Tensile Properties of Plastics*
- ASTM D648-18 *Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position*
- ASTM D695-15 *Standard Test Methods for Compressive Properties of Rigid Plastics*
- ASTM D2393-86 *Standard Test Method for Viscosity of Epoxy Resins and Related Components*
- ASTM D2566-86 *Linear Shrinkage of Cured Thermosetting Casting Resins During Cure*

Classification of epoxy-resin bonding systems consists of a Type, Grade, and Class. The Type distinguishes the applications for which the epoxy-resin system may be used.

- Type I For use in non-load bearing application for bonding hardened concrete to hardened concrete and other materials, and as a binder in epoxy mortars or epoxy concretes.
- Type II For use in non-load bearing applications for bonding freshly mixed concrete to hardened concrete.
- Type III For use in bonding skid-resistant materials to hardened concrete and as a binder in epoxy mortars or epoxy concretes used on traffic bearing surfaces (or surfaces subject to thermal or mechanical movements).
- Type IV For use in load bearing applications for bonding hardened concrete to hardened concrete and other materials and as a binder for epoxy mortars and concretes.
- Type V For use in load bearing applications for bonding freshly mixed concrete to hardened concrete.
- Type VI For bonding and sealing segmental precast elements, as in segment-by-segment erection, and for span-by-span erection when temporary post tensioning is applied.
- Type VII For use as a non-stress carrying sealer for segmental precast elements when temporary post tensioning is not applied as in span-by-span erection.

Grade systems are defined according to the flow characteristics of the epoxy-resin system.

- Grade 1 Low Viscosity
- Grade 2 Medium Viscosity
- Grade 3 Non-Sagging Consistency

Classes A, B, and C are defined for Types I through V, and Classes D, E, and F are defined for Types VI and VII, in accordance with the range of temperatures for which they are suitable.

- Class A For use below 40 °F [4 °C] the lowest allowable temperature to be defined by the manufacturer of the product.
- Class B For use between 40 and 60 °F [4 and 15 °C]
- Class C For use above 60 °F [15 °C] the highest allowable temperature to be defined by the manufacturer of the product.
- Class D For use between 40 and 65 °F [4 and 18 °C] for Type VI and VII applications.
- Class E For use between 60 and 80 °F [15 and 30 °C] for Type VI and VII applications.
- Class F For use above 75 °F [25 °C] for Type VI and VII applications, the highest allowable temperature to be defined by the manufacturer of the product.

ASTM C881 - Viscosity and Gel Time

All materials were weighed to the nearest 0.1 gram. A timer was started as the components were combined. Once thoroughly mixed, 60 grams of the prepared epoxy was transferred to an unwaxed cup and probed every two minutes with a wooden tongue depressor until gelation occurred. Mixing time was added to calculate gel time. The Brookfield DV-E Viscometer was leveled prior to testing, and the subject product was transferred to a 500 mL plastic cup capable of accommodating the viscometer spindle. The spindle was submerged in the material up to the reference mark and adjusted to the highest spindle speed capable of achieving a reading between 20% and 80% of torque. Viscosity was recorded in centipoise and is reported with spindle size, and motor speed.

ASTM C882 – Shear Bond Strength

The mixed material was applied to the surface of two hardened mortar sections cut at a 30-degree angle. The hardened sections were pressed together and allowed to cure at the designated temperature until the time of testing. The specimens were capped with sulfur in accordance with ASTM C617 and loaded at a rate of 35 ± 7 psi/sec. in accordance with ASTM C39 until failure. The peak load and failure type were

ASTM D570 – Water Absorption

2.00” x 0.25” cylindrical specimens were cast and cured at respective temperature until the time of testing. The initial weight and dimensions of the specimens was determined prior to immersion in the solutions. The specimens were immersed in water for 24 hours at standard laboratory temperature. The specimens were removed from the water, dried, and final weight and volume determinations recorded.

ASTM D638 - Tensile Properties

Type I specimens were cast by client and shipped to SGS TEC for final curing at respective temperature until the time of testing. The rate of testing was 0.2 in./min of crosshead displacement. Elongation was determined using an extensometer with a 2.00” gage length.

ASTM D648 – Deflection Temperature under Load

5.00” x 0.50” x 0.50” specimens were cast and cured at respective temperature until the time of testing. Prior to testing, the width and depth of each specimen was measured three times using a digital micrometer. The average width and depth were used to calculate a total applied load equal to a fiber stress of 264 psi. Specimens were loaded edgewise into the testing apparatus, and center point loaded using a span length of 4”. The testing apparatus was immersed in a bath of Precision B+ paraffin oil at room temperature and the calculated load was applied. The deflection measurement gage was adjusted to zero five minutes after the load was applied, and the bath was heated at a rate of 2.0 ± 0.2°C/min. Temperature was recorded when each specimen deflected 0.01”.

ASTM D695 - Compressive Properties

1.00” x 2.00” cylindrical specimens were cast and cured at respective temperature until the time of testing. The rate of testing was 0.05 in./min of crosshead displacement.

Table 1 – Product Information & Mix Proportions

Product Name	**SealBoss 4050 SLV**
Lot # A | Exp Date	**8735 | NA**
Lot # B | Exp Date	**8736 | NA**
Grade Designation	**1**
Class Designation	**C**
Type Designation	**IV**
Components	**2 Component**
Part A *(g)*	**100**
Part B *(g)*	**43**
Mixing Time	**3 minutes**
Mixer Type	**Hand**

Table 2 – Mixing & Cure Conditions

Test Method	**Conditioning and Mixing Temperature of Epoxy (± 2ºF)**	**Curing Temperature of Epoxy (± 2ºF)**
Gel Time	73°F	NA
Viscosity (Grade 1 & 2 only)	73°F	NA
Heat Deflection	73ºF	73ºF
Lineage Shrinkage	73ºF	73ºF
Water Absorption	73ºF	73ºF
Tensile Strength & Elongation*	73ºF	60°F
Compressive Properties	73ºF	60°F
Shear Bond – H | H	73ºF	60°F

*Note – Optional for Grade 3 bonding agents

Table 3 – Plastic Properties

ASTM	**Test Property**	**Age**	**73°F**	**ASTM C881**			
				Type I	**Type II**	**Type IV**	**Type V**
D2393	Viscosity *(Poise)* - Grade 1	Plastic	**2.1**	20 (max)	20 (max)	20 (max)	20 (max)
C881	Gel Time[1] *(min.)*	Plastic	**12**	30 (min)	30 (min)	30 (min)	30 (min)

[1] *The purchaser may specify a minimum gel time of 5 minutes for Types I and IV when automatic proportioning, mixing, and dispensing equipment are used.*

Table 4 – Hardened Properties

ASTM	Test Property	Age	60°F	ASTM C881			
				Type I	Type II	Type IV	Type V
C882	Shear Bond Hardened to Hardened *(psi)*	2 days	**1,280**	1,000 (min)	NA	1,000 (min)	NA
		14 days	**2,310**	1,500 (min)	NA	1,500 (min)	NA
D695	Compressive Yield Strength *(psi)*	7 days	**12,430**	8,000 (min)	5,000 (min)	10,000 (min)	8,000 (min)
	Compressive Modulus *(psi)*	7 days	**398,800**	150,000 (min)	90,000 (min)	200,000 (min)	150,000 (min)
D638	Tensile Strength *(psi)*	7 days	**10,630**	5,000 (min)	2,000 (min)	7,000 (min)	6,000 (min)
	% Elongation	7 days	**2.3**	1.0 (min)	1.0 (min)	1.0 (min)	1.0 (min)
Tests Conditioned and Cured at 75°F							
D2566	Linear Shrinkage *(%)*	48 hrs	**0.0000**	0.005 (max)	0.005 (max)	0.005 (max)	0.005 (max)
D570	Water Absorption *(%)*	14 days	**0.2**	1% (max)	1% (max)	1% (max)	1% (max)
D648	Heat Deflection *(^{o}F)*	7 days	**149**	NA	NA	120º (min)	120º (min)

Summary
Based on the results of our testing to date the submitted product meets the following designations per ASTM C881/AASHTO M235:

Grade 1 | Class C | Type I, IV

We appreciate the opportunity to provide our services to you on this project. Please do not hesitate to contact us at your convenience if you have any questions about this report or if we may be of further assistance.

Sincerely,
SGS TESTING, ENGINEERING & CONSULTING SERVICES, INC.

Tom Dang
Project Manager

James. G. McCants III
Laboratory Manager, Chemist

Table 5 – ASTM D570 – Water Absorption

Specimen ID	**Diameter** *(in.)*	**Thickness** *(in.)*	**Initial Weight** *(g)*	**Weight After 24hr Soak** *(g)*	**Difference** *(g)*	**% Absorption**
1	2.000	0.140	6.4769	6.4933	0.0164	0.25
2	2.000	0.136	6.4002	6.4153	0.0151	0.24
3	2.000	0.127	7.4637	7.4785	0.0148	0.20
					Average	**0.23**

Table 6 – ASTM D648 – Heat Deflection

Specimen ID	**Avg. Width** *(in.)*	**Avg. Depth** *(in.)*	**Total Load Applied** *(g)* **264 psi**	**Heat Deflection Temperature** *(°F)*
1	0.498	0.501	2499.8	149.3
2	0.496	0.502	2496.4	149.4
			Average	**149.4**

Figure 1 – Fracture Types per ASTM C39

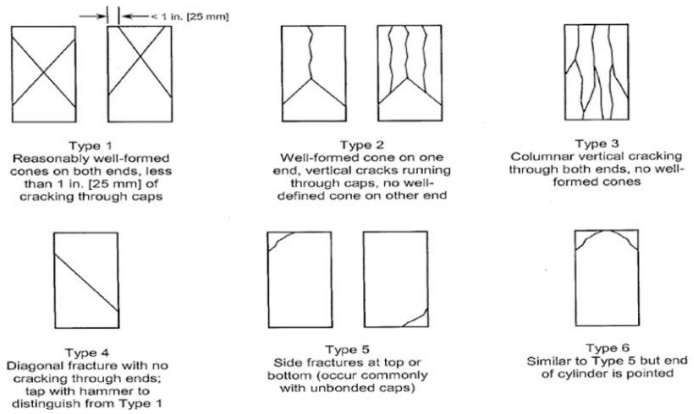

Table 8 – ASTM C882 – Hardened to Hardened – Shear Bond Strength

Curing Temp.	Age	Specimen ID	Dummy Diameter *(in.)*	Slant Height *(in.)*	Bond Area *(in2)*	Peak Load *(lbf)*	Bond Strength *(psi)*	Total Area of Voids	Fracture Type	Average *(psi)*
60°F	2 day	1	3.00	6.00	14.14	18,171	1,290	NA	3	1,280
		2	3.00	6.00	14.14	17,355	1,230	NA	3	
		3	3.00	6.00	14.14	18,765	1,330	NA	3	
	14 day	1	3.00	6.00	14.14	32,858	2,320	NA	3	2,310
		2	3.00	6.00	14.14	31,017	2,190	NA	3	
		3	3.00	6.00	14.14	34,366	2,430	NA	3	

Table 9 – ASTM D695 – Compressive Strength

Curing Temp.	Specimen ID	Diameter *(in.)*	Height *(in)*	Area *(in^2)*	Yield Load *(lbf.)*	Peak Load *(lbf.)*	Compressive Yield Strength *(psi)*	Peak Stress *(psi)*	Compressive Modulus *(psi)*
60°F	1	1.00	2.00	0.7854	9,780	9,780	12,450	12,450	394,700
	2	1.00	2.00	0.7854	9,954	9,954	12,670	12,670	399,400
	3	1.00	2.00	0.7854	10,154	10,154	12,930	12,930	401,300
	4	1.00	2.00	0.7854	9,787	9,787	12,460	12,460	401,000
	5	1.00	2.00	0.7854	9,145	9,145	11,640	11,640	397,800
						Average	**12,430**	**12,430**	**398,800**

Table 10 – ASTM D638 – Tensile Strength

Curing Temp.	Specimen ID	Width *(in.)*	Thickness *(in)*	Area *(in^2)*	Peak Load *(lbf.)*	Peak Stress *(psi)*	% Elongation
60°F	1	0.502	0.131	0.0655	684	10,440	2.2
	2	0.503	0.131	0.0656	694	10,580	2.1
	3	0.502	0.127	0.0638	662	10,380	1.9
	4	0.503	0.129	0.0646	686	10,610	2.5
	5	0.503	0.130	0.0653	728	11,140	2.6
					Average	**10,630**	**2.3**

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