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Using Performance Data to Select the Best Concrete Floor Coatings

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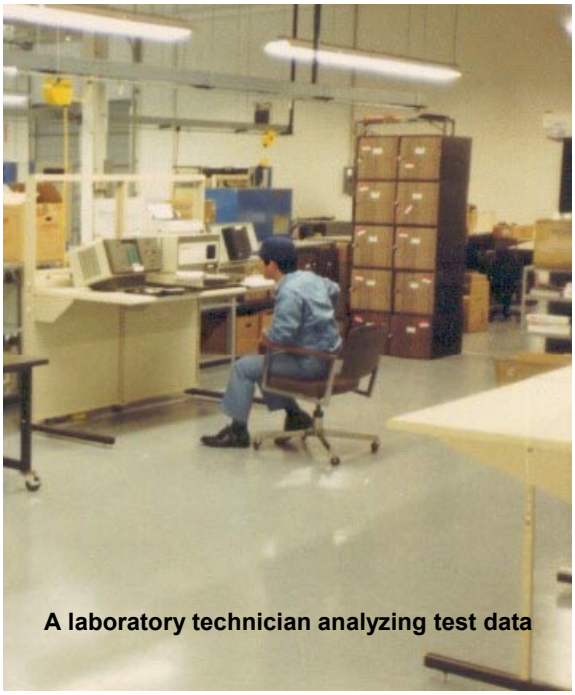
Most owners, architects, and engineers find it difficult to sift through the many available systems when selecting or specifying a protective surfacing for concrete floors. The material selection process is very systematic. Specific jobsite conditions and objectives must be considered and ranked. Also, the performance properties of the available systems need to be compared with each other on an equal footing. Comparing test data and performance characteristics can be totally confusing, however. It is important to make sure that the test methods used to describe a systems performance relate to the jobsite's conditions and objectives.

Protective coatings for concrete floors range in thickness from a few mils to 1/4 - 3/8 inches. Primarily two variances are encountered when comparing system data. Test methods and procedures vary greatly for thin film systems vs. systems greater than 1/8 inch. The second variance concerns the testing of the composite system vs. the individual binder.

Test data generated from laboratory testing are usually the criteria used when making a selection. In many cases, however, material suppliers do not use the same test procedures to report a particular performance criterion such as wear or abrasion resistance. This makes the test results and the numbers incomparable. Since test data is normally derived from a laboratory test taken on a laboratory specimen, it must be reviewed by comparing with other laboratory data and not necessarily be taken as actual performance of the floor. Also when comparing data, you must look at the same test method and procedure using the same thickness and application as is on the floor surface. It is not practical, for instance, to compare the compressive strength on a thin film coating when the required test specimen is a 1/2 X 1/2 inch cube of material (ASTM-D-695).

The American Society for Testing and Materials (ASTM) has established most of the accepted



A laboratory technician analyzing test data

standards for testing materials. ASTM is divided into various sections. ASTM-D numbers generally relate to the paint and coating test methods and to unfilled (neat) binder systems. When testing clear, unfilled binders or coatings, ASTM-D test methods are usually the most applicable. ASTM-C test methods are generally used when dealing with filled systems such as chemical resistant mortars, cement mortars, concrete, and resin mortar systems. In addition, there are some specialty tests such as ASTM-E, used to test flame resistance, and military specifications such as Mil-D-3134F.

Whenever possible, the composite data for a floor coating or mortar overlay system should be compared. Data showing information about the components of the system does not accurately reflect the integrity of the system. A thin film coating system, for example, is only 7-10 mils in thickness. A compressive strength test on such a coating has no meaningful value because there is no way to actually run the test. A compressive strength value for thin films is usually a bogus number. A good way to

measure one system against another when dealing with thicker, 100% solid systems is to compare the neat binder that is used in the system. This provides hardness, heat resistance, strength, and flexibility information on the polymer material used. It does not, however, provide information on the fillers and aggregate that can significantly alter the binder's data. The final comparison should include the system's performance data.

How, then, can the owner or specifier insure that the right kind of data for a given system is being compared? There are many tests that can be used to evaluate flooring systems. Certain tests, however, should not be used as their results do not reflect the necessary information. For example, as shown in **Table I**, the abrasion resistance of binder resins should not be compared. This is because the addition of the fillers and aggregates used with this resin in the final system will change the resin's performance. In this case, the overall data of the system should be compared. **Table I** outlines the appropriate comparisons that should be made between flooring systems.

TABLE I: Tests Used to Compare Floor System Types

Test	Binder Resin	Coatings & Sealers (0-40 mils)	Slurries & Broadcast (50 mils - 1/8")	Mortars & Overlays (1/8-1/4")
Abrasion		X	X	Surface Test
Adhesion		X	X	X
Hardness	X	X	X	Surface Test
Chemical Resistance	X	X	X	X
Stain Resistance	X	X	X	Surface Test
Flexibility	X	X		
Heat Resistance (dry)	X	X		X
Water Absorption	X	X		X
Skid Resistance		X	Surface Test	Surface Test
Compressive Strength	X		X	X
Tensile Strength	X			
Tensile Elongation	X			
Flexural Strength	X			X
Flexural Modulus	X			X
Impact Strength	X	X		X
Thermal Shock	X			X
Indentation	X			X

Test methods for thin film systems do not always provide the correct information for thicker flooring systems. For example, ASTM D-4541 utilizes a one inch diameter button and an elcometer to determine the adhesion of a coating to the substrate. This test does not allow sufficient diameter for adequate pull-off of a mortar system. ACI Committee 403 allows for a two to three inch diameter pipe cap making it more adaptable for an aggregate-filled mortar system. **Table II** shows the best test method for each type of flooring system.

Tensile and flexural strength are not applicable performance values for evaluating surfacing materials on concrete substrates. These tests do not relate to field performance. Looking at **Table II**, one can also see the benefits of the various systems. The testing methods for thicker systems are more involved. Everyone knows that thin film systems should not be used for areas requiring high impact, heavy loads, and high strength. The table also shows us that for chemical resistant applications, a thicker system would be best. The resistance of an entire system is determined through immersion testing, not its stain resistance. Thin film systems simply do not provide the thickness needed to for this testing.

TABLE II: Test Methods Used for Testing Floor Systems

TEST IDENTIFICATION	Binder Resin	Coatings & Sealers (0-40 mils)	Slurries & Broadcast (50 mils - 1/8")	Mortars & Overlays (1/8-1/4")
Abrasion Resistance ASTM D-6040		X	X	X
Adhesion ASTM D-4541		X		
ACI Committee 403			X	X
Hardness ASTM D2240 (Shore D)	X		X	X
ASTM D-3363		X		
Chemical Resistance ASTM D-1308 (spot)		X		
ASTM C-267 (immersion)	X		X	X
Stain Resistance ASTM D-1308 (spot)		X	X	X
Flexibility ASTM D-1737		X		
Heat Resistance (dry) ASTM D-2485	X		X	X
Water Absorption ASTM D-570	X			
ASTM C-413			X	X
Skid Resistance ASTM D-2047		X	X	X
Compressive Strength ASTM D-695	X			
ASTM C-579			X	X
Tensile Strength & Tensile Elongation ASTM D-638	X			
ASTM C-307			X	X
Flexural Strength & Modulus of Elasticity ASTM D-790	X			
ASTM C-580			N/A	N/A
Impact Strength ASTM G-14		X		
Mil D-3134F			X	X
Thermal Shock Resistance ASTM C-884			X	X
Indention ASTM Mil D-3134F			X	X
Coefficient of Thermal Expansion & Contraction ASTM C-531			X	X

When choosing a concrete floor coating system based on performance data, make sure you review data based on the correct test methods for that system. Each test method is designed to determine the performance under specific conditions. It is important to compare the test methods relevant to the application in question. Do not compare the flexural strengths of mortar systems when the flexural strength of the substrate dictates the systems performance. In addition, remember that the performance of the system's components will change when they are incorporated in the final system. Look only at the specific data that relates to the specific application.