FLORIDA DEPARTMENT OF TRANSPORTATION
State Materials Office
5007 NE 39th Avenue
Gainesville, Florida 32609
July 18, 2016

Florida Method of Test for Performance Evaluation of Coated Concrete Subjected to Fungal Attack

Designation: FM 5-613

1. SCOPE

1.1. This outdoor test method evaluates the biological resistance of structural oating materials applied to concrete in a sub-tropical environment. The method is designed to evaluate long-term fungal resistance of structural coatings in an environment specific to Florida.

2. REFERENCED DOCUMENTS

2.1. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

2.2. ASTM D 3274 Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation.

2.3. ASTM C 192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.

2.4. SSPC SP – 1 Surface Preparation Standard No. 1 Solvent Cleaning

2.5. SSPC SP – 13 Surface Preparation of Concrete

3. APPLICABILITY

3.1. This test method is used for comparative analysis of the resistance of exterior coatings to fungal and mildew growth in a sub-tropical environment. This test is specifically designed to mimic conditions found in most concrete bridge substructures in Florida. These testing conditions are specific to Florida and the results will be representative of end-use predictions in this environment only.

4. APPARATUS

4.1. This test method requires a chamber capable of maintaining reproducible conditions providing enough space to place all samples to be evaluated and to limit unnecessary contact between samples.

4.2. The ambient conditions of the testing area shall be representative of the

intended service environment. Local temperature, ultraviolet exposure and humidity shall be monitored (refer to 6.10).

4.3. The environmental chamber shall be placed in a position subject to natural daylight - such that daily conditions alternate between direct and shaded UV exposure. A data logger will record ultra violet exposure at the environmental chamber.

4.4. An acrylic sheet shall be used as the chamber lid to maximize UV transmittance to the coated samples.

4.5. The floor of the environmental chamber shall consist of a healthy soil matrix, receptive to fungal and mildew growth. It shall contain a mixture of potting soil and peat moss.

4.6. The soil shall be inoculated with Aureobasidium pullulans meeting the requirements set forth in American Type Culture Collection (ATCC 9348).

4.7. All appropriate personal protective equipment and operating procedures recommended by the producer of the fungus shall be followed throughout the duration of testing.

4.8. An additional hygiene plan specific to the facility is recommended to protect laboratory personnel.

4.9. Salt (NaCl) and water shall be mixed to produce a solution that is 3.5% NaCl.

5. SAMPLE PREPARATION

5.1. Concrete samples shall be prepared according to ASTM C 192. Samples shall be moist cured 28 days, at 73.5°F (± 3.5°F) prior to being coated. Samples shall have a water/cement ratio between 0.4 and 0.5 to ensure limited voids in the concrete.

5.2. Each sample shall be at least 6” x 4” x 1/2”. Four samples shall be prepared for each coating system evaluated (refer to 5.6 and 5.7). Four additional samples shall be made and used as uncoated control samples.

5.3. Each sample shall be prepared according to specifications in SSPC SP – 13 prior to coating application.

5.4. One face of each concrete sample will be finished with a structural coating material and shall be exposed to the inoculated soil – the face parallel to the exposed face and all other sides (length and width) shall be sealed with a suitable non-reactive epoxy.

5.5. The face which will be exposed, shall have a structural coating applied and allowed to fully cure in accordance with the coating manufacturer’s recommendations before testing begins.

5.6. Each structural coating shall be evaluated in quadruplicate. Three samples shall be evaluated after atmospheric exposure. The fourth sample shall be evaluated after marine-splash, atmospheric exposure. The fourth sample shall be sprayed once a week until a sheen is visible with 3.5% NaCl solution (refer to 4.9) to simulate marine-splash conditions.

5.7. The fungus shall be allowed to colonize in the soil matrix for four weeks prior to the placement of any test samples.

5.8. After four weeks of inoculation (refer to 5.7), several kiln-dried pine boards shall be placed face down into the soil matrix to verify that optimum conditions have been met and ensure the healthy presence of fungal spores. After 4 days (±1 day) of uninterrupted contact, check the face of each pine board for the presence of the Aureobasidium pullulans spores. The presence of the fungus confirms a healthy environment and samples may be placed into the soil matrix. If no fungus is present adjust conditions to promote growth.

6. PROCEDURE

6.1. The samples are placed directly into the inoculated soil to a depth of approximately 1/8” with appropriate spacing to allow the free circulation of air between and around all samples, and to prevent contact with any wall surfaces.

6.2. The soil bed needs to be re-hydrated frequently to maintain a healthy environment for the fungus to thrive. Twice a week, the soil bed will be visibly saturated with water. The sustainability of the fungi will require a moisture content of 6-14%. Once a week, a moisture meter shall be used to take five representative measurements from the surface of the soil. The average of those measurements shall be reported as the moisture content.

6.3. The samples are placed directly into the inoculated soil to a depth of approximately 1/8” with appropriate spacing to allow the free circulation of air between and around all samples, and to prevent contact with any wall surfaces.

6.4. If no fungal growth is detected within four weeks on the uncoated controls, the cabinet conditions are not conducive and changes are necessary to encourage fungus growth.

6.5. If the unsatisfactory conditions/results continue, the test shall be aborted until the problem can be determined and rectified.

6.6. The test duration shall be 6 months (26 weeks).

6.7. The samples shall be visually evaluated for fungal growth every 4 weeks in accordance with the pictorial standards in ASTM D 3274, sections 5 & 6.

6.8. All samples shall be rinsed with deionized water to free the surface of any soil or dirt and be allowed to fully air-dry prior to visual inspection. Keep samples free from contact with bleach and 70% alcohol and avoid unnecessary UV exposure. If a sample comes in contact with bleach or 70% alcohol, make a note at the bottom of the results section. Each structural coating shall be inspected individually, under good lighting, and without the use of a visual aid. All samples removed for inspection shall be returned within 3 hours from the time of removal.

6.9. The marine-splash samples (sprayed with 3.5% NaCl solution) shall be evaluated by the same pictorial standards.

6.10. Local ambient conditions of the testing area shall be reported monthly and reported in 7.5.

6.11. Photographic documentation of all samples, for each structural coating shall be performed during the visual inspection and used as a visual comparison to the written standards. Photos should be taken with the same camera, from the same distance, angle and lighting conditions for every inspection.

7. REPORT

7.1. Fungus Tested

7.2. Coating Manufacturer & System

7.3. Time to First Visual Confirmation of Fungal Growth

7.4. Performance Rating for Each 4 Week Period

7.5. Local Ambient Conditions

7.6. Photographic Documentation