

INSTRUMENTATION

The core of Reflective Cracking Test is to generate repeatable full-scale data, capture crack initiation, and monitor the propagation. Instrumentation is therefore designed to acquire, but not be limited to, joint displacement, temperature profile, and strain responses in the overlay. Instrumentation will take place in three phases: pre-construction, during construction and post-construction. Prior to the overlay construction, 6 Potentiometers (POT) and 4 LVDTs will be connected and secured. The pre-construction installation also includes 8 embedded strain gages (EG), 4 Joint Displacement Gages (JDG), and 2 thermocouples (T) which are located at the surface of existing concrete slabs. During the overlay paving, 8 EGs will be installed at the top of the first 2.5-in lift. Once the overlay temperature has stabilized after the construction, a total of 20 surface strain gages (SG) and remaining thermocouples will be installed. A detailed instrumentation layout is given in Figure 1. Note that all strain gages are directly above and perpendicular to the concrete joint where the first reflection crack would most likely occur.

TEST RECIPE

Phase VI Test will employ a mixed test recipe. The 360-day temperature variations are approximated by a haversine load waveform describing the relationship between the joint opening and cycle time (150 sec). For the first 330 loading cycles, each cycle begins with a loading time of 75 sec, once the actuators (north and south) reaches the maximum horizontal displacement (joint opening) of 12 mil, a 75-sec unloading is executed and then followed by a rest (nonload) period of 600 sec. Then, a different recipe will be executed for the next 30 loading cycles with the same peak displacement (12 mil). Both loading and unloading time will be shortened to 35-sec and a rest period of 300 sec will be included to allow the overlay to relax.

TEST PROCEDURE (SEE DETAILS IN SOP)

The Reflective Cracking Standard Operating Procedure (SOP) was utilized to develop the following test procedure, which will be carried out by CSRA Civil Engineers Type 2, Subcontractor Civil Engineers Type 3, and Instrumentation Engineer.

- a. GENERAL. Data collection frequency should be set at 1 Hz. The overlay bottom temperature should be maintained within $\pm 1^{\circ}\text{F}$ from the target 32°F . The Reflective Cracking Rig interlocks must be set correctly and active at all times.
- b. PRE-CONSTRUCTION SHAKE-DOWN. Prior to the setup of the form work, run 100 cycles of the test recipe with a maximum horizontal displacement of 100 mils to ensure the performance of the Reflective Cracking Rig. The operator shall check all that all test parameters, machine readings, interlocks, and rig response are correct.
- c. POST-CONSTRUCTION SHAKE-DOWN. Upon the completion of post-construction instrumentation, all sensors should be calibrated and tested. Because the dependency of the HMA's relaxation on the temperature, the length of rest period shall be estimated during the shake-down with a smaller joint opening for not impart damage in the overlay. Next, run 100 cycles of the test recipe with a maximum horizontal displacement of 5 mils to confirm sensor responses.

- d. FORMAL TEST. Run the test recipe(s) until a complete separation of the overlay above the joint.
- e. POST-TEST FORENSICS. Conduct examinations of the failed overlay, including documenting and photographing the failures, retrieving and preserving HMA samples. All HMA samples shall be neatly cut from the sampling area west to the RC Rig with a diamond core drill bit. The minimum diameter of the sample shall be 6 inches. Samples that are clearly defective, as a result of sampling, shall be discarded and another sample taken. If any of the cores reveal that the bottom of individual lift is not fully bonded to the layer immediately below then additional cores shall be taken to determine the extent of any delamination. Core holes shall be properly back-filled where necessary. HMA cores retrieved from the sampling area should be labeled and stored in the designated area in the FAA Materials Laboratory.

MONITORING

- a. TEST DATA. During the shake-down and formal test, strain gage, displacement sensor, and thermocouple readings will be collected through the DAQ and utilized directly to monitor responses indicating crack initiation and propagation. An attempt shall be made to repair or replace any malfunction sensors.
- b. PAVEMENT EVALUATION. Visual inspection of the test pavement should be conducted at least twice a day, once in the morning and once in the afternoon. As needed, the inspection will be augmented with wire brushes, chalk markings, flashlights and other tools to ascertain the presence and pattern of very fine cracks. Once visible cracks/damage are located, detailed measurements and photos shall be taken.

DATA STORAGE

- a. Instrumentation Data: [\\IOMEGASTORAGE\Daily\TestDate\Reflective Cracking](#)
- b. Daily Notes (loading cycles, pavement deterioration, and any hardware and software issues): [\\IOMEGASTORAGE\Daily\TestDate](#)