Development of Pedestal-Set Slab Load Criteria

Recipient: Concrete Masonry and Hardscapes Association
Grant: $61,180
Completion: 2023
Project Summary: 26

icpi
Foundation for
Education and Research

Background and Need

In 2020, The lab at (NCMA) National Concrete Masonry Association was retained by the ICPI Foundation for Education & Research to develop testing protocol and performance criteria for pedestal-set concrete paving slabs and to investigate alternative support and loading conditions to simulate those seen in the field. Pedestal-set concrete paving slabs have become a popular decking system for pedestrian plaza and rooftop applications as facility owners look to expand usable space and create functional outdoor places. While testing protocols currently exist in ASTM C140/C140M, *Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units* for evaluating the flexural strength of concrete paving slabs, these established protocols test slabs under conditions that do not replicate the in-situ loading and support conditions of pedestal-set slabs.

Objectives

ASTM C140/C140M Test Procedures for Segmental Concrete Paving Slabs was originally developed with the assumption that concrete paving slabs would meet the requirements of ASTM C1782/C1782M, Standard *Specification for Segmental Concrete Paving Slabs*, and predominately be installed over a base that provides continuous support similar to conventional pavements. Using the ASTM C140/C140M testing protocols, the modulus of rupture of a paving slab was determined by applying a line load to the mid-span of a simply-supported slab.

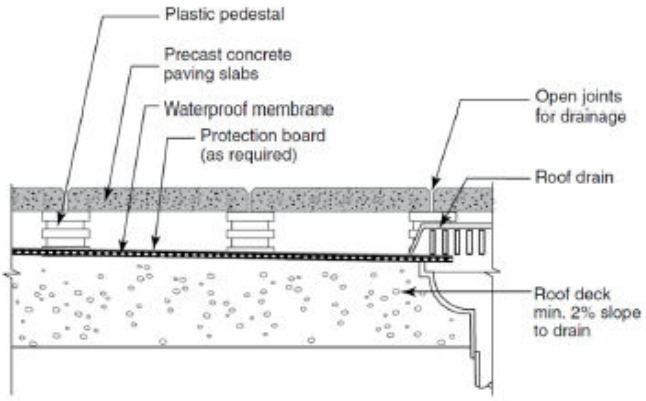

Figure 1: Pedestal-Set Concrete Paving Slabs

Figure 2: Corner Supported, Center Point Loading Testing Conditions

To better replicate the support, loading conditions and potential failure mechanisms of pedestal-set paving slabs illustrated in Figure 1, this investigation explored alternative testing protocols using ASTM C140/C140M Annex A8, as a baseline with the following modifications:

1. The wood and rubber loading strip was replaced with a nominal 2 in. (50 mm) diameter vulcanized rubber loading pad positioned at the center of the slab. The concentrated load at the center of the slab would represent a more conservative loading scenario.
2. The steel support rollers on opposite edges of the slab were replaced with vulcanized rubber pads placed at each corner of the slab to simulate pedestal supports.

While the testing configuration shown in Figure 2 mimics the support and potential loading conditions a paving slab may see in service, this test setup would present challenges to most testing laboratories that may not have the space or equipment necessary to test full-size slab specimens. As such, a secondary objective to this investigation was to determine if a correlation could be established between the strength of full-size slabs and the strength of slabs reduced in size to facilitate routine quality control testing. Additionally, testing smaller specimens was conducted to enable laboratories with smaller test equipment to perform the tests. Finally, a tertiary objective of this research project was to compare the flexural strengths measured through the corner-supported specimens of this study to the flexural strengths that would be obtained through conventional flexural testing in accordance with ASTM C140/C140M. This last goal is intended to provide a degree of benchmarking between previously established and vetted testing procedures and those used as part of this research investigation.

Outcomes

The following modifications developed during this investigation to testing protocols in Annex A8 of ASTM C140/C140M have been proposed.

Minimum slab strength for pedestal-set slabs under concentrated loads,

- *At the time of delivery to the job site, the average concentrated failing load of the test specimens shall be a minimum of 2,000 lb [8,900 N] with no individual unit less than 1,800 lb [8,000 N] when tested using the protocols as outlined in Appendix E of the final report.*
- *If the specimens are tested as reduced-size specimens the average concentrated failing load shall be a minimum of 2,700 lb [12,000 N] with no individual unit less than 2,450 lb [10,900 N].*

Given that these testing protocols only accommodate slab sizes up to 24 in. (610 mm), a prescriptive limit on the spacing of support pedestals of 24 in. (610 mm) should also be considered. These constraints should not be construed to preclude unique slab geometries or support configurations, but acknowledge that such conditions would require additional design analysis.

The final report is available online.