

# JOINT TRANSPORTATION RESEARCH PROGRAM

**Principal Investigators:** W. Jason Weiss, Oregon State University, [jason.weiss@oregonstate.edu](mailto:jason.weiss@oregonstate.edu), 541.737.1885

Jan Olek, Purdue University, [olek@purdue.edu](mailto:olek@purdue.edu), 765.494.5015

Pablo Zavattieri, Purdue University, [zavattie@purdue.edu](mailto:zavattie@purdue.edu), 765.496.9644

**Program Office:** [jtrp@purdue.edu](mailto:jtrp@purdue.edu), 765.494.6508, [www.purdue.edu/jtrp](http://www.purdue.edu/jtrp)

**Sponsor:** Indiana Department of Transportation, 765.463.1521

SPR-3905

2019

## Concrete Patching Materials and Techniques and Guidelines for Hot Weather Concreting

### Introduction

High early strength (HES) concrete is increasingly being used to repair damaged concrete pavement sections. Its use enables repaired pavement to be opened within hours of placing the concrete, reducing both delays for the traveling public and exposure to traffic for construction personnel. However, the use of HES concrete also presents challenges due to strict requirements for opening strength and severe penalties for not achieving the target strength. This project examined failure to obtain long-term strength in long patches in concrete pavements.

### Findings

When the temperature of HES concrete patches is expected to be elevated and accelerating admixtures are used, the balance of sulfates need to be considered. While the experiments showed that additional sulfate can improve the effectiveness of accelerating admixture, this is likely not practical for field use. Rather, experiments to determine whether the sulfate balance is attained at high temperatures with admixtures may be useful for suppliers.

Since these mixtures are mixed at a low water-to-cement ratio, they are prone to self-desiccation that leads to shrinkage and causes hydration and strength development to cease. Internal curing can be used to supply additional curing water to HES mixtures, thus improving durability, hydration, and strength development (i.e., mechanical properties). Modified maturity methods that account for self-desiccation can be used to increase the accuracy of target strength predications. This would

consist of adding a term to standard current practices to account for self-desiccation.

### Implementation

This project examined why INDOT patching mixtures were not obtaining the strength predicted by standard testing methods. It was determined that the use of admixtures at a high temperature resulted in challenges with the balance of sulfates that interfered with the hydration process. These findings were presented to the study advisory committee, at Purdue Road School, and at the annual meeting of the American Concrete Paving Association. Furthermore, self-desiccation limits strength development, and this research report outlines a procedure that incorporates a term to be added to the maturity method to account for how strength development can be limited by self-desiccation.

### Recommended Citation for Report

Weiss, J., Zavattieri, P., Olek, J., Wilson, C., Esmaeeli, H. S., & Todd, N. (2019). *Concrete patching materials and techniques and guidelines for hot weather concreting* (Joint Transportation Research Program Publication No. FHWA/IN/JTRP-2019/11). West Lafayette, IN: Purdue University. <https://doi.org/10.5703/1288284316921>

View the full text of this technical report here: <https://doi.org/10.5703/1288284316921>

Published reports of the Joint Transportation Research Program are available at <http://docs.lib.purdue.edu/jtrp/>.

