

AN ABSTRACT OF A THESIS

EVALUATION OF NEW PCC MATURITY TECHNOLOGY

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The combined effect of time and temperature on the curing progress of Portland Cement Concrete has long been a subject of research. The earliest documented research dates back to the beginning of the twentieth century, but the term "maturity" was not used until the middle of the century. The objective of this study was to evaluate the ability of a new maturity technology to predict compressive strength development in Tennessee rigid pavements. The information contained within this document will assist the Tennessee Department of Transportation in making a decision on whether or not to allow this new technology to be used in lieu of cylinder compressive strength results for opening new PCC pavements to traffic.

Two field investigations were conducted to determine the accuracy of the maturity compressive strength predictions. Most states agree that maturity-based predictions of compressive strength are within ten percent of the observed. The I-65 study revealed that average maturity predictions were within ten percent of the measured strength of field-cured cylinders and pavement cores. However, the average predictions for the I-75 study exceeded ten percent; the average maturity predictions were within twelve and one-half percent of the actual measured strength of field-cured cylinders and pavement cores.

Along with the field investigations, a laboratory experiment was performed to validate the maturity concept. At or greater than 2400°C·Hrs, it was determined that cylinders with the same maturity indices, but cured at three distinctly different temperatures, maintain equivalent compressive strength development.

The new technology is capable of providing more relevant information on concrete curing progress than lab-cured cylinders. The information can be provided more frequently and more conveniently compared to lab- or field-cured cylinders. Lab-cured cylinders represent potential compressive strength at standard curing temperature, not the compressive strength of the structure that has experienced different curing conditions. Furthermore, the new technology appears to be robust and reliable enough for field use by the Tennessee Department of Transportation (the reliability is contingent on correlation with appropriate mixtures), and its use along with the Implementation Protocol provided herein is recommended on projects containing thirty or more batches of concrete of the same mixture design.