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Implementation of Maturity for Concrete Strength Measurement and Pay

INTRODUCTION

Using the maturity to determine concrete strength has been done for more than four decades. The concept was originally conceived in the late 1940s and early 1950s. More and more state and municipal DOTs are implementing its use every year, with some having used this technology as early as the mid-1980s. There are many proven benefits for the use of this method, as it is a relatively simple and reliable approach for estimating in place strength.

This project piloted the use of the maturity method on current construction projects in Louisiana and reviewed literature and specification from other departments around the country.

OBJECTIVE

The objective of this implementation project was to pilot the maturity concept on ongoing structural and paving projects. Maturity curves were developed using rapid patching material or high early strength concrete in a laboratory setting, as well as structural class concrete in the field. The project has provided assistance to districts and proof of the maturity concept to the Department.

SCOPE

To meet the objectives of this project, a review of the state-of-the-practice and state specifications was completed. Two maturity curves were developed for paving projects and one maturity curve was developed for a structural project. Of these projects, one pavement rehabilitation project and one structural project were instrumented with maturity loggers. Recommended procedures for quality control and acceptance have been established.

METHODOLOGY

Strength maturity relationships were established per ASTM C1074. Since this project used the same temperature datum to establish the strength-maturity relationship as it did to determine the approximate strength of in place concrete, all tests used a temperature datum of 0°C. Pavement opening and form removal times will remain the same regardless of what datum

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Figure 1
intelliRock II reader and logger

temperature is used, as long as it is held constant. Cylinders produced to determine the maturity relationships were produced from ready mix trucks, both on site and at the batching plant.

This project utilized intelliRock II maturity readers that LTRC loaned to the districts for the duration of the projects, shown in Figure 1. These readers offered reliable operation for quick and easy maturity readings. They are also able to store project data from numerous loggers, which could later be offloaded onto a computer. There are several different loggers available depending of the needs of the project. Two types of loggers were utilized for this project, one which logged maturity readings every hour for 28 days and one that logged every minute for 24 hours. Faster data reading times were needed for the high early strength mixture used in pavement rehabilitation.

CONCLUSIONS & RECOMMENDATIONS

The results of this project warrant the following conclusions. The piloted projects show that the maturity method for strength estimation is a very useful tool for the Department. The findings are in line with what has been shown in many other studies, in many other states. The maturity method, when implemented properly, can be very accurate and efficient. Personnel time and construction time can be saved with this method, while also reducing the susceptibility to error. It gives the best representation of in-place concrete strength while also being a non-destructive test.

The maturity strength relationship is easy to establish, but must be completed ahead of time, illustrating that planning and communication are keys to proper implementation. District and contractor personnel need to be trained on proper use of the maturity method, noting that any changes in the PCC mixture need to be communicated.

The authors recommend incorporating the maturity method for strength estimation into the standards and specifications for Department use. ASTM C1074 should be used when creating the strength-maturity relationship and specifications should be developed for the use of maturity loggers on Department projects. The Department may find the best benefit from the maturity method when using high early PCC mixtures and on mass concrete pours. It provides an accurate estimation of the in-place strength, which a normally cast and cured cylinder cannot do, in most instances.