

2019 UDOT RESEARCH PROBLEM STATEMENT

*** Problem statement deadline is Feb. 6, 2019. Submit statements to UTRAC@utah.gov. ***

Title: Maturity measurements in rapid setting concretes

No. (Office Use): 19.01.04

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Select **ONE** Subject Area Materials/Pavements Maintenance Traffic Mgmt/Safety Structures/Geotech
 Planning Perf Mgmt/Data Analytics Public Transportation Other

1. Describe the problem to be addressed:

Concrete maturity is a technique in widespread use to estimate concrete strength without the need of breaking representative cylinders. Rapid set and accelerated cure concretes are becoming more common as UDOT attempts to minimize concrete repair impact upon the public. However, control of rapid set concrete testing suffers from the rapid setting nature limiting the usefulness of cylinder testing and increasing costs as well as making proper curing of sampled cylinders more important. UDOT has recently added maturity testing to the 3058 (Rapid Setting Hydraulic Cement Concrete) specification to take advantage of this technology, limiting the need for cylinder testing and streamlining construction. However ASTM C1074 (Estimating Concrete Strength by the Maturity Method) makes no mention of many materials that are now used for rapid concretes (Calcium Sulfo-Aluminate Cement, Magnesium Phosphate etc.) and was developed for ordinary portland cement mixtures.

Recent research as USU has shown differences in heat development and strength development for rapid setting concrete mixtures compared to ordinary portland cement mixtures indicating long term strength may not be predictable but does suggest it is possible to accurately predict short term strength using the maturity method. It is well known that for ordinary Portland cement concrete, the maturity method may only be accurate up to an equivalent age of 7 days. For rapid set concretes, it may make sense that this timeline will also be shortened, but it is not known how much. Additionally, the use of external heating, often used in precast applications, and its effect on the maturity measurement of the concrete is not well known. The effect of variable heat curing regimes, intentional or unintentional on an accelerated concrete mixture and the maturity curve is also not understood.

2. Write the project objective (25 words or less):

Develop guidelines for use of maturity method for predicting short and long term strength for rapid setting and accelerated curing concrete mixtures.

3. Explain why this research is important:

(In response, consider addressing specific UDOT goals, applicability in Utah or other states, etc.)

Understanding the differences in curing for accelerated and rapid set concretes will further allow UDOT and UDOT contractors to be comfortable expanding the use of the maturity method which would save considerable time and cost on many UDOT project.

4. List the major tasks:

1. Review of existing literature, AASHTO and UDOT specifications

2. Experimental work

- a. Laboratory mixtures: A set of lab mixtures (proprietary and non-proprietary rapid set, and ordinary portland cement) under varying conditions (normal, inconsistent curing, and accelerated curing)
- b. Field behavior of out where concrete strengths will be estimated using maturity, compressive cylinders and compressive cores (where possible) are taken on-site.
 - i. Rapid setting repairs
 - ii. Precast concrete

3. Analyze data

4. Preparation of final report.

