

Executive Summary, Research Readiness Level Assessment, and Technology Transfer

Influence of Curing Conditions on Concrete Specimens (Cylinders) in Hot and Cold Weather in the Field

Research Objectives

Concrete properties vary considerably depending upon the temperature subject to early time of hydration. This study presents the different curing methods the DOT currently uses in the winter and summer time.

Conclusion

The curing conditions of cylinders was found to have a significant effect on the compressive strength of the cylinders used for acceptance. Therefore, care must be taken in the curing and protecting concrete cylinders to minimize the effect of cold and high ambient temperatures.



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Background

Concrete properties vary depending upon the temperature and humidity that they are subjected to in the first few hours of curing. The ASTM standard that dictates the procedures for making and curing test cylinders, ASTM C31, *Practice for Making and Curing Concrete Test Specimens in the Field* ^[1], requires that standard cured cylinders for concrete acceptance should undergo initial curing between 60°F and 80°F in the first 48 hours after which they should be transferred to a moist cure room or water tank. However, in the field this may not always be practiced.

Standard Curing Cylinders per ASTM C31: This condition involves subjecting the specimens to standard temperature and humidity conditions and the strength results are primarily used for concrete acceptance and quality control.

Field Curing Cylinders per ASTM C31: This condition involves subjecting the specimens to the temperature and humidity that the actual structure experiences and the strength results are primarily used for determining whether a structure is capable of being put in service and scheduling form work removal.

NDOT Recommendations Based On Completed Research

Adequate protection of cylinders during the first 48 hours after casting is essential to stay within specifications requirements; therefore, based on this study the Department will recommended, the following:

- **Cold Weather Conditions:** The use of curing box should be used on a project during cold weather conditions. Other necessary steps may include using a frost blanket and creating heat during initial set with hand warmers.
- **Hot Weather Conditions:** Water should be used in the coolers when ambient temperatures are above 80°F for several days in a row. The water should cover a minimum of 75% of the concrete cylinder.

M&R's recommendation for ambient temperatures that are above 80°F for several days in a row, water should be used to cure the concrete cylinders in the field. The water should cover a minimum of 75% of the concrete cylinders. When the temperatures start dropping below 80°F for several days, then revert back to standard curing.

- As provided by Wally Heyen, Lead TAC Member

Interested in finding out more?

Final report is available at:

[NDOT Research Website](#)

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Research Readiness Level (RRL) Assessment

Level 5: Standard Practice

Research/Technology fully implemented and understood. No follow-up is necessary.

RRL 5

Technology Transfer

- Presentation to Nebraska and Concrete and Aggregates Association (NC&AA) Annual Meeting -2020
- Presentation to NDOT Project Managers - 2020

This brief summarizes the In-house Research project: “Influence of Curing Conditions on Concrete Specimens (Cylinders) in Hot and Cold Weather in the Field.”

Nebraska Department of Transportation Research Program