

Extending the Delivery Time of Concrete Mixtures

The Minnesota Department of Transportation has plans to reconstruct several small bridge projects throughout the state. While MnDOT restricts the transport time of air-entrained concrete mixtures to 60 minutes, several of these proposed structures, located in less accessible rural areas, are difficult to reach within the imposed time limit. Other states allow up to 90 minutes to distribute similar concrete mixtures, and limiting transport times could unnecessarily increase the construction costs of these bridges.

Research Goals

Prompted by the Minnesota concrete industry, a new study evaluates the effects of longer hauling times on concrete performance. More specifically, this project evaluates how air-entrained concrete mixtures (often used in the Midwest) react when their transit time is increased to 90 minutes or longer. Differences in mix designs and materials as well as various environments in which the concrete must perform are also considered.

This project evaluates the influence of concrete delivery time by measuring material properties from laboratory-batched concrete with different materials and admixtures. Materials and admixture from ready mix plants in each region of the state were also evaluated to account for any regional issues.

Results

Research verifies that extending the delivery time of air-entrained concrete to 120 minutes has no effect on compressive strength or freeze-thaw durability. According to test results, there are no performance-related issues directly related to the use of retarding and water reducer admixtures (beyond the loss of slump and air content).

Statistical evaluations showed the following when extending transit time from 60 to 120 minutes:

- There was no significant effect on concrete compressive strength
- There was not a significant effect on freeze-thaw durability
- There is a drop in plastic and hardened air content, from 1.3 and 1.2 percent, respectively.
- There is a significant loss of slump with an average loss of 1.7 inches.

Recommendations

Researchers recommend updating MnDOT specifications to allow a longer delivery time (up to two hours). This adjusted specification, however, must offset expected losses in plastic air content and slump.

The full report can be accessed here: <http://www.lrrb.org/pdf/201126.pdf>

