

## ABSTRACT

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In recent years, there have been a number of truck fires involving bridges with concrete components. If the fire burns for a significant period of time, the structural integrity of the concrete components will be damaged due to fire. A guidance to assist bridge inspectors in determining the level of fire damage is currently unavailable and would be very beneficial.

This project focused on evaluating the effects of fire induced damage on the structural performance of concrete bridge deck elements. In order to achieve this goal, a series of heating experiments and material analysis were conducted. During heating experiments, two concrete bridge deck specimens from I-469 over Feighner Road were heated to various time durations to measure the temperature profiles through the depth of deck specimens. After heating experiments, heated concrete samples were taken from the deck specimens for material analysis. Various types of material analytical tests were then conducted, using heated concrete samples, to correlate the microstructure degradation with the through-depth temperature profiles of deck specimens.

From the experimental results, several critical parameters that can be affected by fire temperature and duration were discussed: through-depth temperature profiles, cracks on the exposed surface, color changes through depth, microstructure degradation through depth, and content of calcium hydroxide at various depths. Based on the results from heating experiments and observations from material analysis, recommendations and guidance for evaluating concrete structures subjected to realistic fire scenarios were provided to assist bridge inspectors.