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Effect of Fire Exposure on Mechanical Properties of Normal Strength Concrete: An Overview

A.Omar*[a], *B.H. Abu Bakar*[b], *Khairunisa Muthusamy*[a] *and* ***Mohammad I. AL Biajawi*[a]**

[a]Faculty of Civil Engineering Technology, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Pahang, Malaysia

[b]School of Civil Engineering, Engineering Campus, Universiti Sains Malaysia, Pulau Pinang 14300, Malaysia

**Corresponding author*: khairunisa@ump.edu.my

Abstract

Concrete is widely utilized as a construction material owing to its desirable mechanical properties, which include high compressive strength, durability, hardness, workability, and fire resistance. In addition, concrete is often utilized as a structural element in buildings where fire resistance is one of the main design concerns. Nevertheless, the prolonged vulnerability of concrete to fire resulted in the deterioration of its mechanical properties. This represents a significant vulnerability for concrete structures. Therefore, researchers need to pay more attention to the issue. In addition, the thermal and mechanical properties of concrete affect fire behavior of concrete. These characteristics fluctuate substantially with temperature and rely on the constitution and properties of the concrete mixture, as well as the temperature range and further external factors. The aim of this paper is to lay out an overview of the impact of fire exposure on the mechanical properties of concrete and to identify specific areas that could be investigated by further researchers. A review of the data revealed that the mechanical properties of normal concrete go through three main phases. Strength increases slightly in the first phase (20°C-300°C), decreases sharply in the second phase (300°C-800°C), and is lost in the third phase (above 800°C). In addition, the type of aggregate, moisture content, concrete grade, heating rate, heating duration, and additives were found to strongly influence the fire resistance of concrete. Optimal use of admixtures improves the fire behavior of concrete through pozzolanic reaction.

Keywords: Fire Damage concrete; Mechanical properties; Porosity; High temperature; Elevated temperature.