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LONG-TERM EFFECT OF DIFFERENT PARTICLE SIZE DISTRIBUTIONS OF WASTE GLASS POWDER ON THE MECHANICAL PROPERTIES OF CONCRETE

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Abstract
In this paper, a comprehensive experimental investigation was conducted into the effect of the particle size distributions (PSDs) and percentages of waste powdered glass as a partial replacement of cement on the long-term mechanical behavior of concrete produced at two different cement levels. For this purpose, two different mixtures of concrete were used as reference mixtures; the first has a relatively low cement content (331 kg/m^3), and the second has a relatively high cement content (490 kg/m^3). Two different PSDs of glass powder (GP) labeled GP-A and GP-B ((55 µm < GP-A < 135 µm) and (55 µm > GP-B) were used, and the considered GP content for the low cement content mixture (LCCM) and the high cement content mixture (HCCM) were (0%, 5%, and 10%) and (0%, 5%, 10%, and 15%) by weight of cement, respectively. The mechanical performance of all concrete mixtures at 180 days was investigated and evaluated in related tests as compressive strength and toughness, splitting and flexural tensile strength, elastic modulus, and compressive stress-strain behavior. The experimental results generally indicated that the compressive strength of GP-modified concrete improved significantly over the long-term age (180-days) compared to the early age (28-days). The contribution of PSDs of GP to enhancing the mechanical properties of concrete is insignificant compared to its replacement amount. Finally, independent of the PSDs, the incorporation of 10% GP for LCCM and 15% of GP for HCCM has a positive effect on the long-term mechanical properties of concrete, indicating that GP can be used as a replacement for cement.

Keywords: **Long-term mechanical properties; Particle size; Stress-strain curves; Supplementary cementitious material; Waste glass powder.**