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Correlation Between Mechanical and Thermal Properties of Lightweight Concrete Made from Expanded Glass

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EXTENDED ABSTRACT

Lightweight concrete has become a popular construction material because of several advantages it holds over conventional concrete. Lightweight concrete is characterized by good compressive strength, durability and the most important advantages – low density and improved properties of thermal conductivity.

The aim of the study is to identify a correlation between mechanical and thermal properties of the lightweight concrete made from expanded glass aggregates. Six different concrete mixes with different amount of expanded glass granules and quartz sand were produced. Properties of fresh concrete like density and flow table test were tested. Flexural and compressive strength as well as density, water absorption and porosity were determined for 28 days old lightweight concrete samples. Thermal conductivity of lightweight concrete was determined and correlation between thermal and mechanical properties was identified.

Producers of lightweight expanded glass granules indicate the compressive strength from 0.45 −0.55MPa. By incorporating such material in cement matrix concrete compression strength could be limited due to the expanded glass granule compressive strength. Lightweight aggregate outer shell thickness, macroporosity and broken grains percentage all affect the aggregate strength (Y.Ke *et al.* 2009).

The materials used in this study were commercially available raw materials, cementitious materials and admixtures. Physical and mechanical properties of the expanded glass granules were determined.

The identified lightweight concrete properties were affected by quantity of expanded glass granule and sand content in mixture design. The compressive strength of lightweight concrete with expanded glass granules and sand could vary from 3.2 to 5.8MPa. Thermal conductivity decreases with the increasing amount of expanded glass granules (from 0.163 to 0.140 W/(m·K)) and increases with sand incorporation in lightweight concrete mixture (from 0.138 to 0.177 W/(m·K)).

Keywords: Expanded glass granules, Lightweight concrete, Mechanical and thermal properties.

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REFERENCES

Jasaitiene, J., Ivanauskas, E., Dauksys, M. 2010. Investigation of Lightweight Concrete with Porous Aggregates. In: Preceeding of the 2nd International Conference Advanced Construction, Lithuania, 2010.

Jennings, H., Thomas, J. J. 2009. Materials of cement science primer. A final report submitted to the Infrastructure Technology Institute for TEA-21 funded projects designated A474 Northwestern University, Evanston.

Ke, Y., Beaucor, A.L., Ortola, S., Dumontet, H., Cabrillac, R. 2009. Influence of volume fraction and characteristics of lightweight aggregates on the mechanical properties of concrete. In: Construction and Building Materials 23. P.2821-2828.

Kralj, D. 2009. Experimental study of recycling lightweight concrete with aggregates containing expanded glass. In: Process Safety and Environmental Protection 87, P.267-273.

Nemes, R. 2006. Lightweight concrete made with expanded glass aggregate. Budapest University of Technology and Economics, Budapest.

Tommy Y.Lo, Tang, W.C., Cui, H.Z. 2007. The effects of aggregate properties on lightweight concrete. In: Building and Environment 42.

US Patent 7695560. Strong, lower density composite concrete building material with foam glass aggregate. 2011.