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Hasan Şahan Arel

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Hasan Şahan AREL

Faculty of Architecture, İzmir University, Gürsel Aksel Bulvarı, No:14, 35350, Üçkuyular /

İzmir / Turkey

sahanarel@gmail.com

ABSTRACT

This review reports on the replacement of cement with waste marble and the use of waste marble as aggregate in concrete production. On the basis of the reviewed studies, it was observed that as the amount of marble powder used in place of fine aggregate increases, its workability decreases; however, this powder contributes to the compressive strength of concrete because of CaCO_3 and SiO_2 present in the chemical structure of marble, while marble pieces used in place of coarse aggregate contribute to the workability and mechanical properties of concrete. When natural standard sand is replaced with marble dust at a ratio of 15–75%, the compressive strength increases by 20–26% while the splitting tensile strength increases by 10–15%. However, coarse marble aggregates achieved the best results at a 100% replacement ratio. Moreover, waste marble in coarse aggregate form improves the mechanical properties over the dust form. Marble powder that is replaced with cement in quantities of 20% or more was determined to have adverse effects on the compressive strength and workability of concrete. Besides affecting the mechanical properties of concrete, marble dust at a cement-replacement ratio of 5–10% not only decreases the global annual CO_2 emissions by 12% but also lowers the costs from US\$40/m³ to US\$33/m³. Based on the reviewed studies, mathematical equations quantifying the replacement of cement with marble dust and the use of dust aggregates are derived in this paper.

Keywords: Marble, aggregate, CO_2 emission, cement production, mechanical properties, concrete

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