

## Re-Use of Waste Marble in Producing Green Concrete

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**Abstract :** In this study, literature related to the replacement of cement with waste marble and the use of waste marble as an aggregate in concrete production was examined. Workability of the concrete decreased when marble powder was used as a substitute for fine aggregate. Marble powder contributed to the compressive strength of concrete because of the  $\text{CaCO}_3$  and  $\text{SiO}_2$  present in the chemical structure of the marble. Additionally, the use of marble pieces in place of coarse aggregate revealed that this contributed to the workability and mechanical properties of the concrete. When natural standard sand was replaced with marble dust at a ratio of 15% and 75%, the compressive strength and splitting tensile strength of the concrete increased by 20%-26% and 10%-15%, respectively. However, coarse marble aggregates exhibited the best performance at a 100% replacement ratio. Additionally, there was a greater improvement in the mechanical properties of concrete when waste marble was used in a coarse aggregate form when compared to that of when marble was used in a dust form. If the cement was replaced with marble powder in proportions of 20% or more, then adverse effects were observed on the compressive strength and workability of the concrete. This study indicated that marble dust at a cement-replacement ratio of 5%-10% affected the mechanical properties of concrete by decreasing the global annual  $\text{CO}_2$  emissions by 12% and also lowering the costs from US\$40/m<sup>3</sup> to US\$33/m<sup>3</sup>.

**Keywords :** cement production, concrete, CO<sub>2</sub> emission, marble, mechanical properties

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