

## The Effects of SCMs on the Mechanical Properties and Durability of Fibre Cement Plates

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**Abstract :** Fibre cement plates, often used in construction, generally are made using quartz as an inert material, cement as a binder and cellulose as a fibre. This paper first of all investigates the mechanical properties and durability of fibre cement plates when quartz is both partly and fully replaced with diatomite. Diatomite does not only have lower density compared to quartz but also has high pozzolanic activity. The main objective of this paper is the investigation of the effects of supplementary cementing materials (SCMs) on the short and long term mechanical properties and durability characteristics of fibre cement plates prepared using diatomite. Supplementary cementing materials such as ground granulated blast furnace slag (GGBS) and fly ash (FA) are used in this study. 10, 20, 30 and 40% of GGBS and FA are used as partial replacement materials to cement. Short and long term mechanical properties such as compressive and flexural strengths as well as capillary absorption, sorptivity characteristics and mass were investigated. Consistency and setting time at each replacement levels of SCMs were also recorded. The effects of using supplementary cementing materials on the carbonation and sulphate resistance of fibre cement plates were then experimented. The results, first of all, show that the use of diatomite as a full or partial replacement to quartz resulted in a systematic decrease in total mass of the fibre cement plates. The reduction of mass was largely due to the lower density and finer particle size of diatomite compared to quartz. The use of diatomite did not only reduce the mass of these plates but also increased the compressive strength significantly as a result of its high pozzolanic activity. The replacement levels of both GGBS and FA resulted in a systematic decrease in short term compressive strength with increasing replacement levels. This was essentially expected as the total heat of hydration is much lower in GGBS and FA than that of cement. Long term results however, indicated that the compressive strength of fibre cement plates prepared using both GGBS and FA increases with time and hence the compressive strength of plates prepared using SCMs is either equivalent or more than the compressive strength of plates prepared using cement alone. Durability characteristics of fibre cement plates prepared using SCMs were enhanced significantly. Measurements of capillary absorption and sorptivity characteristics were also indicated that the plates prepared using SCMs has much lower permeability compared to plates prepared cement alone. Much higher resistance to carbonation and sulphate attack were observed with plates prepared using SCMs. The results presented in this paper show that the use of SCMs does not only support the production of more sustainable construction materials but also enhances the mechanical properties and durability characteristics of fibre cement plates.

**Keywords :** diatomite, fibre, strength, supplementary cementing material

**Conference Title :** ICCCE 2015 : International Conference on Civil and Construction Engineering

**Conference Location :** London, United Kingdom

**Conference Dates :** August 20-21, 2015