

Information Paper

Durability of alkali-activated binder concretes

Early age performance data

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Alkali-activated (AA) binders use less energy and emit less carbon dioxide in their production than conventional Portland cements (PC)^[1] and can also offer durability benefits. Initial indications from BRE research work under laboratory conditions are that AA binder concretes can produce durable concrete with physical properties that are comparable to or better than those of equivalent PC concrete. This Information Paper presents some initial results (to two years of exposure) of a programme of long-term durability tests conducted under recent BRE-led research programmes. The paper will be of interest to specifiers of concrete products, concrete product producers and those with an interest in the materials performance of concrete.

A brief introduction to alkali-activated binder concretes

Alkali-activated (AA) binder concretes use a single mineral binder or blend of binder sources (comprising mainly aluminosilicate) instead of conventional hydraulic cements (such as Portland cement, PC); this solid binder is 'chemically activated' by adding a high-pH activator solution (generally sodium silicate). The highly alkaline environment in the solution breaks down the silicon-oxygen (Si-O) chemical bonds within the glassy component of the binder. These constituents then become available to react with the alkali in the liquid to produce a form of 'inorganic polymer', which comprises silicate-aluminate chains or other molecular networks. The concrete mixture, which also includes conventional construction aggregates, sets and hardens over a period of time roughly equivalent to conventional concrete mixes; the liquid activator is consumed during the chemical reaction.

This BRE Information Paper describes the initial results of a programme of work to assess the strength development and durability of AA binder concretes based on pulverised fuel ash (pfa; also known as 'fly ash') and other binders over exposure



Figure 1: Alkali-activated binder concrete in industrial pumping trial to place piling concrete for aggressive ground conditions



Figure 2: Fresh alkali-activated binder concrete