

# Mechanical properties of fly ash based geopolymer concrete with addition of GGBS

Discussion by Vijaya Rangan

Replies by V. Bhikshma and T. Naveen Kumar

## READER'S QUERY

I read with interest the feature titled 'Point of View: Mechanical properties of fly ash based geopolymer concrete with addition of GGBS', authored by V. Bhikshma and T. Naveen Kumar, published in The Indian Concrete Journal (September 2016, Vol. 90, No. 9, pp. 64-68).

The paper presents some interesting results on geopolymer concrete. The percentage of GGBS used in the mixtures varies from 9 to 43 percent (Table 2). Incorporation of some amount of calcium-rich GGBS assists the curing of geopolymers at room temperature. I consider that Mixtures M20 and M30 are acceptable as the calcium in the mixture will have minimal interference with the geopolymer process.

When the content of GGBS exceeds 20 percent the compressive and tensile strengths may increase (Tables 3 and 4). However, the calcium content in the mixture will affect the geopolymer process and the benefits of geopolymers with regard to long-term behavior and resistance against acid or sulphate attack significantly diminish. Mixtures M40, M50, M60 (Table 2) belong to this category and may not be considered as geopolymers.

The authors should include the slump values measured in Table 3.

*Best wishes*

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## AUTHOR'S REPLY

This has references to the readers comments. Prerequisite requirement for hardening mechanism of alkali activated fly ash Geo-Polymer concrete is temperature curing. It is already established that for high strength required higher temperature curing. Therefore with no option, temperature curing has become inevitable for fly ash based Geo-Polymer concrete.

Under practical considerations temperature curing is main hindrance. Hence, GGBS was considered to avoid temperature curing and to achieve required strength of Geo-Polymer concrete with variable percentage of GGBS in fly ash.

In India and other countries the research work on Mechanical strength characteristics of fly ash/fly ash+ GGBS based Geo-Polymer concrete have been led to successful results so far.

Regarding durability studies on fly ash based Geo-Polymer concrete only limited work is done and results are on positive side due to technical advantage of pozzolana material.

The structural integrity of fly ash+GGBS based Geo-Polymer concrete whether it is in low grade or higher grade, is obtained by alkali activation on minerals contains silica, alumina and also calcium by formation of geo-polymers through Geo-polymerization process only. Hence, the other Grades M40, M50 & M60 are also considered.

However, it is admitted that as more calcium in chemical composition will have impact on durability. Utilization of Fly ash or Fly ash+GGBS based Geo-Polymer concrete limited and not yet reached to international standard since it is under developing stage.

It requires little work to carry out reach performance level in terms of durability.

with our kindest regards

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