

DISCUSSION FORUM

Use of fly ash in structural concrete – How much?

This has reference to the paper titled "Use of fly ash in structural concrete : Part II – How much?" by A.K. Mullick published in the Journal, June 2005, Vol. 79, No. 6, pp. 10-14. Regarding the quantity of certain admixtures used in some projects, I would beg to differ. Hence, I request the authors to provide the following clarifications.

(i) Regarding Delhi Metro Rail Corporation Ltd (DMRC), as mentioned on page 12, it is hereby informed that pile foundations in DMRC project have been constructed with portland slag cement (PSC) using 52 percent slag.

(ii) Concrete for lining of 27.4-km long headrace tunnel of Nathpa Jhakri hydroelectric project used the following cements:

- Headrace tunnel 16 km - PSC with 52 percent slag (Total quantity 0.22 million tonnes.)
- Headrace tunnel — 11 km:
 - 4.5 km — low alkali ordinary portland cement (OPC) (reinforced)
 - 900 m — OPC plus 30 percent fly ash
 - 6 km — Portland pozzolana cement (PPC) with 25 percent fly ash
- Dam, desilting chambers, intake structure, surge shaft, power house and TRT were constructed with low alkali OPC
- Total quantity consumed is 530,000 t of low alkali OPC.

All cements except PPC have low alkali content as per the standard of the International Commission of Large Dams

(ICOLD). The alkali content in OPC was less than 0.6 percent as Na_2O equivalent and in PSC less than 0.9 percent as Na_2O equivalent.

The statement that 27.4 km headrace tunnel of Nathpa Jhakri has been done by 30 percent fly ash is incorrect.

I feel that since the facts given in the paper are incorrect and may provide a wrong impression to the readers, the author may provide clarification.

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The author's reply

The discussor's interest in the paper is noteworthy, although I am somewhat disappointed with the comments.

The paper has presented case studies of constructions in India, where fly ash, in various dosages, have been used in structural concrete. It did not imply that other cementitious materials could not or have not been used.

Of course, the data on usage of fly ash presented in the paper are totally correct. These are borne by published papers, authored by project engineers in each case (References 2 to 12 of the paper).

The entire DMRC project comprises of different phases and packages. The location, where fly ash was used in underground constructions can be identified from reference 2 (of the paper). A recent paper describes another instance of use of fly ash to improve durability of concrete placed below the ground level in Delhi Metro works¹.

Being a member of the Panel of Experts (POE), the author has personal knowledge of constructions in Nathpa Jhakri project. In view of seepage of hot water containing harmful chemicals, the cement systems to be adopted were recommended by CSMRS New Delhi. It included, *inter alia*, PSC with at least 50 percent slag or PPC with at least 30 percent fly ash. Contract I of the project, comprised of the main dam and 8 km of the head race tunnel (HRT). PSC was used for the lining of tunnel in this contract. Contract II involved the remaining part of the 27.4 km of the HRT, which mainly used OPC plus fly ash. Since IS: 1489 – Part I at that time permitted addition of fly ash only up to 25 percent, the project adopted replacement of 30 percent of OPC by fly ash at the site. This being the first instance of large scale addition of fly ash in concrete at the site for hydroelectric projects, it gave rise to certain technical and contractual disputes. The author was the member of a two-member team nominated to adjudicate the issues.

No statement such as '27.4 km headrace tunnel of Nathpa Jhakri has been done by 30 percent fly ash' has been made in the paper. A careful reading of the text will convey that concrete for lining of head race tunnel of Nathpa Jhakri project (which is 27.4 km long) is another example of use of fly ash, no more, no less.

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References

1. SHETTY, M. S., MUENZ, KLAUS and GALL, NORBERT, Delhi Metro : Quality control of concrete for underground section, *The Indian Concrete Journal*, April 2005, Vol. 79, No. 4, pp. 11-21.

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