

Evaluating the effectiveness of fly ash incorporation as PPC vis-à-vis separate addition to the site-mixed OPC concrete

I wish to inform you that I have studied the paper titled, 'Evaluating the effectiveness of fly ash incorporation as PPC vis-à-vis separate addition to the site mixed OPC concrete' published in the April 2006 issue of the *Journal* and I wish to give my comments as under.

The conclusions arrived at by the authors are very appropriate. Many PWD engineers are adding fly ash as a 'savings item' to OPC, especially in canal lining works, and other works. Furthermore, as far as my knowledge goes, except Andhra Pradesh, no other state has approved the usage of PPC even though it has many advantages as noted by the authors. Hence, I request you to send a copy of this paper to the PWD secretaries of all states with a request to permit the usage of PPC in the civil engineering works immediately. Similar request has to be made to the CPWD secretary of the Govt. of India.

It is possible to use 300 kg of PPC per m^3 of concrete to get M20 grade concrete and the authors may be requested to find out the different materials needed per m^3 of concrete and arrive at the ratio of concrete on volumetric basis since most of the site engineers are only using volumetric basis of concrete mixing. Most of the engineers are assuming that the

traditional volume-based mix of 1:2:4 is equal to M15 grade and 1:1.5:3 as equivalent to M20 grade concrete. The former is being used for reinforced concrete (RC) slabs and the other for RC beams and columns and one full bag of cement is mixed without giving any discrimination either to OPC or PPC. Due to the presence of more quantity of cement, automatically the compressive strength will be in the range of 20-25 N/mm² after 28-day curing. However, the colossal wastage of cement should be put to an end immediately. Hence, it will be more beneficial if the authors conduct tests on concrete using PPC with 300 kg/m³ of concrete and furnish the ratios on volume basis. As the saying goes, 'While in Rome do as the Roman do', it is not practically possible to change the traditional volume basis ratios, but we can convert ourselves to that and prove the advantages of using PPC in civil engineering jobs.

As regards the use of PPC in cement mortar the practice adopted is on volumetric basis. Here, if sand measured in mortar pans PPC should also be measured in the similar manner in which case, due to its reduced bulk density, the quantity of PPC will be less when compared to the volume of OPC. Thus, the consumer gets about 14 to 15 percent

savings. This point has to be highlighted and brought to the knowledge of all the civil engineers and the government departments.

Due to proper usage of PPC, the country gets the following advantages:

- (i) waste products from thermal power stations is productively used and environmental problem is reduced.
- (ii) usage of limestone and coal is reduced thus saving scarce national mineral resources
- (iii) power needed for PPC manufacturing is less which is always good.

The BIS specifically states that the most advantageous cement for concrete under- sea and coastal areas is PPC/slag cement. But none of the port trusts are following this. Hence, as a member of the Institute of Engineers and a concerned citizen I wrote a letter to the President, BIS, New Delhi recently. I also request you to apprise the BIS accordingly.

I am writing this letter in the capacity of a Member of the Institute of Standards Engineers attached to Chennai Section and also as a private citizen for your kind consideration and also to eliminate the national loss of usage of cement.

There are many Central (quasi) Govt., organisations like Tuticorin Port Trust etc., who are laying massive cement concrete in seawater. As per Clause 8.2.8 of IS 456: 2000 *Indian standard – plain and reinforced concrete – Code of practice [fourth revision]*, the concrete in sea water or exposed directly along the sea coast shall be at least M20 grade in the case of plain concrete and M30 in the case of reinforced concrete and the use of slag or pozzolana cement is advantageous under such conditions. Unfortunately, none of the organisations are using this advantageous cement and they are using ordinary Portland cement.

The bulk density of OPC is 1440 kg/m³ whereas the bulk density of PPC is around 1200 kg/m³, if ten tonnes of OPC is required, the equivalent requirement of PPC, will be only 8.333 tonnes.

Hence I request you to kindly suggest to all the Port trusts that they should use slag or pozzolana cement only for laying concrete under sea – water or exposed directly along the sea-coast as per clause 8.2.8 of IS 456 : 2000.

The CPWD's Director General [Works], New Delhi has to be requested to furnish the coefficients for cements consumption for works in either under sea-water or sea-coast by adopting the litre weight of PPC as 1.2 kg immediately and this should be communicated to all the Port trusts besides giving specific approval to use PPC only in such cases.

By using PPC, we not only get the most durable concrete but also get the most economical material and we can eliminate

the loss of 16.7 percent of OPC. I request that early action may kindly be taken in this regard.

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The authors' reply

We are glad that the findings of our work in the laboratory with respect to the problems and shortcomings of mixing fly ash in ordinary drum mixers at small sites is echoed by an experienced engineer like Mr Lakshmanan, with vast site experience. This should help practicing engineers to appreciate the points brought forth by the study.

As regards arriving at a volumetric proportioning with PPC, we would like to point out that the very basis of nominal mixes by volumetric basis (as was allowed in the old IS 456 : 1978) was the assumption that one bag of cement measures 35 litre and that measuring boxes should be of 35 litre. Proportioning all ingredients including cement with a measuring box of any size will result in leaner mixes. This applies to all cement types. However, in case of PPC, there will be a little (over 1 percent) excess yield due to the lower density of PPC than OPC.

However, the latest code of practice for the plain and reinforced concrete IS 456 : 2000 does not specify volumetric

proportions for nominal mixes. Accordingly, *Table 9* of IS 456 indicates the weight of cement, aggregates and the maximum quantity of water allowed for the given grades of concrete. That too is allowed only up to M-20 grade concrete. As most of the concrete experts would agree, proportioning by weight basis is more accurate than the volumetric basis, leading to better quality of concrete with minimum variance. If weigh batchers are not available at small sites then measurement boxes can be made by converting weight in to volume.

In view of the above, we recommend only weigh batching of ingredients for making concrete. Further, fly ash should be added only at RMC / batching plant, where quality control and mixing efficiency of mixer is much better as compared to ordinary drum mixer. However if the desired quality of fly ash is not available or the resource / expertise to test the fly ash is not available, then the use of PPC in small and big projects including batching plants would result in to better concrete, since product performance of PPC is assured by the manufacturer.

As a leading manufacturer of cement, our Company has taken up the issue of using blended cements, particularly PPC, for various civil engineering works in different national fora, including the BIS, IRC, etc.

Anil Banchhor
S. Krishnan
The Associated Cement Companies Limited

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