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No. RW/NHVI-50(18)/80-Vol. II. *Dated the 7th July, 1987*

To

1. The Chief Engineers of States and Union Territories PWDs dealing with National Highways and other Centrally Financed Roads.
2. The Director General (Works), Central PWD.
3 The Director General Border Roads.

Subject : Use of Portland Pozzolana Cement (PPC) in Highway Bridges

Reference is invited to this Ministry's circular letter No. PL-50(8)/74-A-NHVI dated the 9th March, 1978, wherein, the use of portland pozzolana cement was permitted on components of bridges where plain concrete work is involved and where reinforcement is not taken into account in the design of the members. Further, it was also stated that all such concrete work shall be carried out under the strict control subject to stipulations stated in the letter.

2. Since various user Departments have been reluctant to use portland pozzolana cement in reinforced cement concrete and prestressed concrete structures because of lack of data relating to its engineering properties, a cooperative study under the joint auspices of Indian Roads Congress and Indian Standards Institution (now Bureau of Indian Standards) was therefore undertaken by four Research Institutes (viz. CRRI, CBRI, HRS Madras and NCCBM) under the guidance of an Expert Group constituted on the basis of a decision taken in a High Level Meeting convened by this Ministry and attended hy the representatives of User Ministries, Cement Manufacturers, Research Institutes, ISI and State PWD's etc. The report furnished hy the Expert Group was considered in a High Level Meeting held in this Ministry on 22nd April, 1987. From the report of the Expert Group, it was noted that all the samples of pozzolana and portland pozzolana cement taken for testing by the four Research Institutes have failed to comply with Indian Standards and Specifications. Moreover, on the basis of studies carried out by the Central Electro-Chemical Research Institute (CECRI), Karaikudi regarding corrosion aspects of PPC, it is seen that based on lower durability factor and higher corrosion rate obtained in cracked and uncracked conditions the use of PPC in marine structures is not recommended.

3. Accordingly, it was decided in the High Level Meeting held on 22.4.87 that it is not possible to recommend the use of portland pozzolana cement in reinforced cement concrete and prestressed concrete works at this stage on the basis of results projected by the cooperative study of IRC end ISI as well as the studies undertaken by CECRI. A copy of the minutes of the High Level Meeting held on 22.4.87 is enclosed herewith for ready reference.

Enclosure to letter No. RW/NHVI-50(18)/80-Vol. II dated 7.7.87

MINUTES OF THE HIGH LEVEL MEETING HELD IN THE MINISTRY OF SURFACE TRANSPORT (ROADS WING), NEW DELHI ON 22.4.1987 REGARDING THE USE OF PORTLAND POZZOLANA CEMENT IN STRUCTURAL CONCRETE

PRESENT

1.	Shri L.S. Bassi, Addl. Director General (Bridges), Ministry of Surface Transport, (Roads Wing)	Chairman

MEMBERS

Ministry of Surface Transport (Roads Wing) :

2.	Shri N. Sivaguru	Addl. Director General (Roads).
3.	Shri Ninan Koshi	Chief Engineer (Bridges).
4.	Shri R.L. Kapoor	Chief Engineer (Bridges)
5.	Shri P.R. Kalra	Superintending Engineer (Bridges)
6.	Shri N.K. Sharma	Executive Engineer (Bridges)

	Ministry of Railways	
7.	Shri V. Srihari	Joint Director, RDSO.
	Central Public Works Deptt.	
8.	Dr. V. Thiruvangdam	Superintending Engineer (Designs)
	Director General Border Roads	
9.	Shri S.D. Aphale	Joint Director (Bridges)
	Ministry of Water Resources	
10.	Shri S.B. Suri	Chief Research Officer, CSMRS
11.	Shri K.R. Aggarwal	Chief Research Officer, CSMRS
	State Public Works Deptt.	
12	Shri S.K. Bansal	Executive Engineer (Designs) Haryana PWD (B&R)
	Bureau of Indian Standards	
13.	Shri N.C. Bandyopadhyay	Deputy Director
	Indian Roads Congress	
14.	Shri A.D. Narain	Deputy Secretary.
	Central Road Research Instt.	
15.	Dr. P. Ray Chaudhuri	Area Co-ordinator
16.	Shri S.S. Seehra	
	Central Building Research Institute	
17.	Dr. Kalyan Dass	Scientist
	National Council for Cement & Building Materials	
18.	Dr. C. Rajkumar	General Manager
	The Concrete Association of India	
19.	Shri M.G. Dandavate	Manager

Shri L.S. Bassi, Addl. Director General (Bridges), Ministry of Surface Transport (Roads Wing) after welcoming the members to this important meeting explained the circumstances for chairing this meeting in place of the Director General (Road Development) & Addl. Secretary. The Chairman then gave a brief background information for holding this meeting, which is a follow-up action of an earlier high level meeting held in this Ministry on 16.2.1978 between representatives of various user Ministries, Cement Manufacturers, Research Institutes, State PWDs etc. regarding the use of Portland Pozzolana Cement (PPC) in structural concrete. It was noted at that time that all the user Ministries/Departments/State PWDs etc. were not using PPC in reinforced concrete members for want of sufficient engineering data. Therefore, it was recommended that large scale tests should be got conducted to make available the necessary engineering data. These studies were required to be carried out under the joint auspices of Indian Roads Congress and Indian Standards Institution (now Bureau of Indian Standards). For this purpose, an Expert Group was constituted to discuss as to what detailed studies are to be undertaken to make available engineering data in respect of the following properties :

(a) Bond strength of steel with concrete
(b) Shrinkage of concrete.
(c) Creep of concrete.
(d) Modulus of rupture.
(e) Young's modulus.
(f) Shear capacity.
(g) Tensile strength.
(h) Corrosion of steel.

2. The Chairman observed that various reports furnished by the Expert Group have already been circulated for information of the members and now we are required to arrive at a conscious decision regarding use of PPC in RCC works based on the recommendations made by the Expert Group. He further mentioned that the most important recommendation is contained in para 7.10 of the Report which mentions that the tests have revealed that all the pozzolanas failed to comply with the prescribed Indian Standards and as such no clear cut recommendation for the use of PPC can be made at this stage. He also mentioned that the Expert Group has recommended further studies for a minimum period of one year to ascertain the quality of pozzolana now being used in the manufacturer of PPC after the introduction of compulsory ISI Certification for all cements (which includes test of pozzolana also) since 1.7.83.

The Chairman further drew the attention of the members to the studies carried out by the Central Electro-Chemical Research Institute (CECRI), Karaikudi (relevant extracts circulated) regarding corrosion aspects. It is seen from the final recommendation part

that based on lower durability factor and higher corrosion rate obtained under cracked and uncracked conditions, the use of portland pozzolana cement (PPC) in marine structures is not recommended.

Thereafter the Chairman invited Shri N. Koshi, Co-Chairman of the Expert Group to apprise the members about the deliberations of the Expert Group.

3. Shri Koshi explained that the Expert Group during the course of its deliberations decided that tests for creep of concrete and shear capacity need not be undertaken as these properties could be considered as functions of the compressive strength of concrete. Also it was agreed by the Expert Group that no separate study regarding corrosion need be carried out in view of the detailed studies being undertaken by CECRI under one of the sponsored research schemes of the Ministry of Surface Transport. The collaborative testing of cement samples was entrusted to the following four research institutes by the Expert Group with CRRI to act as the coordinating laboratory.

(a) Central Road Research Institute, New Delhi.

(b) Central Building Research Institute, Roorkee.

(c) Highway Research Station, Madras.

(d) National Council for Cement & Building Materials, New Delhi.

The Report on the cooperative study conducted by the four research institutes as prepared and submitted by CRRI was considered by the Expert Group and the main findings "Overall Analysis and Observations" contained under para 7 of the Report were modified and approved by the Expert Group in its last meeting held on 3.2.87.

Shri N. Koshi then requested Dr. Ray Chaudhuri of CRRI to elaborate the sampling and testing part undertaken by the Research Institutes involved in this programme.

4. Dr. Ray Chaudhuri explained that the details about the sampling and testing are fully covered in the Report prepared by CRRI (the coordinating laboratory). About final results obtained after testing the samles, Dr. Ray Chaudhuri emphasised that all the 11 samples of pozzolana collected from various factories were found to be not conforming to Indian Standards. Even it was seen that the average value of pozzolana in PCC was about 12% only against the permissible percentage of 10 to 25% as per Indian Specifications. As such, in real terms, none of the samples taken for testing can be strictly termed as portland pozzolana cement.

5. Shri N. Sivaguru, Addl. Director General (Roads) of the Ministry of Surface Transport opined that in view of the fact that cent per cent samples of pozzolana had failed to pass the prescribed Indian Specifications and Standards, it will be advisable to use PPC only in plain concrete works and not for RCC works. Further, he emphasised that there appears to be no need to extend the testing programme of pozzolana for a further period of one year as recommended by the Expert Group.

6. Shri M.G. Dandavate of the Concrete Association of India expressed that more or less the engineering properties of PPC are quite comparable to OPC as per the Report. The question was of the quality of pozzolana and this had improved after the introduction of compulsory ISI Certification. Therefore, there appears to be a need for carrying out further studies for a period of one year more as recommended by the Expert Group, As regards the corrosion aspects included in the Report of CECRI, Sh. Dandavate was of the opinion that the durability factor of PPC with reference to OPC as shown in various tabular statements was not bad for alll the cases undertaken and in some cases it was more than one. Therefore, in his opinion, PPC may not be that bad for use in marine structures as recommended by CECRI. Sh. Dandavate was informed that the main recommendation of CECRI regarding not permitting use of PPC in marine structures is not based on the results obtained for a single case but this is judged on an overall basis and moreover the CECRI Report also brings out that in relative performance of different pozzolana concretes in the order of decreasing corrosion resistance, portland cement concrete is on top of the list in order. Dr. Kalyan Dass of CBRI corroborated the findings of CECRI and he explained that CBRI has also conducted independent studies about the corrosive effects of PPC in marine and interior environments. CBRI has found that PPC accelerates corrosion even in lesser aggressive environments in the interior areas. Dr. Ray Chaudhuri of CRRI also informed that on the basis of studies carried out by their Institute, it is seen that the inhibitor for corrosion is reactive with OPC and not with PPC.

7. After detailed discussions it was decided that in view of the fact that all samples of pozzolana taken for testing by the Research Institutes failed to comply with Indian Standards and the PPC had been found to be more corrosion prone by CECRI studies, it is not possible to recommend the use of PPC in structural concrete at this stage. Further, as regards the testing programme for a further period of one year as recommended by the Expert Group, it was felt that it is not considered essential at present since ISI compulsory certification has come into force only from 1.7.83 and for a real effect on the end product, some more time is definitely required. Moreover, the studies that have been completed now have taken 9 years as against 1½ years desired in the first high level meeting. Therefore, it may be better to review the position, if necessary, at a later date and till such time PPC may be used only in mass concrete works and not for RCC/PSC works.

8. The meeting ended with a vote of thanks to the Chair.

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1 In reference to Ministry Circular no PL-50(8)/74-A-NH VI dated 9.03.1978, Use of Portland Pozzolana Cement (PPP) in Highway Bridges where plain concrete work