IS 12269 (1987): 53 grade ordinary Portland cement [CED 2: Cement and Concrete]

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भारतीय मानक

साधारण पोर्टलैंड सीमेंट, 53 ग्रेड — विशिष्टि

(पहला पुनरीक्षण)

Indian Standard

ORDINARY PORTLAND CEMENT, 53 GRADE — SPECIFICATION

(First Revision)

ICS 91.100.10

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

March 2013 **Price Group 5**

Cement and Concrete Sectional Committee, CED 2

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

This standard was published in 1987. This revision incorporates the experience gained with the use of this standard and brings the standard in line with the latest developments in this field.

Since the publication of this standard, a large number of amendments were issued from time-to-time in order to modify various requirements based on experience gained with the use of the standard and the requirements of the users, and also keeping in view the raw materials available in the country and found suitable for the manufacture of cement. The important amendments included: use of performance improvers for addition during clinker grinding stage, incorporation of requirement of chloride content for the cement used in structures other than prestressed concrete, permitting use of 25 kg, 10 kg, 5 kg, 2 kg and 1 kg bags for packing of cement, and requirement of packing cement for export. In view of the large number of amendments, the Sectional Committee decided to bring out this first revision of the standard incorporating all these amendments so as to make it more convenient for the users. Further, following are the other significant modifications incorporated in this revision:

a) Requirement for insoluble residue has been specified as 5.0 percent, maximum irrespective of addition of performance improver(s) or otherwise.
b) SO_3 content requirement has been revised to 3.5 percent maximum irrespective of C_3A content, primarily to accommodate use of coal/pet coke as fuel which may have higher sulphur content; subject to the cement conforming to all the requirements of the standard.
c) A clause has been introduced requiring manufacturer to furnish a certificate indicating alkali content if required by the purchaser.
d) Requirement of marking of type and amount of performance improver(s) on the bag has been incorporated.
e) Requirement of testing the cement samples at the earliest but not later than 3 months since the receipt of samples for testing, has been included.

With the increase in SO_3 content limit in this revision, suitable caution needs to be exercised for limiting the sulphates in concrete in accordance with the provision of IS 456 : 2000 ‘Code of practice for plain and reinforced concrete (*fourth revision*)’.

Quantity of cement packed in bags and the tolerance requirements for the quantity of cement packed in bags shall be in accordance with the relevant provisions of the *Standards of Weights and Measures (Packaged Commodities) Rules,* 1977 and **B-1.2** (*see* Annex B). Any modification in these rules in respect of tolerance on quantity of cement would apply automatically to this standard.

This standard contains Sl No. (viii) of Table 2 and **12.2.1** which give option to the purchaser and Sl No. (v) of Table 3 and **9.2**, **9.3**, **9.4** and **9.4.3**, which call for agreement between the purchaser and the supplier.

Specific requirements of ordinary Portland cement for manufacture of railway sleepers to be designated as 53-S grade are given in **5.2**, Table 3 and **10.1**. To differentiate it with normal grade, ‘53-S grade’ shall be marked on the bags/packages for such cement in place of ‘53 grade’.

The composition of the technical Committee responsible for the formulation of this standard is given in Annex C.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

ORDINARY PORTLAND CEMENT, 53 GRADE — SPECIFICATION

(First Revision)

1 SCOPE

This standard covers the manufacture and chemical and physical requirements of 53 grade ordinary Portland cement.

2 REFERENCES

The standards given in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 4845 shall apply.

4 MANUFACTURE

4.1 Ordinary Portland cement, 53 grade shall be manufactured by intimately mixing together calcareous and argillaceous and/or other silica, alumina or iron oxide bearing materials, burning them at a clinkering temperature and grinding the resultant clinker so as to produce a cement capable of complying with this standard. No material shall be added after burning, other than gypsum (natural mineral or chemical, *see* Note), water, performance improver(s), and not more than a total of 1.0 percent of air-entraining agents or other agents including colouring agents, which have proved not to be harmful.

NOTE — Chemical gypsum shall be added provided that the performance requirements of the final product as specified in this standard are met with.

4.1.1 Limit of addition of performance improver shall be as given in Table 1 and shall be inclusive of 1 percent additives as mentioned above.

If a combination of above performance improvers is added, the maximum limit of total addition shall be 5 percent.

5 CHEMICAL REQUIREMENTS

5.1 When tested in accordance with the methods given in IS 4032, ordinary Portland cement, 53 grade shall comply with the chemical requirements given in Table 2.

Table 1 Performance Improvers
(*Clause* 4.1.1)

Sl No.	Performance Improver	Percentage Addition by Mass, *Max*	Requirement
(1)	(2)	(3)	(4)
i)	Fly ash	5	Conforming to IS 3812 (Part 1)
ii)	Granulated slag	5	Conforming to IS 12089
iii)	Silica fume	5	Conforming to IS 15388
iv)	Limestone	5	$CaCO_3$ content calculated from CaO content shall not be less than 75 percent when tested in accordance with IS 1760 (Part 3)
v)	Rice husk ash	5	a) Reactive silica shall not be less than 80 percent when tested as per IS 3812 (Part 1) b) Pozzolanic activity index shall not be less than 90 percent when tested as per **10** of 1S 1727 c) Loss on ignition shall not be more than 5.0 percent when tested as per IS 1727
vi)	Metakaolin	5	a) Silicon dioxide (SiO_2) plus aluminium oxide (Al_2O_3) in percent by mass shall not be less than 94.0 percent when tested as per IS 1727 b) Loss on ignition shall not be more than 2.0 percent when tested as per IS 1727 c) Total alkalis as sodium oxide (as Na_2O equivalent) in percent by mass shall not be more than 1.5 percent when tested as per IS 4032 d) Particles retained on 45 micron IS sieve (wet sieving) shall not be more than 1.5 percent when tested as per 1S 1727

Table 2 Chemical Requirements for Ordinary Portland Cement, 53 Grade
(*Foreword* and *Clauses* 5.1 *and* 5.2)

Sl No. (1)	Characteristic (2)	Requirement (3)
i)	Ratio of percentage of lime to percentages of silica, alumina and iron oxide, when calculated by the formula: $\frac{CaO - 0.7\ SO_3}{2.8\ SiO_2 + 1.2\ Al_2O_3 + 0.65\ Fe_2O_3}$	0.80-1.02
ii)	Ratio of percentage of alumina to that of iron oxide, *Min*	0.66
iii)	Insoluble residue, percent by mass, *Max*	4.0
iv)	Magnesia, percent by mass, *Max*	6.0
v)	Total sulphur content calculated at sulphuric anhydride (SO_3), percent by mass, *Max*	3.5
vi)	Loss on ignition, percent by mass, *Max*	4.0
vii)	Chloride content, percent by mass, *Max*	0.1
viii)	Alkali content	0.05 (for prestressed structures, *see* Note)

NOTE — Alkali aggregates reactions have been noticed in aggregates in some parts of the country. On large and important jobs where the concrete is likely to be exposed to humid atmosphere or wetting action, it is advisable that the aggregate be tested for alkali aggregate reaction. In the case of reactive aggregates, the use of cement with alkali content below 0.6 percent expressed at sodium oxide (Na_2O), is recommended. Where, however, such cements are not available, use of alternative means may be resorted to for which a reference may be made to **8.2.5.4** of IS 456. If so desired by the purchaser, the manufacturer shall carry out test for alkali content.

5.2 Cement used for railway sleepers shall additionally satisfy the following chemical/mineralogical requirements and shall be designated as 53-S grade:

a) Magnesia, percent by mass, *Max* 5.0
b) Tricalcium aluminate content, percent by mass, *Max* 10.0
c) Tricalcium silicate, percent by mass, *Min* 45.0

NOTE — The tricalcium aluminate content (C_3A) and tricalcium silicate content (C_3S) are calculated by the formula:

$C_3A = 2.65\ (Al_2O_3) - 1.69\ (Fe_2O_3)$

$C_3S = 4.07\ (CaO) - 7.60\ (SiO_2) - 6.72\ (Al_2O_3) - 1.43\ (Fe_2O_3) - 2.85\ (SO_3)$

where each symbol in brackets refers to the percent (by mass of total cement) of the oxide, excluding any contained in insoluble residue referred to at Sl No. (iii) of Table 2.

6 PHYSICAL REQUIREMENTS

Ordinary Portland cement, 53 grade shall comply with the physical requirements given in Table 3.

7 STORAGE

The cement shall be stored in such a manner as to permit easy access for proper inspection and identification, and in a suitable weather-tight building to protect the cement from dampness and to minimize warehouse deterioration (*see also* IS 4082).

8 MANUFACTURER'S CERTIFICATE

8.1 The manufacturer shall satisfy himself that the cement conforms to the requirements of this standard and, if requested, shall furnish a certificate to this effect to the purchaser or his representative, within ten days of testing of the cement (except for 28 days compressive strength test results, which shall be furnished after completion of the test).

8.2 The manufacturer shall furnish a certificate indicating the alkali content, if requested.

9 PACKING

9.1 The cement shall be packed in any of the following bags:

a) jute sacking bag conforming to IS 2580;
b) multi-wall paper sacks conforming to IS 11761;
c) light weight jute conforming to IS 12154;
d) HDPE/PP woven sacks conforming to IS 11652;
e) jute synthetic union bags conforming to IS 12174; or
f) any other approved composite bag.

Bags shall be in good condition at the time of inspection.

9.1.1 The net quantity of cement per bag shall be 50 kg subject to provisions and tolerance given in Annex B.

9.2 The net quantity of cement per bag may also be 25 kg, 10 kg, 5 kg, 2 kg or 1 kg subject to tolerances as given in **9.2.1** and packed in suitable bags as agreed to between the purchaser and the manufacturer.

9.2.1 The number of bags in a sample taken for

Table 3 Physical Requirements for Ordinary Portland Cement, 53 Grade
(*Foreword* and *Clause* 6)

Sl No. (1)	Characteristic (2)	Requirement (3)	Method of Test, Ref to (4)
i)	Fineness, m^2/kg, *Min*	225 370 for 53-S grade	IS 4031 (Part 2)
ii)	Soundness:		
	a) By Le Chatelier method, mm, *Max*	10 } See Note 1	IS 4031 (Part 3)
	b) By autoclave test method, percent, *Max*	0.8 } See Note 1	
iii)	Setting time:		
	a) Initial, min, *Min*	30 60 for 53-S grade } See Note 2	IS 4031 (Part 5)
	b) Final, min, *Max*	600	
iv)	Compressive strength, MPa (*see* Note 4):		IS 4031 (Part 6)
	a) 72 ± 1 h, *Min*	27	
	b) 168 ± 2 h, *Min*	37 37.5 for 53-S grade	
	c) 672 ± 4 h, *Min*	53	
v)	Transverse strength (optional)	See Notes 3 and 4	IS 4031 (Part 8)

NOTES

1 In the event of cements failing to comply with any one or both the requirements of soundness specified in this table, further tests in respect of each failure shall be made as described in IS 4031 (Part 3), from another portion of the same sample after aeration. The aeration shall be done by spreading out the sample to a depth of 75 mm at a relative humidity of 50 to 80 percent for a total period of 7 days. The expansion of cements so aerated shall be not more than 5 mm and 0.6 percent when tested by Le Chatelier method and autoclave test respectively. For 53-S grade cement, the requirement of soundness of unaerated cement shall be maximum expansion of 5 mm when tested by the Le-Chatelier method.

2 If cement exhibits false set, the ratio of final penetration measured after 5 min of completion of mixing period to the initial penetration measured exactly after 20 s of completion of mixing period, expressed as percent, shall be not less than 50. In the event of cement exhibiting false set, the initial and final setting time of cement when tested by the method described in IS 4031 (Part 5) after breaking the false set, shall conform to the value given in this table.

3 By agreement between the purchaser and the manufacturer, transverse strength test of plastic mortar in accordance with the method described in IS 4031 (Part 8) may be specified. The permissible values of the transverse strength shall be mutually agreed to between the purchaser and the supplier at the time of placing the order.

4 Notwithstanding the compressive and transverse strength requirements specified as per this table, the cement shall show a progressive increase in strength from the strength at 72 h.

weighment showing a minus error greater than 2 percent of the specified net quantity shall be not more than 5 percent of the bags in the sample. Also the minus error in none of such bags in the sample shall exceed 4 percent of the specified net quantity of cement in the bag. However, the average of net quantity of cement in a sample shall be equal to or more than 25 kg, 10 kg, 5 kg, 2 kg or 1 kg, as the case may be.

9.3 Supplies of cement in bulk may be made by arrangement between the purchaser and the supplier (manufacturer or stockist).

NOTE — A single bag or container containing 1 000 kg and more, net quantity of cement shall be considered as the bulk supply of cement. Supplies of cement may also be made in intermediate bags/containers, for example, drums of 200 kg, by agreement between the purchaser and the manufacturer.

9.4 When cement is intended for export and if the purchaser so requires, packing of cement may be done in bags or in drums with net quantity of cement per bag or drum as agreed to between the purchaser and the manufacturer.

9.4.1 For this purpose, the permission of the certifying authority shall be obtained in advance for each export order.

9.4.2 The words 'FOR EXPORT' and the net quantity of cement per bag/drum shall be clearly marked in indelible ink on each bag/drum.

9.4.3 The packing material shall be as agreed to between the manufacturer and the purchaser.

9.4.4 The tolerance requirements for the quantity of cement packed in bags/drum shall be as given in **9.2.1** except the net quantity which shall be equal to or more than the quantity in **9.4**.

10 MARKING

10.1 Each bag of cement shall be legibly and indelibly marked with the following:

a) Manufacturer's name and his registered trade-mark;

b) The words 'Ordinary Portland Cement, 53 Grade' or 'Ordinary Portland Cement, 53-S Grade', whichever is applicable;

c) Net quantity, in kg;
d) The words 'Use no Hooks';
e) Batch/control unit number in terms of week, month and year of packing;
f) Address of the manufacturer; and
g) Type and percentage of performance improver(s) added, in case of addition of performance improvers.

10.2 Similar information shall be provided in the delivery advices accompanying the shipment of packed or bulk cement and cement drums (*see* **9.3**).

10.3 BIS Certification Marking

The cement may also be marked with the Standard Mark.

10.3.1 The use of the Standard Mark is governed by the provisions of *the Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which a license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

11 SAMPLING

11.1 A sample or samples for testing may be taken by the purchaser or his representative, or by any person appointed to superintend the work for the purpose of which the cement is required or by the latter's representative.

11.1.1 The samples shall be taken within three weeks of the delivery and all the tests shall be commenced within one week of sampling.

11.1.2 When it is not possible to test the samples within one week, the samples shall be packed and stored in air-tight containers and tested at the earliest but not later than 3 months since the receipt of samples for testing.

11.2 In addition to the requirements of **11.1**, the methods and procedure of sampling shall be in accordance with IS 3535.

11.3 The manufacturer or the supplier shall afford every facility, and shall provide all labour and materials for taking and packing the samples for testing the cement and for subsequent identification of cement sampled.

12 TESTS

12.1 The sample or samples of cement for test shall be taken as described in **11** and shall be tested in the manner described in the relevant clauses.

12.2 Independent Testing

12.2.1 If the purchaser or his representative requires independent tests, the samples shall be taken before or immediately after delivery at the option of the purchaser or his representative, and the tests shall be carried out in accordance with this standard on the written instructions of the purchaser or his representative.

12.2.2 The manufacturer/supplier shall supply, free of charge, the cement required for testing. Unless otherwise specified in the enquiry and order, the cost of the tests shall be borne as follows:

a) By the manufacturer/supplier, if the results show that the cement does not comply with the requirements of this standard, and
b) By the purchaser, if the results show that the cement complies with the requirement of this standard.

12.2.3 After a representative sample has been drawn, tests on the sample shall be carried out as expeditiously as possible (*see* **11.1.1** and **11.1.2**).

13 REJECTION

13.1 Cement may be rejected if it does not comply with any of the requirements of this standard.

13.2 Cement remaining in bulk storage at the factory, prior to shipment, for more than six months, or cement in bags, in local storage such as, in the hands of a vendor for more than 3 months after completion of tests, shall be retested before use and shall be rejected if it fails to conform to any of the requirements of this standard.

ANNEX A
(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
456 : 2000	Code of practice plain and reinforced concrete (*fourth revision*)
650 : 1991	Specification for standard sand for testing of cement (*second revision*)
1727 : 1967	Methods of test for pozzolanic materials (*first revision*)
1760 (Part 3) : 1992	Methods of chemical analysis of limestone, dolomite and allied materials: Part 3 Determination of iron oxide, alumina, calcium oxide and magnesia (*first revision*)
2580 : 1995	Textiles — Jute sacking bags for packing cement — Specification (*third revision*)
3535 : 1986	Methods of sampling hydraulic cements (*first revision*)
3812 (Part 1) : 2013	Specification for pulverized fuel ash: Part 1 For use as pozzolana in cement, cement mortar and concrete (*third revision*)
4031	Methods of physical tests for hydraulic cement
(Part 2) : 1999	Determination of fineness by specific surface by Blaine air permeability method (*second revision*)
(Part 3) : 1988	Determination of soundness (*first revision*)
(Part 5) : 1988	Determination of initial and final setting times (*first revision*)
(Part 6) : 1988	Determination of compressive strength of hydraulic cement (other than masonry cement) (*first revision*)
(Part 8) : 1988	Determination of transverse and compressive strength of plastic mortar using prism (*first revision*)
4032 : 1985	Methods of chemical analysis of hydraulic cement (*first revision*)
4082 : 1996	Recommendations on stacking and storage of construction materials and components at site (*second revision*)
4845 : 1968	Definitions and terminology relating to hydraulic cement
4905 : 1968	Methods for random sampling
11652 : 1986	Specification for high density polyethylene (HDPE)/polypropylene (PP) woven sacks for packing cement (*second revision*)
11761 : 1986	Specification for multi-wall paper sacks for cement (*first revision*)
12089 : 1987	Specification for granulated slag for manufacture of Portland slag cement
12154 : 1987	Light weight jute bags for packing cement
12174 : 1987	Jute synthetic union bags for packing cement
15388 : 2003	Specification for silica fume

ANNEX B
(*Foreword* and *Clause* 9.1.1)

TOLERANCE REQUIREMENTS FOR THE QUANTITY OF CEMENT PACKED IN BAGS

B-1 The average of the net quantity of cement packed in bags at the plant in a sample shall be equal to or more than 50 kg. The number of bags in a sample shall be as given below:

Batch Size	*Sample Size*
100-150	20
151-280	32
281-500	50
501-1 200	80
1 201-3 200	125
3 201 and over	200

The bags in a sample shall be selected at random. For methods of random sampling, IS 4905 may be referred to.

B-1.1 The number of bags in a sample showing a minus error greater than 2 percent of the specified net quantity (50 kg) shall be not more than 5 percent of the bags in the sample. Also the minus error in none of such bags in a sample shall exceed 4 percent of the specified net quantity of cement in the bag.

NOTE — The matter given in **B-1** and **B-1.1** are extracts based on the *Standards of Weights and Measures (Packaged Commodities) Rules*, 1977 to which reference shall be made

for full details. Any modification made in these Rules and other related Acts and Rules would apply automatically.

B-1.2 In case of a wagon/truck load of up to 25 tonne, the overall tolerance on net quantity of cement shall be 0 to 0.5 percent.

NOTE — The mass of a jute sacking bag to hold 50 kg of cement is 531 g, the mass of a 6-ply paper bag to hold 50 kg of cement is approximately 400 g, the mass of a light weight jute bag to hold 50 kg of cement is approximately 450 g, the mass of a HDPE/PP woven sack to hold 50 kg of cement is approximately 70 g/71 g respectively, and the mass of a jute synthetic union bag to hold 50 kg of cement is approximately 420 g.

ANNEX C
(*Foreword*)

COMMITTEE COMPOSITION

Cement and Concrete Sectional Committee, CED 2

Organization	*Representative(s)*
Delhi Tourism and Transportation Development Corporation Ltd, New Delhi	Shri Jose Kurian (***Chairman***)
ACC Ltd, Mumbai	Shri S. A. Khadilkar Shri Sharad Kumar Shrivastava (*Alternate*)
Ambuja Cements Limited, Mumbai	Shri C. M. Dordi Dr A. N. Vyasa Rao (*Alternate*)
Association of Consulting Civil Engineers (India), Bangalore	Shri Avinash D. Shirode Shri K. K. Meghashyam (*Alternate*)
Atomic Energy Regulatory Board, Mumbai	Shri L. R. Bishnoi Shri Saurav Acharya (*Alternate*)
Builders' Association of India, Mumbai	Dr Narendra D. Patel
Building Materials and Technology Promotion Council, New Delhi	Shri J. K. Prasad Shri C. N. Jha (*Alternate*)
Cement Corporation of India Limited, New Delhi	Shri R. R. Deshpande Shri M. K. Agarwal (*Alternate*)
Cement Manufacturers' Association, Noida	Shri N. A. Viswanathan Dr S. K. Handoo (*Alternate*)
Central Board of Irrigation and Power, New Delhi	Secretary Director (Civil) (*Alternate*)
Central Building Research Institute (CSIR), Roorkee	Dr B. K. Rao Dr S. K. Agarwal (*Alternate*)
Central Public Works Department, New Delhi	Shri A. K. Garg Shri Manu Amitabh (*Alternate*)
Central Road Research Institute (CSIR), New Delhi	Dr Rakesh Kumar Dr Renu Mathur (*Alternate*)
Central Soil and Materials Research Station, New Delhi	Shri Murari Ratnam Shri N. Sivakumar (*Alternate*)
Central Water Commission, New Delhi	Director (CMDD)(N&W) Deputy Director (CMDD) (NW&S) (*Alternate*)
Conmat Technolgies Pvt Ltd, Kolkata	Dr A. K. Chatterjee
Construction Chemicals Manufacturers' Association, Mumbai	Shri Samir Surlaker Shri Upen Patel (*Alternate*)
Construction Industry Development Council, New Delhi	Shri P. R. Swarup Shri Ravi Jain (*Alternate*)
Delhi Development Authority, New Delhi	Chief Engineer (QAC) Director (Material Management) (*Alternate*)
Engineers India Limited, New Delhi	Shri Vinay Kumar Shri A. K. Mishra (*Alternate*)

Organization	*Representative(s)*
Fly Ash Unit, Department of Science and Technology, New Delhi	Dr Vimal Kumar
Gammon India Limited, Mumbai	Shri Venkataramana N. Heggade Shri Manish Mokal (*Alternate*)
Grasim Industries Limited, Mumbai	Shri A. K. Jain Dr S. P. Pandey (*Alternate*)
Hindustan Construction Company Ltd, Mumbai	Dr Chetan Haazaree Shri Manohar Cherala (*Alternate*)
Housing and Urban Development Corporation Limited, New Delhi	Shri Deepak Bansal
Indian Association of Structural Engineers, New Delhi	Prof Mahesh Tandon Shri Ganesh Juneja (*Alternate*)
Indian Bureau of Mines, Nagpur	Shri S. S. Das Shri Meerul Hasan (*Alternate*)
Indian Concrete Institute, Chennai	Shri Vivek Naik Secretary General (*Alternate*)
Indian Institute of Technology Kanpur, Kanpur	Dr Sudhir Misra Dr Sudib K. Mishra (*Alternate*)
Indian Institute of Technology Madras, Chennai	Prof Devdas Menon Dr Manu Santhanam (*Alternate*)
Indian Institute of Technology Roorkee, Roorkee	Prof V. K. Gupta Dr Bhupinder Singh (*Alternate*)
Indian Roads Congress, New Delhi	Secretary General Director (*Alternate*)
Institute for Solid Waste Research & Ecological Balance, Visakhapatnam	Dr N. Bhanumathidas Shri N. Kalidas (*Alternate*)
Jai Prakash Associates Ltd, New Delhi	Shri M. K. Ghosh
Lafarge India Pvt Ltd, Mumbai	Ms. Madhumita Basu Shri Sanjay Jain (*Alternate*)
Madras Cements Ltd, Chennai	Shri Balaji K. Moorthy Shri Anil Kumar Pillai (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Army Headquarter, New Delhi	Maj-Gen N. R. K. Babu Shri S. K. Jain (*Alternate*)
Ministry of Road Transport & Highways, New Delhi	Shri A. N. Dhodapkar Shri S. K. Puri (*Alternate*)
National Council for Cement and Building Materials, Ballabgarh	Shri V. V. Arora Dr M. M. Ali (*Alternate*)
National Test House, Kolkata	Shri B. R. Meena Shrimati S. A. Kaushil (*Alternate*)
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OCL India Limited, New Delhi	Dr S. C. Ahluwalia
Public Works Department, Government of Tamil Nadu, Chennai	Superintending Engineer Executive Engineer (*Alternate*)
Research, Design & Standards Organization (Ministry of Railways), Lucknow	Shri R. M. Sharma Shri V. K. Yadava (*Alternate*)
Sanghi Industries Limited, Sanghi Nagar	Shri D. B. N. Rao Dr H. K. Patnaik (*Alternate*)
Structural Engineering Research Centre (CSIR), Chennai	Dr K. Ramanjaneyulu Shri P. Srinivasan (*Alternate*)
The India Cements Limited, Chennai	Dr D. Venkateswaran Shri S. Gopinath (*Alternate*)
The Indian Hume Pipe Company Limited, Mumbai	Shri P. R. Bhat Shri S. J. Shah (*Alternate*)

Organization	*Representative(s)*
The Institution of Engineers (India), Kolkata	Dr H. C. Visvesvaraya Shri S. H. Jain (*Alternate*)
The National Institute of Engineering, Mysore	Dr N. Suresh Shri H. N. Ramathirtha (*Alternate*)
Ultra Tech Cement Ltd, Mumbai	Dr Subrato Chowdhury Shri Biswajit Dhar (*Alternate*)
Voluntary Organization in Interest of Consumer Education, New Delhi	Shri M. A. U. Khan Shri H. Wadhwa (*Alternate*)
In personal capacity (*36, Old Sneh Nagar, Wardha Road, Nagpur)*	Shri L. K. Jain
In personal capacity (*EA-92, Maya Enclave, Hari Nagar, New Delhi*)	Shri R. C. Wason
In personal capacity (*E-1, 402, White House Apartments, R.T. Nagar, Bangalore*)	Shri S. A. Reddi
BIS Directorate General	Shri A. K. Saini, Scientist 'G' and Head (Civ Engg) [Representing Director General (*Ex-officio*)]

Member Secretaries
Shri Sanjay Pant
Scientist 'E' & Director (Civ Engg), BIS

Shri S. Arun Kumar
Scientist 'C' (Civ Engg), BIS

Cement, Pozzolana and Cement Additives Subcommittee, CED 2 : 1

In personal capacity (*E-1, 402, White House Apartments, R.T. Nagar, Bangalore*)	Shri S. A. Reddi (***Convener***)
ACC Ltd, Mumbai	Shri S. A. Khadilkar Shri Sharad Kumar Shrivastava (*Alternate*)
AIMIL Ltd, New Delhi	Dr V. M. Sharma Shri Aman Khullar (*Alternate*)
All India Mini Cement Manufacturers' Association, Hyderabad	Shri S. R .B. Ramesh Chandra Shri S. Srikanth Reddy (*Alternate*)
Ambuja Cements Ltd, Ahmedabad	Shri C. M. Dordi Dr A. N. Vyasa Rao (*Alternate*)
Atomic Energy Regulatory Board, Mumbai	Shri L. R. Bishnoi Shri Saurav Acharya (*Alternate*)
Building Materials and Technology Promotion Council, New Delhi	Shri J. K. Prasad Shri C. N. Jha (*Alternate*)
Cement Corporation of India Ltd, New Delhi	Shri M. K. Agarwal Shrimati Saraswathi Devi (*Alternate*)
Cement Manufactuters' Association, Noida	Shri Subrato Chowdhury Dr K. C. Narang (*Alternate*)
Central Building Research Institute (CSIR), Roorkee	Dr B. K. Rao Dr S. K. Agarwal (*Alternate*)
Central Electricity Authority, New Delhi	Shri Y. K. Sharma Shri Mohan Kumar (*Alternate*)
Central Pollution Control Board, Delhi	Shri J. S. Kamyotra Shri P. K. Gupta (*Alternate*)
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