

**AMENDMENT NO. 4 MAY 2013
TO
IS 456 : 2000 PLAIN AND REINFORCED CONCRETE — CODE OF PRACTICE**

(Fourth Revision)

(Page 14, clause 5.3, second sentence) — Delete.

(Page 14, clause 5.3.4, second sentence) — Delete.

(Page 14, clause 5.4, line 1) — Substitute 'Water, natural or treated,' for 'Water'.

(Page 14, clause 5.4.3, first sentence) — Substitute the following for the existing sentence:

'Sea water shall not be used for mixing or curing of concrete because of presence of harmful salts.'

(Page 15, clause 5.5.6) — Insert the following new clause:

'5.5.7 The amount of admixture added to a mix shall be recorded in the production record. Redosing of admixtures is not normally permitted. In special circumstances, if necessary, additional dose of admixture may be added at project site and mixed adequately in mixer itself to regain the workability of concrete with the mutual agreement between the producer/supplier and the purchaser/user of concrete. However, the producer/supplier shall assure the ultimate quality of concrete supplied by him and maintain record of quantity and time of addition.'

(Page 16, Table 2) — Substitute the following table for the existing table:

Table 2 Grades of Concrete
(Clauses 6.1, 9.2.2, 15.1.1 and 36.1)

Group	Grade Designation	Specified Characteristic Compressive Strength of 150 mm Cube at 28 days N/mm ²
(1)	(2)	(3)
Ordinary Concrete	M 10	10
	M 15	15
	M 20	20
Standard Concrete	M 25	25
	M 30	30
	M 35	35
	M 40	40
	M 45	45
	M 50	50
	M 55	55
High Strength Concrete	M 60	60
	M 65	65
	M 70	70
	M 75	75
	M 80	80
	M 85	85
	M 90	90
	M 95	95
	M 100	100

NOTES

1 In the designation of concrete mix M refers to the mix and the number to the specified characteristic compressive strength of 150 mm size cube at 28 days, expressed, in N/mm².

2 For concrete of grades above M 60, design parameters given in the standard may not be applicable and the values may be obtained from specialized literatures and experimental results.

Price Group 3

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(Page 17, clause 8.1, line 3) — Insert the word ‘life’ after ‘service’.

(Page 20, Table 5, Note 1) — Substitute the following for the existing note:

‘1 Cement content prescribed in this table is irrespective of grades and types of cement and is inclusive of mineral admixtures mentioned in 5.2. The mineral admixtures such as fly ash or ground granulated blast furnace slag shall be taken into account in the concrete composition with respect to the cement content and water-cement ratio not exceeding the limit of fly ash and slag specified in IS 1489 (Part 1) and IS 455 respectively, beyond which these additions, though permitted, shall not be considered for these purposes.’

(Page 20, Table 5, Note 2) — Insert the following new note:

‘3 The minimum cement content, maximum free water-cement ratio and minimum grade of concrete are individually related to exposure.’

[Page 21, clause 8.2.5.4 (b), para 2] — Substitute ‘fly ash conforming to IS 3812 (Part 1) or ground granulated’ for ‘fly ash (Grade 1) conforming to IS 3812 or granulated’ and ‘25 percent’ for ‘20 percent’.

(Page 21, clause 8.2.6.2, para 2) — Substitute the following for the existing para:

‘Additional protection may be obtained by the use of suitable impermeable barriers.’

(Page 22, clause 9.2.1) — Insert the following at the end:

‘If so desired, the employer shall be provided with supporting data including graphs showing strength *versus* water-cement ratio for range of proportions, complete trial mix proportioning details to substantiate the choice of cement content, fine and coarse aggregate content, water, mineral admixtures, chemical admixtures, etc.’

(Page 22, clause 9.2.2, first sentence) — Insert the following after first sentence:

‘Proportion/grading of aggregates shall be made by trial in such a way as to make densest possible concrete.’

(Page 23, Table 8) — Substitute the following for the existing table:

Table 8 Assumed Standard Deviation
(Clause 9.2.4.2 and Table 11)

Grade of Concrete	Assumed Standard Deviation N/mm ²
M 10 } M 15 }	3.5
M 20 } M 25 }	4.0
M 30 } M 35 } M 40 } M 45 } M 50 } M 55 } M 60 }	5.0

NOTES

1 The above values correspond to the site control having proper storage of cement; weigh batching of all materials; controlled addition of water; regular checking of all materials, aggregate grading and moisture content; and periodical checking of workability and strength. Where there is deviation from the above, the values given in the above table shall be increased by 1 N/mm².

2 For grades above M 60, the standard deviation shall be established by actual trials based on assumed proportions, before finalizing the mix.

(Page 24, clause 10.2, para 2) — Substitute the following for the existing para:

‘For large and medium project sites, the concrete shall be sourced from ready-mixed concrete plants or from captive on-site or off-site automatic batching and mixing plants. The concrete produced and supplied by ready-mixed concrete plants shall be in accordance with IS 4926. In case of concrete from captive on-site or off-site automatic batching and mixing plants, similar quality control shall be followed.’

(Page 24, clause 10.2.1, first sentence) — Substitute the following for the existing sentence:

‘The grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in right proportions, the different sizes being stocked in separate stock-piles.’

(Page 24, clause 10.2.2) — Substitute the following for the existing clause:

‘10.2.2 The accuracy of the measuring equipment shall be within ± 2 percent of the quantity of cement and mineral admixtures being measured and within ± 3 percent of the quantity of aggregate, chemical admixtures and water being measured. In a batching plant, the concrete production equipment shall be calibrated initially at the time of installation or reconditioning of the equipment and subsequently at the following intervals:

- a) Mechanical/ knife edge systems : At least once every two months
- b) Electrical/ load cell systems : At least once every three months’.

(Page 24, clause 10.2.3) — Substitute the following for the existing clause:

‘10.2.3 All ingredients of concrete shall be used by mass except water and chemical admixtures, which may be by volume.’

(Page 24, clause 10.2.5, fourth sentence) — Insert the following after fourth sentence:

‘Where batching plants are used, it is recommended to determine moisture content by moisture probes fitted to the batching plants.’

(Page 24, clause 10.3, first and second sentence) — Substitute the following for the existing sentences:

‘Concrete shall be mixed in a mechanical mixer (*see also* IS 1791 and IS 12119). It shall be ensured that stationary or central mixers and truck mixers shall comply with the performance criteria of mixing efficiency as per IS 4634. Mixing efficiency test shall be performed at least once in a year.’

(Page 25, clause 10.3.1) — Substitute the following for the existing clause:

‘10.3.1 As a guidance, the mixing time shall be at least 2 min for conventional free fall (drum) batch type concrete mixers. For other types of more efficient mixers, manufacturers’ recommendations shall be followed.’

(Page 25, clause 10.3.3) — Substitute the following for the existing clause:

‘10.3.3 Dosages of retarders, plasticizers and superplasticizers shall be restricted to 0.5, 1.0 and 2.0 percent respectively by mass of cementitious materials; however, the dosages of polycarboxylate based admixtures shall not exceed 1.0 percent. A higher value of above admixtures may be used, if agreed upon between the manufacturer and the constructor based on performance tests relating to workability, setting time and early age strength.’

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(Page 25, clause 11.1, informal table) — Substitute the following for the existing table:

a) Deviation from specified dimensions of cross-section of columns and beams	+10 - 5 mm
b) Deviation from dimensions of footings:	
1) Dimensions in plan	+50 -10 mm
2) Eccentricity	0.02 times the width of the footing in the direction of deviation but not more than 50 mm
3) Thickness	+50 -10 mm or ± 0.05 times the specified thickness, whichever is less

(Page 27, clause 13.4, para 1, fourth sentence) — Delete.

[Page 30, Table 11 (see also Amendments No. 1 and 3)] — Substitute the following for the existing Table 11:

Table 11 Characteristic Compressive Strength Compliance Requirement
(Clauses 16.1 and 16.3)

Specified Grade	Mean of the Group of 4 Non-Overlapping Consecutive Test Results in N/mm ²	Individual Test Results in N/mm ²
	Min (2)	Min (3)
(1) M 15 and above	$\geq f_{ck} + 0.825 \times \text{established standard deviation}$ (rounded off to nearest 0.5 N/mm ²) or $f_{ck} + 3 \text{ N/mm}^2$, whichever is greater	$\geq f_{ck} - 3 \text{ N/mm}^2$

NOTES

1 In the absence of established value of standard deviation, the values given in Table 8 may be assumed, and attempt should be made to obtain results of 30 samples as early as possible to establish the value of standard deviation.

2 For concrete of quantity up to 30 m³ (where the number of samples to be taken is less than four as per the frequency of sampling given in 15.2.2), the mean of test results of all such samples shall be $f_{ck} + 4 \text{ N/mm}^2$, minimum and the requirement of minimum individual test results shall be $f_{ck} - 2 \text{ N/mm}^2$, minimum. However, when the number of sample is only one as per 15.2.2, the requirement shall be $f_{ck} + 4 \text{ N/mm}^2$, minimum.

[Page 41, clause 24.4.1 (a)] — Substitute the following for the existing:

'a) Calculate the sum of the midspan moment and the average of the support moments (neglecting signs) for each panel.'

(Page 42, clause 26.2.1, Note 2) — Insert the following new note:

'3 For plain cement concrete of M15 grade with nominal reinforcement, the design bond stress may be taken as 1.0 N/mm².'

(Page 43, clause 26.2.1.1, para 2) — Insert the following at the end of para:

'For fusion bonded epoxy coated deformed bars, design bond stress values shall be taken as 80 percent of the values given in the above table.'

(Page 67, clause 35.3.2, last para, third sentence) — Substitute the following for the existing sentence:

'For particularly aggressive environment, such as 'very severe' and 'extreme' categories given in Table 3, the assessed surface width of cracks should not in general, exceed 0.1 mm.'

(Page 74, clause 40.5.2, formula) — Substitute, ' ΣA_{sv} ' for ' A_s ' in the formula.

[Page 80, clause B-2.1.1, informal table (see also Amendment No. 2)] — Substitute

M 50 and above	for	M 50 M 55
5.2		5.2 5.6

[Page 81, Table 21 (see also Amendment No.2)] — Substitute the entries against M 55 and insert new row for M 60, as follows:

Grade of Concrete	Permissible Stress in Compression		Permissible Stress in Bond (Average) for Plain Bars in Tension
	Bending	Direct	
(1)	(2)	(3)	(4)
M 55	18.0	13.5	1.5
M 60	20.0	15.0	1.6

(Page 92, clause E-1, line 5) — Substitute 'Fig. 27' for 'Fig. 26'.