AMENDMENT NO. 4 – MAY 2013
TO
IS 456: 2000 PLAIN AND REINFORCE CONCRETE - CODE OF PRACTICE

Sl. No.	Clause	Before Amendment	After Amendment
1.	5.3 Aggregates	Aggregates shall comply with the requirements of IS 383. As far as possible preference shall be given to natural aggregates.	Aggregates shall comply with the requirements of IS 383.
2.	5.3.4	Coarse and fine aggregate shall be batched separately. All-in-aggregate may be used only where specifically permitted by the engineer-in-charge.	Coarse and fine aggregate shall be batched separately.
3.	5.4 Water	Water used for mixing and curing shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel.	Water, natural or treated, used for mixing and curing shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel.
4.	5.4.3 Sea Water	Mixing or curing of concrete with sea water is not recommended because of presence of harmful salts in sea water. Under unavoidable circumstances sea water may be used for mixing or curing in plain concrete with no embedded steel after having given due consideration to possible disadvantages and precautions including use of appropriate cement system.	Sea water shall not be used for mixing or curing of concrete because of presence of harmful salts. Under unavoidable circumstances sea water may be used for mixing or curing in plain concrete with no embedded steel after having given due consideration to possible disadvantages and precautions including use of appropriate cement system.
5.	5.5.7 – *New clause added*	-	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 a 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.

<table>
<tr>
<td>6.</td>
<td>Table 2 –
Grades of Concrete</td>
<td>IS 456 : 2000
Table 2 Grades of Concrete
(Clause 6.1, 9.2.2, 15.1.1 and 36.1)
<table>
<tr><th>Group</th><th>Grade Designation</th><th>Specified Characteristic Compressive Strength of 150 mm Cube at 28 Days in N/mm²</th></tr>
<tr><td>(1)</td><td>(2)</td><td>(3)</td></tr>
<tr><td>Ordinary Concrete</td><td>M 10
M 15
M 20</td><td>10
15
20</td></tr>
<tr><td>Standard Concrete</td><td>M 25
M 30
M 35
M 40
M 45
M 50
M 55</td><td>25
30
35
40
45
50
55</td></tr>
<tr><td>High Strength Concrete</td><td>M 60
M 65
M 70
M 75
M 80</td><td>60
65
70
75
80</td></tr>
</table>
NOTES
1 In the designation of concrete mix M refers to the mix and the number to the specified compressive strength of 150 mm size cube at 28 days, expressed in N/mm².
2 For concrete of compressive strength greater than M 55, design parameters given in the standard may not be applicable and the values may be obtained from specialized literatures and experimental results.</td>
<td>(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)
<table>
<tr><th>Group</th><th>Grade Designation</th><th>Specified Characteristic Compressive Strength of 150 mm Cube at 28 days N/mm²</th></tr>
<tr><td>(1)</td><td>(2)</td><td>(3)</td></tr>
<tr><td>Ordinary Concrete</td><td>M 10
M 15
M 20</td><td>10
15
20</td></tr>
<tr><td>Standard Concrete</td><td>M 25
M 30
M 35
M 40
M 45
M 50
M 55
M 60</td><td>25
30
35
40
45
50
55
60</td></tr>
<tr><td>High Strength Concrete</td><td>M 65
M 70
M 75
M 80
M 85
M 90
M 95
M 100</td><td>65
70
75
80
85
90
95
100</td></tr>
</table>
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.</td>
<td>In this amendment, Classification of Concrete has been changed. M60Gr. has been shifted to Standard concrete and from Grades M85 to M100 are added to High strength concretes. In note to M55 is replaced with M60.</td>
</tr>
<tr>
<td>7.</td>
<td>8.1
General</td>
<td>A durable concrete is one that performs satisfactorily in the working environment during its anticipated exposure conditions during service. The materials and mix proportions specified and used should be such as to maintain its integrity and, if applicable, to protect embedded metal from corrosion.</td>
<td colspan="2">A durable concrete is one that performs satisfactorily in the working environment during its anticipated exposure conditions during service life. The materials and mix proportions specified and used should be such as to maintain its integrity and, if applicable, to protect embedded metal from corrosion.</td>
</tr>
<tr>
<td>8.</td>
<td>NOTES to Table 5 Minimum Cement Content, Maximum Water-Cement Ratio and Minimum Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20 mm Nominal Maximum Size</td>
<td>Cement content prescribed in this table is irrespective of the grades of cement and it is inclusive of additions mentioned in 5.2. The additions such as fly ash or ground granulated blast furnace slag may be taken into account in the concrete composition with respect to the cement content and water-cement ratio if the suitability is established and as long as the maximum amounts taken into account do not exceed the limit of pozzolona and slag specified in IS 1489 (Part I) and IS 455 respectively.</td>
<td colspan="2">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 I) and IS 455 respectively, beyond which these additions though permitted, shall not be considered for these purposes.</td>
</tr>
<tr>
<td>9.</td>
<td>NOTES to Table 5 – Note 3 added</td>
<td>Only 2 note items mentioned.</td>
<td colspan="2">3. The minimum cement content, maximum free water-cement ratio and minimum grade of concrete are individually related to exposure.</td>
</tr>
</table>

10.	**8.2.5.4 Alkali-aggregate reaction**	b) Use of low alkali ordinary Portland cement having total alkali content not more than 0.6 percent (as Na_2O equivalent). Further advantage can be obtained by use of fly ash (Grade 1) conforming to IS 3812 or granulated blast furnace slag conforming to IS 12089 as part replacement of ordinary Portland cement (having total alkali content as Na2O equivalent not more than 0.6 percent), provided fly ash content is at least 20 percent or slag content is at least 50 percent.	b) Use of low alkali ordinary Portland cement having total alkali content not more than 0.6 percent (as Na_2O equivalent). Further advantage can be obtained by use of flyash conforming to IS 3812 (Part I) or ground granulated blast furnace slag conforming to IS 12089 as part replacement of ordinary Portland cement (having total alkali content as Na2O equivalent not more than 0.6 percent), provided fly ash content is at least 25percent or slag content is at least 50 percent.
11.	**8.2.6.2 Drainage**	At sites where alkali concentrations are high or may become very high, the ground water should be lowered by drainage so that it will not come into direct contact with the concrete. Additional protection may be obtained by the use of chemically resistant stone facing or a layer of plaster of Paris covered with suitable fabric, such as jute thoroughly impregnated with bituminous material.	At sites where alkali concentrations are high or may become very high, the ground water should be lowered by drainage so that it will not come into direct contact with the concrete. Additional protection may be obtained by the use of suitable impermeable barriers.
12.	**9.2 Design Mix Concrete 9.2.1**	As the guarantor of quality of concrete used in the construction, the constructor shall carry out the mix design and the mix so designed (not the method of design) shall be approved by the employer within the limitations of parameters and other stipulations laid down by this standard.	As the guarantor of quality of concrete used in the construction, the constructor shall carry out the mix design and the mix so designed (not the method of design) shall be approved by the employer within the limitations of parameters and other stipulations laid down by this standard. 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.,
13.	**9.2.2**	The mix shall be designed to produce the grade of concrete having the required workability and a characteristic strength not less than appropriate values given in Table 2. The target mean strength of concrete mix should be equal to the characteristic strength plus 1.65 times the standard deviation.	The mix shall be designed to produce the grade of concrete having the required workability and a characteristic strength not less than appropriate values given in Table 2. Proportion/grading of aggregates shall be made by trial in such a way as to make densest possible concrete. The target mean strength of concrete mix should be equal to the characteristic strength plus 1.65 times the standard deviation.

14.	**Table 8 Assumed Standard Deviation**	**Table 8 Assumed Standard Deviation** *(Clause* 9.2.4.2 and *Table* 11*)* Grade of Concrete: M 10, M 15 — Assumed Standard Deviation N/mm²: 3.5 M 20, M 25 — 4.0 M 30, M 35, M 40, M 45, M 50 — 5.0 NOTE—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 gradings 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 1N/mm².	*(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: 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.	*In this amendment, M55 and M60 has been added in the amended version to the Grade of Concrete. Also note 2 is added.*
15.	**10.2 Batching**	To avoid confusion and error in batching, consideration should be given to using the smallest practical number of different concrete mixes on any site or in any one plant. In batching concrete, the quantity of both cement and aggregate shall be determined by mass; admixture, if solid, by mass; liquid admixture may however be measured in volume or mass; water shall be weighed or measured by volume in a calibrated tank (see also IS 4925). Ready-mixed concrete supplied by ready-mixed concrete plant shall be preferred. For large and medium project sites the concrete shall be sourced from ready mixed concrete plants or from on site or off site batching and mixing plants (see IS 4926).	To avoid confusion and error in batching, consideration should be given to using the smallest practical number of different concrete mixes on any site or in any one plant. In batching concrete, the quantity of both cement and aggregate shall be determined by mass; admixture, if solid, by mass; liquid admixture may however be measured in volume or mass; water shall be weighed or measured by volume in a calibrated tank (see also IS 4925). 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.	
16.	**10.2.1**	Except where it can be shown to the satisfaction of the engineer-in-charge that supply of properly graded aggregate of uniform quality can be maintained over a period of work, the grading of aggregate should be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions when required, the different sizes being stocked in separate stock-piles. The material should be stock-piled for several hours preferably a day before use. The grading of coarse and fine aggregate should be checked as frequently as possible, the frequency for a given job being determined by the engineer-in charge to ensure that	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. The material should be stock-piled for several hours preferably a day before use. The grading of coarse and fine aggregate should be checked as frequently as possible, the frequency for a given job being determined by the engineer-in charge to ensure that the specified grading is maintained.	

		the specified grading is maintained.	
17.	**10.2.2**	The accuracy of the measuring equipment shall be within + 2 percent of the quantity of cement being measured and within + 3 percent of the quantity of aggregate, admixtures and water being measured.	The accuracy of measuring equipment shall be within ±2 percent of the quantity of cement and mineral admixtures being measured and within ±3percent 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
18.	**10.2.3**	Proportion/Type and grading of aggregates shall be made by trial in such a way so as to obtain densest possible concrete. All ingredients of the concrete should be used by mass only.	All ingredients of concrete shall be used by mass except water and chemical admixtures which may be by volume.
19.	**10.2.5**	It is important to maintain the water-cement ratio constant at its correct value. To this end, determination of moisture contents in both fine and coarse aggregates shall be made as frequently as possible, the frequency for a given job being determined by the engineer-in-charge according to weather conditions. The amount-of the added water shall be adjusted to compensate for any observed variations in the moisture contents. For the determination of moisture content in the aggregates, IS 2386 (Part 3) may be referred to. To allow for the variation in mass of aggregate due to variation in their moisture content, suitable adjustments in the masses of aggregates shall also be made. In the absence of -exact data, only in the case of nominal mixes, the amount of surface water may be estimated from the values given in Table 10.	It is important to maintain the water-cement ratio constant at its correct value. To this end, determination of moisture contents in both fine and coarse aggregates shall be made as frequently as possible, the frequency for a given job being determined by the engineer-in-charge according to weather conditions. The amount-of the added water shall be adjusted to compensate for any observed variations in the moisture contents. For the determination of moisture content in the aggregates, IS 2386 (Part 3) may be referred to. Where batching plants are used, it is recommended to determine moisture content by moisture probes fitted to the batching plants. To allow for the variation in mass of aggregate due to variation in their moisture content, suitable adjustments in the masses of aggregates shall also be made. In the absence of -exact data, only in the case of nominal mixes, the amount of surface water may be estimated from the values given in Table 10.

20.	**10.3 Mixing**	Concrete shall be mixed in a mechanical mixer. The mixer should comply with IS 1791 and IS 12119. The mixers shall be fitted with water measuring (metering) devices. The mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency. If there is segregation after unloading from the mixer, the concrete should be remixed.	Concrete shall be mixed in 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. The mixers shall be fitted with water measuring (metering) devices. The mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency. If there is segregation after unloading from the mixer, the concrete should be remixed.	
21.	**10.3.1**	For guidance, the mixing time shall be at least 2 min. For other types of more efficient mixers, manufacturers' recommendations shall be followed; for hydrophobic cement it may be decided by the engineer-in-charge.	As a guidance, the mixing time shall be at least 2min for conventional free fall (drum) batch type concrete mixers. For other types of more efficient mixers, manufacturers' recommendations shall be followed.	
22.	**10.3.3**	Dosages of retarders, plasticisers and superplasticisers shall be restricted to 0.5, 1.0 and 2.0 percent respectively by weight of cementations' materials and unless a higher value is agreed upon between the manufacturer and the constructor based on performance test.	Dosages of retarders, plasticisers and superplasticisers 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 1.0percent. A higher value of above admixtures may be used, if agreed upon between the manufacturer and the constructor based on performance test relating to workability, setting time and early age strength.	
23.	**11.1 General**	**11.1 General** The formwork shall be designed and constructed so as to remain sufficiently rigid during placing and compaction of concrete, and shall be such as to prevent loss of slurry from the concrete. For further details regarding design, detailing, etc, reference may be made to IS 14687. The tolerances on the shapes, lines and dimensions shown in the drawing shall be within the limits given below: a) Deviation from specified dimensions of cross-section of columns and beams: +12 −6 mm b) Deviation from dimensions of footings 1) Dimensions in plan: +50 −12 mm 2) Eccentricity: 0.02 times the width of the footing in the direction of deviation but not more than 50 mm 3) Thickness: ± 0.05 times the specified thickness	(*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	*In this amendment, The tolerances on shapes, lines and dimensions are revised.*

24.	**13.4 Construction Joints and Cold Joints**	Joints are a common source of weakness and, therefore, it is desirable to avoid them. If this is not possible, their number shall be minimized. Concreting shall be carried out continuously up to construction joints, the position and arrangement of which shall be indicated by the designer. Construction joints should comply with IS 11817.	Joints are a common source of weakness and, therefore, it is desirable to avoid them. If this is not possible, their number shall be minimized. Concreting shall be carried out continuously up to construction joints, the position and arrangement of which shall be indicated by the designer.	
25.	**Table 11**	**Table 11 Characteristic Compressive Strength Compliance Requirement** (*Clauses* 16.1 *and* 16.3) Specified Grade (1) — Mean of the Group of 4 Non-Overlapping Consecutive Test Results in N/mm² (2) — Individual Test Results in N/mm² (3) M 15 — ≥ f_{ck} + 0.825 × established standard deviation (rounded off to nearest 0.5 N/mm²) or f_{ck} + 3 N/mm², whichever is greater — ≥ f_{ck} − 3 N/mm² M 20 or above — ≥ f_{ck} + 0.825 × established standard deviation (rounded off to nearest 0.5 N/mm²) or f_{ck} + 4 N/mm², whichever is greater — ≥ f_{ck} − 4 N/mm² NOTE—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.	[*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 (1) — Mean of the Group of 4 Non-Overlapping Consecutive Test Results in N/mm² Min (2) — Individual Test Results in N/mm² Min (3) M 15 and above — ≥ f_{ck} + 0.825 x established standard deviation (rounded off to nearest 0.5 N/mm²) or f_{ck} + 3 N/mm², whichever is greater — ≥ f_{ck} - 3 N/mm² 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 N/mm², minimum and the requirement of minimum individual test results shall be f_{ck} - 2 N/mm², minimum. However, when the number of sample is only one as per 15.2.3, the requirement shall be f_{ck} + 4 N/mm², minimum.	*In this amendment, The characteristic compressive strength compliance requirements are revised. In the revision it is same for M15 and above grades. Note 2 is added.*
26.	**24.4.1 Restrained Slab with Unequal Conditions at Adjacent Panels**	In some cases the support moments calculated from Table 26 for adjacent panels may differ significantly. The following procedure may be adopted to adjust them. a) Calculate the sum of moments at midspan and supports (neglecting signs).	In some cases the support moments calculated from Table 26 for adjacent panels may differ significantly. The following procedure may be adopted to adjust them. a) Calculate the sum of the midspan moments and the average of the support moments (neglecting signs) for each panel.	
27.	**26.2.1 Development Length of Bars - NOTES – *Note 3 added***	Only 2 Note items mentioned.	3) For plain cement concrete of M15grade with nominal reinforcement, the design bond stress may be taken as 1.0 N/mm^2.	
28.	**26.2.1.1 Design bond stress in limit state method for plain bars in tension shall be as below:**	For deformed bars conforming to IS 1786 these values shall be increased by 60 percent. For bars in compression, the values of bond stress for bars in tension shall be increased-by 25 percent.	For deformed bars conforming to IS 1786 these values shall be increased by 60 percent. For bars in compression, the values of bond stress for bars in tension shall be increased-by 25 percent. 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.	

<table>
<tr><td>29.</td><td>35.3.2
Cracking – 3rd para</td><td>The surface width of the cracks should not, in general, exceed 0.3 mm in members where cracking is not harmful and does not have any serious adverse effects upon the preservation of reinforcing steel nor upon the durability of the structures. In members where cracking in the tensile zone is harmful either because they are exposed to the effects of the weather or continuously exposed to moisture or in contact soil or ground water, an upper limit of 0.2 mm is suggested for the maximum width of cracks. For particularly aggressive environment, such as the ‘severe’ category in Table 3, the assessed surface width of cracks should not in general, exceed 0.1 mm.</td><td colspan="2">The surface width of the cracks should not, in general, exceed 0.3 mm in members where cracking is not harmful and does not have any serious adverse effects upon the preservation of reinforcing steel nor upon the durability of the structures. In members where cracking in the tensile zone is harmful either because they are exposed to the effects of the weather or continuously exposed to moisture or in contact soil or ground water, an upper limit of 0.2 mm is suggested for the maximum width of cracks. 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.</td></tr>
<tr><td>30.</td><td>40.5.2
Shear Reinforcement for Sections Close to supports</td><td>If shear reinforcement is required, the total area of this is given by:
$As = a_v b(\tau_v - 2d\tau_c/a_v)/0.87f_y \geq 0.4\, a_v b/0.87f_y$</td><td colspan="2">If shear reinforcement is required, the total area of this is given by:
$\Sigma A_{SV} = a_v b(\tau_v - 2d\tau_c/a_v)/0.87f_y \geq 0.4\, a_v b/0.87f_y$</td></tr>
<tr><td>31.</td><td>B-2.1.1
Direct Tension</td><td>For M50, Tensile stress – 5.2
For M55, Tensile stress – 5.6</td><td colspan="2">For M50 and above, Tensile stress – 5.2</td></tr>
<tr><td>32.</td><td>Table 21</td><td>
Table 21 Permissible Stresses in Concrete IS 456 : 2000
(Clauses B-1.3, B-2.1, B-2.1.2, B-2.3 and B-4.2)
All values in N/mm².
<table>
<tr><th rowspan="2">Grade of Concrete</th><th colspan="2">Permissible Stress in Compression</th><th rowspan="2">Permissible Stress in Bond (Average) for Plain Bars in Tension</th></tr>
<tr><th>Bending</th><th>Direct</th></tr>
<tr><td>(1)</td><td>(2)</td><td>(3)</td><td>(4)</td></tr>
<tr><td></td><td>σ_{cbc}</td><td>σ_{cc}</td><td>τ_{bd}</td></tr>
<tr><td>M 10</td><td>3.0</td><td>2.5</td><td>—</td></tr>
<tr><td>M 15</td><td>5.0</td><td>4.0</td><td>0.6</td></tr>
<tr><td>M 20</td><td>7.0</td><td>5.0</td><td>0.8</td></tr>
<tr><td>M 25</td><td>8.5</td><td>6.0</td><td>0.9</td></tr>
<tr><td>M 30</td><td>10.0</td><td>8.0</td><td>1.0</td></tr>
<tr><td>M 35</td><td>11.5</td><td>9.0</td><td>1.1</td></tr>
<tr><td>M 40</td><td>13.0</td><td>10.0</td><td>1.2</td></tr>
<tr><td>M 45</td><td>14.5</td><td>11.0</td><td>1.3</td></tr>
<tr><td>M 50</td><td>16.0</td><td>12.0</td><td>1.4</td></tr>
</table>
NOTES
1 The values of permissible shear stress in concrete are given in Table 23.
2 The bond stress given in col 4 shall be increased by 25 percent for bars in compression.
</td><td>
[Page 81, Table 21 (see also Amendment No.2)] — Substitute the entries against M 55 and insert new row for M 60, as follows:
<table>
<tr><th rowspan="2">Grade of Concrete</th><th colspan="2">Permissible Stress in Compression</th><th rowspan="2">Permissible Stress in Bond (Average) for Plain Bars in Tension</th></tr>
<tr><th>Bending</th><th>Direct</th></tr>
<tr><td>(1)</td><td>(2)</td><td>(3)</td><td>(4)</td></tr>
<tr><td>M 55</td><td>18.0</td><td>13.5</td><td>1.5</td></tr>
<tr><td>M 60</td><td>20.0</td><td>15.0</td><td>1.6</td></tr>
</table>
</td><td>In this amendment, The change to the table is
a)Substituting the entries against M55
b)Insertion of a new row for M60</td></tr>
</table>

33.	**ANNEX E (Clause 25.2) EFFECTIVE LENGTH OF COLUMNS**	E-l : In the absence of more exact analysis, the effective length of columns in framed structures may be obtained from the ratio of effective length to unsupported length l_{ef}/l given in Fig. 26 when relative displacement of the ends of the column is prevented and in Fig. 26 when relative lateral displacement of the -ends is not prevented. In the latter case, it is recommended that the effective length ratio l_{ef} /l may not be taken to be less than 1.2.	E-l : In the absence of more exact analysis, the effective length of columns in framed structures may be obtained from the ratio of effective length to unsupported length l_{ef}/l given in Fig. 26 when relative displacement of the ends of the column is prevented and in Fig. 27 when relative lateral displacement of the -ends is not prevented. In the latter case, it is recommended that the effective length ratio l_{ef} /l may not be taken to be less than 1.2.