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7-DAYS COMPRESSIVE STRENGTH OF CONCRETE (As per IS-Code)

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ABSTRACT :

There is lot of confusion on how much percentage to consider for 7-days Compressive Strength of Concrete. It was not mentioned directly in any IS codes. But it is clearly indicated in most cases, even though various interpretations are on same. To overcome this issue, here it is clearly described on 7-days Compressive Strength of Concrete. In this paper, it is described based on IS: 456 codes.

Key Words: IS 456-2000, 7-days Strength, 65-Percentage, Explanatory Handbook, Amend. No: 5, OPC, PPC.

1.INTRUDUCTION

The statement that concrete cube strength at 7-days should be at least 65 percent of the 28-day strength is not explicitly mentioned in IS 456:2000 as a requirement for acceptance. However, it is a widely accepted guideline and is often used as an indicator of concrete quality. The primary standard for concrete testing in India is IS-516:1959, which outlines the methods for determining the compressive strength of concrete. Although IS-516 doesn't mandate 65% at 7 days, it does specify the procedures for testing concrete cubes at 7 and 28 days.

2.BREAKDOWN ON 7-DAYS STRENGTH AS PER IS-CODES

- **IS 456:2000,** is the main Indian standard for plain and reinforced concrete. It focuses on the 28-day compressive strength as the primary criterion for concrete acceptance, but it does not specifically require 65% strength in 7 days.
- **IS 516:1959,** details the procedures for concrete cube testing, including the determination of compressive strength at 7 and 28 days.

3.THE 65 PERCENT GUIDELINE ON 7-DAY'S STRENGTH

Testing for 7-days helps to identify potential issues with the concrete mix or curing process early in the construction phase, allowing for timely corrective measures.

The table below shows the Compressive Strength gained by Concrete after 1, 3, 7, 14 and 28 days respect to the Grade of Concrete we use

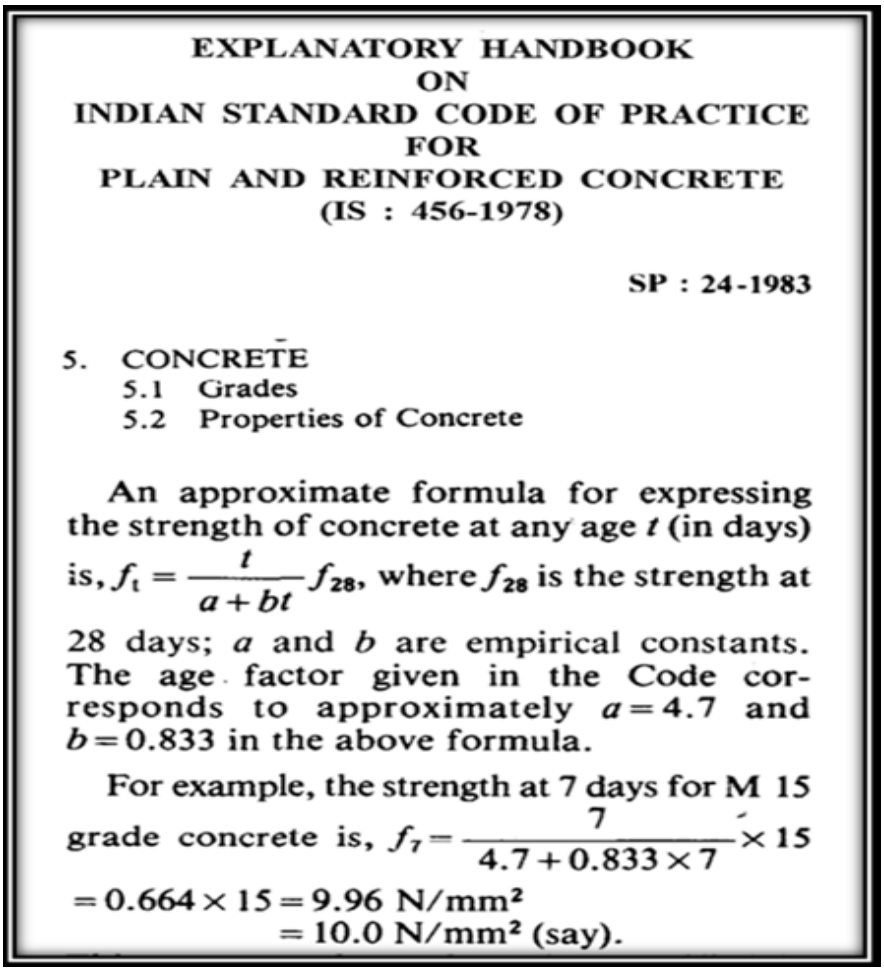
Age	Strength %
1 Day	16
3 Days	40
7 Days	65
14 Days	90
28 Days	100

Figure 1: Age-wise Strength of Concrete

If the 7-day strength is significantly below 65%, It might indicate problems with the concrete mix, curing, or other factors that need to be addressed.

4.EXPLANATORY HANDBOOK IS: 456-1978 (SP: 24-1983)

The 65% guideline on 7-day's compressive strength of concrete is a practical rule of thumb often used by experienced engineers and construction professionals to assess the quality and potential of concrete early on based on the civil explanatory handbooks, like standard code of practice IS: 456-1978 (SP: 24-1983) [3].



EXPLANATORY HANDBOOK
ON
INDIAN STANDARD CODE OF PRACTICE
FOR
PLAIN AND REINFORCED CONCRETE
(IS : 456-1978)

SP : 24-1983

5. CONCRETE
5.1 Grades
5.2 Properties of Concrete

An approximate formula for expressing the strength of concrete at any age t (in days) is, $f_t = \frac{t}{a+bt} f_{28}$, where f_{28} is the strength at 28 days; a and b are empirical constants. The age factor given in the Code corresponds to approximately $a = 4.7$ and $b = 0.833$ in the above formula.

For example, the strength at 7 days for M 15 grade concrete is, $f_7 = \frac{7}{4.7 + 0.833 \times 7} \times 15$

$= 0.664 \times 15 = 9.96$ N/mm²
$= 10.0$ N/mm² (say).

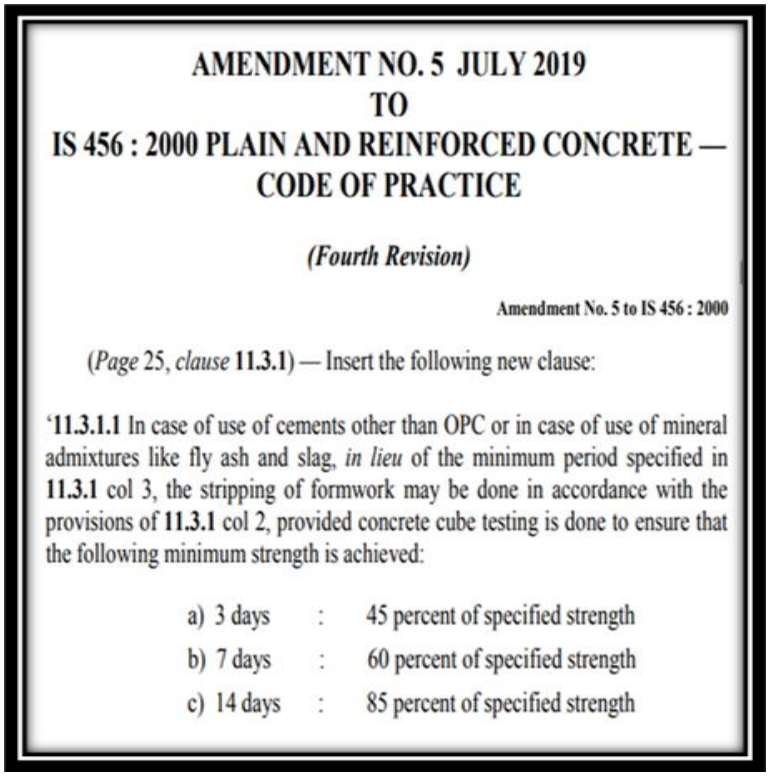
Figure 2: IS 456-1978 (SP: 24-1983)

In above formula with example (Figure 2) is clearly indicated for M15 Grade 7-days strength is calculated 10 N/mm2, its value is 66.5% we can say (Round off value) 65%. With the help of the above formula, it can also be determining day-wise compressive strength of concrete.

5.AS PER THE NEW CLAUSE OF AMENDMENT 5, IS: 456-2000

As per New clause 11.3.1.1, (Figure 3) in case of use of cements other than OPC or in case of use of mineral admixtures like fly ash and slag, in lieu of the minimum period specified in **11.3.1 col 3,** the stripping of formwork may be done in accordance with the provisions of **11.3.1 col 2,** provided concrete cube testing is done to ensure that the following minimum strength is achieved [3]:

a) 3 days: 45 percent of specified strength
b) 7 days: 60 percent of specified strength
c) 14 days: 85 percent of specified strength



AMENDMENT NO. 5 JULY 2019
TO
IS 456 : 2000 PLAIN AND REINFORCED CONCRETE — CODE OF PRACTICE

(Fourth Revision)

Amendment No. 5 to IS 456 : 2000

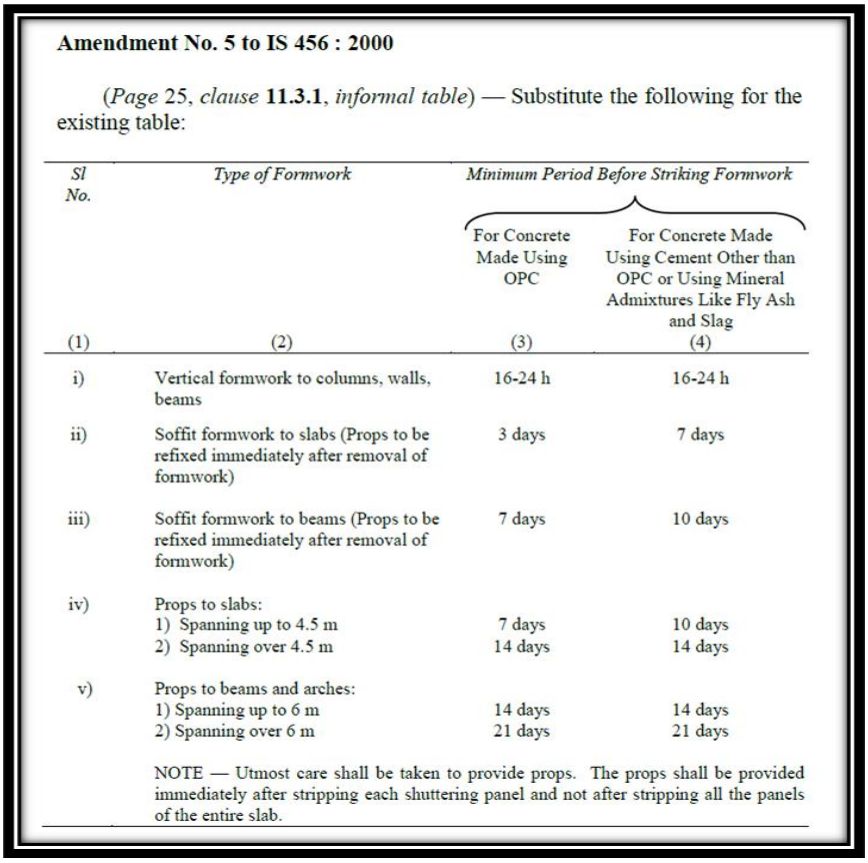
(*Page* 25, *clause* **11.3.1**) — Insert the following new clause:

'**11.3.1.1** In case of use of cements other than OPC or in case of use of mineral admixtures like fly ash and slag, *in lieu* of the minimum period specified in **11.3.1** col 3, the stripping of formwork may be done in accordance with the provisions of **11.3.1** col 2, provided concrete cube testing is done to ensure that the following minimum strength is achieved:

a) 3 days : 45 percent of specified strength
b) 7 days : 60 percent of specified strength
c) 14 days : 85 percent of specified strength

Figure 3: IS 456-200, Amend No-5, July2019

In the amendment No:5 of IS:456-2000 of clause 11.3.1 for Minimum Period Before Striking Formwork for various types of Formworks for OPC and other than OPC based concrete works (Figure 4) [3].



Amendment No. 5 to IS 456 : 2000

(*Page* 25, *clause* **11.3.1**, *informal table*) — Substitute the following for the existing table:

Sl No.	*Type of Formwork*	*Minimum Period Before Striking Formwork*	
		For Concrete Made Using OPC	For Concrete Made Using Cement Other than OPC or Using Mineral Admixtures Like Fly Ash and Slag
(1)	(2)	(3)	(4)
i)	Vertical formwork to columns, walls, beams	16-24 h	16-24 h
ii)	Soffit formwork to slabs (Props to be refixed immediately after removal of formwork)	3 days	7 days
iii)	Soffit formwork to beams (Props to be refixed immediately after removal of formwork)	7 days	10 days
iv)	Props to slabs:		
	1) Spanning up to 4.5 m	7 days	10 days
	2) Spanning over 4.5 m	14 days	14 days
v)	Props to beams and arches:		
	1) Spanning up to 6 m	14 days	14 days
	2) Spanning over 6 m	21 days	21 days
	NOTE — Utmost care shall be taken to provide props. The props shall be provided immediately after stripping each shuttering panel and not after stripping all the panels of the entire slab.		

Figure 4: IS 456-200, Minimum striking formwork

6.SUMMARY OF STUDY

- 7-days test only to get a relatively quicker idea of the quality of concrete, optional test for 7-days' compressive strength of concrete be carried out [1], [5], [6].
- In all the cases, the 28-days compressive strength shall alone be the criterion for acceptance or rejection of the concrete, as per the IS: 456-2000 [1], [5], [6].
- Based on the explanatory handbook, Standard code of practice IS: 456-1978 (SP: 24-1983), the compressive strength of concrete to be considered about 65% for 7 days concrete (Figure 2) [3].
- As per new clause 11.3.1.1 of IS:456-2000 of amendment No:5, other than OPC based concrete the compressive strength of concrete to be considered 60% for 7 days concrete (figure 3) [1].
- So, the 7-days compressive strength for OPC based concretes 65% and 60% for other than OPC based concretes (PPC, PSC etc. using mineral admixtures Like fly ash and slag) [1], [3].

7.CONCLUSION

It is mentioned with separate columns in amendment No:5 of IS: 456-2000 of clause 11.3.1 for Minimum Period Before Striking Formwork for various types of Formworks for OPC and other than OPC based concrete works.
In this paper, the total description asper Explanatory Handbook on Indian standard code of practice for plain and reinforced concrete IS: 456-1978 (SP: 24-1983) and IS: 456-2000 with amendment No-5, July-2019, 4th revision. Latest amendments (if any) not described.

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[6] Posannapeta Y Ganga Ram, "Acceptance Criteria of Concrete as per IS: 456- 2000, 4th Revision, Amendment No. 4, IJSRET, Volume 7, Issue 6, Nov-Dec-2021.
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