

A Comparative Case study of Compressive Strength of M45 and M40 Grade Concrete by Accelerated Curing Test method and Normal 28 days Curing Method

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Abstract: In this paper correlation in compressive strength of concrete using accelerated curing and normal 28days curing has been discussed. The work has been carried out especially on M45grade and M40 Grade concrete pump able mix. After finalisation of mix design cubes were casted for each grade as per Indian standard. The cubes were tested by accelerated curing test method specified in IS 9013:1978 and 28days compressive strength as per IS516:1959. These compressive strength results were analysed

It was observed that compressive strength of cubes after 28days curing and that of after accelerated curing have a variation ranges from 2% to 7%.approximately. Therefore it was concluded that under controlled test condition strength determined by accelerated curing test is always higher than normal 28days strength.

Keywords: Compressive strength, accelerated curing, water cement ratio, pump able concrete mix, hydration, IS method.

I. Introduction:

Compressive strength of concrete is the most important parameter to evaluate the construction quality of concrete. This parameter specify the Compressive strength of concrete at the age of 28days as prescribed by relevant Indian standard IS 456:2000. Traditionally the procedure adopted to determine the 28 days compressive strength is specified in IS 516: 1959. But this period is too much long and not suitable for speed construction practices. Thus, assessment of compressive strength of concrete at an early stage is demanded and specified by the accelerated curing test method prescribed in IS 9013:1978. The new method of accelerated curing needs to be compared with the actual results of traditional method of 28days period.

II. Materials And Test Method:

Following materials used in developing and designing concrete mix:

Cement: Portland Pozzolana Cement

Table 1: Properties of Cement

Property	Value	Specification
Make/Brand	Ultratech	IS1489:1991part1
Specific Gravity	3.15	
Consistency	31%	
Setting Time Initial (Minute)	160	
Setting Time Final (Minute)	205	
Compressive Strength At 28 Days (N/Mm ²)	53.89	

Water: Potable water was used as ingredient. Water is an important ingredient of concrete as it reacts with cement resulting in hydration.

Aggregates: Fine Aggregates and Coarse Aggregate.

Fine aggregate: River sand used as fine aggregate from Kotputli, Rajasthan. The sand was tested to comply as per IS383:1970 requirement.

Coarse aggregate: Two size 10mm and 20mm coarse aggregate taken from Pali, Haryana. The aggregates were tested to comply the requirement as per IS 383:1970.

Table 2: Properties of Fine Aggregate (River Sand)

Property	Value	Specification
Source	Kotputli	IS383:1970
Zone	II	
Specific Gravity	2.63	
W.A.	0.96	
Colour	Yellow Brown	

Table 3: Properties of Coarse Aggregate

Property	Value	Specification
Source	Pali (Haryana)	IS383:1970
Specific Gravity	2.64	
W.A.	0.30	
Colour	Greyish Black	

Admixture: Superplasticiser based on naphthalene formaldehyde sulphonate polymer used from SWC, confirming to IS9103:2003.

Table 4: Properties of Admixture

Property	Value	Specification
Make/Brand	SWC	IS9103:2003
Form	Liquid	
Sp. Gravity	1.235	
Ph	7.3	
Chloride Content	Nil	
Colour	Brown	

Table 5: Design stipulation

Data	M45 Grade Pumpable Mix	M40 Grade Pumpable Mix
Max Agg Size	20MM	20MM
Slump @90min	100-150	100-150
Exposure Condition	Moderate	Moderate
Quality Control	Good	Good
Target Mean Strength	53.25N/MM ²	48.25N/MM ²

Table 6: Mix Design Data

Data	M45 Grade	M40 Grade
Mix Type	Pump able	Pump able
Cement Content (Kg/Cum)	470	440
Water(Kg/Cum)	164	165
Fine Aggregate	679	688
Coarse Aggregate 20mm	640	648
Coarse Aggregate 10mm	426	432
W/C Ratio	0.35	0.38

III. RESULTS AND DISCUSSION

Concrete cube specimen of size 150mmx150mmx150mm were prepared and tested with respect to each of method. The cubes were tested on calibrated compressive strength test machine (CTM). Then compressive strength is calculated as per the expression:

$$\text{Compressive strength} = P/A$$

where P=Failure load in Newton, and A=cross sectional area of specimen in mm²

The results obtained for two different grades of concrete M45 and M40 has been tabulated. Three mix has been used for each grade and results summarised in table No.8. The table demonstrate

that results of accelerated curing test are higher than normal 28days curing test.

Table 7: Properties of Fresh Concrete

Property	Initial	After 90 Min
Slump Observed	Collapse	120-130

Table 8: Sample Identification Used

Sample ID	Description
M45A	M45 Grade Concrete Sample 1
M45B	M45 Grade Concrete Sample 2
M45C	M45 Grade Concrete Sample 3
M40A	M40 Grade Concrete Sample 1
M40B	M40 Grade Concrete Sample 2
M40C	M40 Grade Concrete Sample 3

Table 9: Properties of Hardened Concrete

Sample ID	28 days Comp Strength(N/MM ²)	ACT Comp. Strength(N/MM ²)
M45A	59.39	61.57
M45B	60.42	61.78
M45C	57.83	60.31
M40A	50.48	53.96
M40B	52.02	55.30
M40C	53.48	56.64

Table 10: %Variation In Compressive Strength

Sample ID	28days Comp Strength(N/MM ²)	Act Comp. Strength (N/MM ²)	%Variation In Calculated Comp. Strength
M45A	59.39	61.57	3.67
M45B	60.42	61.78	2.25

M45C	57.83	60.31	5.76
M40A	50.48	53.96	6.89
M40B	52.02	55.30	6.30
M40C	53.48	56.64	5.62

IV. Conclusion:

Accelerated curing test method was developed to cater the need of early assessment of compressive strength for concrete. This study has been conducted to find out the correlation of the Compressive strength obtained from two procedures which concludes that

(1) The strength results obtained by accelerated curing test are slightly higher than the results obtained by 28days compressive strength test.

(2)The variation ranges between 2% to 7% approximately. The variation seems to be more for M40 grade of concrete as compared to M45 grade.

References:

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