



Concrete Testing For 3D Concrete Printing

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Abstract : Concreting in a particular way, layer by layer and same as the derived design which makes the final constructed property attractive. Apart from this the additives and material mixture we use in regular day to day life, here it is slightly varies like the way it prints concrete mixture with specific additives (silica, lime, fly ash, etc) it sticks rapidly and makes stronger bond than other mixtures, so it is reliable quality of mixture to use for building construction. As per the reviews and reports people will adopt this new technology in future. Having so many advantages in a single method/machine and also people will make it more eco-friendly. As described here Eco friendly, which means we also found by our material mixture and testing method that if we use plastic waste (0.10%) in a mixture it will make a concrete somewhat durable and stronger too. The concrete grade we have here tested is M25 and M30 grade, the material tested results and detailed information we have derived below.

I. INTRODUCTION

The new era is extremely awaiting the change in every superior things and if we include the future of construction method, it goes to the different equipments, automation, techniques, use of machineries, less need of manpower and especially time management that all qualities in single machine can have is 3D concrete printing. 3D concrete printing word defines the machine that prints concrete layer by layer, concrete which is exactly flows through the nozzle in three axes in accordance of the coded data, so that it can print in a particular shape. This 3DCP machine was firstly invented by Charles Hull in 1984 and He is also known as the father of the 3D printing world. This new construction technology is also about the material and additive manufacturing AM. Additive manufacturing means the making of resultant material by the collection of relative materials in such proportion. In upcoming years new methods of construction will be optimized by the builders, where the time, energy and money will be saved. This will also give an impression to the construction costs and overall expenses. Here we have discovered some facts, advantages and disadvantages of this construction method in description.

Key words

Material testing for 3d concrete printing, concrete block strength ;etc

Concrete Tests

Casting M30	Curing	Size sample	Weight grams	Load KN	Strength	Requirement Is456
12-3-22	24-3-22	15x.15x115	8410	430.3	19N/mm ²	Min 19.5 N/mm ²
12-3-22	24-3-22	15x294.9x15	8570	478	20.11	For 7 days
12-3-22	24-3-22	15x15.2x15	8520	462.2	20.54	

- As we started casting of M30 concrete, we cured 3-3 different samples of concrete in various concrete blocks the results for the same are concluded in 7 days for some specific concrete cubes. As per IS 456 the 7 days curing system, concrete cubes should be strengthened nearby or minimum 19.5 N/mm². We loaded the blocks nearly around 450 KN in the concrete block and the weight of the concrete block was under 8500 gms. So, the obvious results came in between of 19 and 20 N/mm². For three of the blocks resulted are 19N/mm², 20.11 N/mm² and the last one took 20.54 N/mm².

In such cases the concrete cubes took much more time to cure and that initial setting
The concrete took more than 28 days. So far the results are nearly under the IS 456
results.

Casting date for M30	Curing date	Size sample in cm	Weight gms	Load KN	Strength N/mm ²	Requirement IS 456
20-1-22	22-2-22	15.1×15×15.1	9070	772.5	34.11	Min 30 N/mm ²
20-1-22	22-2-22	15×15×15	8795	699.3	31.08	As per IS456
20-1-22	22-2-22	15×15×15.1	8605	673.4	29.93	For 30 days

- Casting of M30 grade concrete for minimum 28 to 35 days in the cube size (15*15*15cm) with the weight of concrete mixture around 9000 gms. After that 30 days of curing the mixture was stiffened with the cube, so then started to test the concrete by doing a concrete strength test. Firstly started testing with a compressive strength test by loading 600-700 KN load on the cube and found the required strength nearby 29 to 34 N/mm². As per IS 456 the required standard strength of the cube for 30 days is 30 N/mm². So, our results matched nearly to the standard requirements.

Another starting of casting M25 concrete in the way of 14 and 28 days for initial and final phase, it starts making strength day by day. The relative information and testing results are shown below in the table.

Casting date for M25	Curing date	Size sample(cm)	Weight gms	Load KN	Strength N/mm ²	Requirement as per IS 456
24-12-21	27-1-22	15*15*14.9	8530	614.4	27.31	Min 25 N/mm ²
24-12-21	27-1-22	15*15*15	8745	643.7	28.61	For 28 days.
24-12-21	27-1-22	15*15*15	8430	589.9	26.22	

Casting date for M25	Curing date	Size sample in cm	Weight gms	Load KN	Strength N/mm ²	Requirement as per IS 456
13-01-22	21-01-22	14.7*15.2*15.2	8550	412.6	18.47	Min 16.50 N/mm ²
13-01-22	21-01-22	15*15*15	8730	399.8	17.77	For 07 days.
13-01-22	21-01-22	15*15*15	8495	396.6	17.63	

- The table derives that concreting for 28 days gives strength around 27 N/mm² by applying 600 KN load over the block. There are three different test results for the same M25 concrete. The results for three of them are all nearly related to the standard requirements.
- The curing of M25 concrete for 7 days and the requirements for the same will be around 16.50 N/mm² as per IS 456 standard codes. After the testing of these concrete blocks the results came nearly to 16.50 N/mm².

Comparison:

M25 and M30 grade of concrete performs in the way of bonding and strength for the stiffness in between the particles. For 7 days of curing M30 grade concrete block it gives overall 19.5 N/mm² strength after applying load over it and after the whole testing process. On the other hand, M25 grade concrete gives overall 17.00 N/mm² strength of the block. So, the resultant strength is of M30 grade of concrete.

For 28 days of final setting time of concrete block it gives higher strength than 7 days of initial setting time, as the results says for M30 grade of concrete block gives overall 31 N/mm² strength and for other side M25 grade of

concrete block gives total 26 N/mm² strength. Here, the higher strength was achieved by M30 grade of concrete than M25 grade concrete.

REFERENCES

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- [4] IS 516:1959 - Method for test for the strength of concrete

