STRESS STRAIN ANALYSIS OF STANDARD AND HIGH STRENGTH CONCRETE

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ABSTRACT

This documentation presents the analysis of standard and high strength concrete with stress-strain relation. Many researchers have been performed on stress-strain analysis by using UTM machineries and other analytical works, but this paper includes usage of Compress meter for finding of stress-strain analysis. To know the perfect behaviour of any material we need to analyze ultimate strength, strain and its maximum elasticity, and the values obtained are clearly mentioned in the main content in form of tables and graphs. We all know that high strength concrete is the higher load resistance material obtained by reducing water-cement ratio and adding super plasticizers. This research work includes the different trial works to obtain high strength concrete and the maximum obtained strength is 77.1 N/mm² and other values are clearly mentioned in conclusion and graphs with different curing periods (i.e. 14, 28, 56, 90 days of curing).

KEYWORDS: Ultimate Strength, UTM Machines, Elasticity, Compress Meter

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INTRODUCTION

We all know that different types of researches are going on concrete from the past two decades, different types of materials and chemicals are developed to obtain the high strength concrete by replacing the cement and other materials of concrete. Here in this research work I have been replaced the cement with silica fume and reduced the water-cement ratio to 0.23 and added the Tamcem 60R superplasticizer.

High strength concrete is very much different from the standard concrete in form of strength, materials, mixing, etc. The main important features of high strength concrete are higher load resistance, against chemical attacks, durability, etc.

MATERIALS AND TRIALS FOR HIGH STRENGTH CONCRETE

There is no specific code for the high strength concrete mean like standard concrete, one has to perform different trial methods until they obtain the designed high strength concrete. Here I have mentioned the materials and the specific codes used.

Cement-OPC 43 grade and tests are performed according to IS-12269-1989.

Aggregates- Tests are performed according to IS: 2386 (part 1-8).

Water- bacterial free water and codes used are IS 3025-1964 and revised edition IS 456- 2009.

Silica fume- It is the material obtained from coal industry which is 100 times smaller than the cement.

Superplasticizer- Different superplasticizers are there in the market which is used to reduce water- cement

ratio, one can use any Superplastizer available in the market with care full instructions and guidance of chaperons. I have been used Tamcem 60R Superplastizer, where it can be used at 1.5 to 2.0 % weight of cement.

All the densities of different materials mentioned above are clearly given in the table number 1.

Table 1: Mix Proportions and Densities

Mix No	M1	M2	M3	M4
Cement (Kg/m ³)	564.29	455.01	505.82	546.09
Fine aggregate (Kg/m ³)	689.23	727.82	698.02	689.23
Coarse aggregate (Kg/m ³)	1143.8	1207.83	1187.4	1143.8
Water(kg/m ³)	137.9	137.9	137.9	137.9
W/C ratio	0.23	0.27	0.25	0.23
Slump	75	80	80	80
Silica fume (Kg/m ³)	42.47	50.55	55.83	60.67
Superplasticizer	1.5%of cement	1.5%of cement	1.7% of cement	1.8%of cement

Four trials have been done, in which Mix 4 has obtained the high strength of 70.9 N/mm². For the comparison of high strength concrete, I have elected the normal grade concrete of M25 grade. The strengths of each cube are clearly mentioned in form of graphs for standard and high strength concrete.

Figure 1: Compressive Strength of M60 Cubes.

Figure 2: Compressive Strength of M25 Cubes.

METHODOLOGY FOR STRESS STRAIN ANALYSIS

To find the stress and strain the gauge length of the Compress meter and area of cylinder is to calculated.

- The ratio of the gauge value to the gauge length is the strain in cylinder, were as gauge value is the dial reading of the Compressometer.

Strain = Gauge value/Gauge length.

Gauge length is equal to 150mm which is the diameter of the cylinder.

- Stress is calculated by the formula load to the area

Stress = Load/area

Area =17662.5 mm².

- Modulus of elasticity = stress / strain

Different graphs were plotted for stress strain behavior of each cylinder with various curing periods.

Figure 3: Stress-Strain Graph of M60 Grade Concrete.

Figure 4: Stress-Strain Graph of M25 Grade Concrete.

The above graphs show the variation in stress-strain of M60 and M25 grade concrete for 28, 56, 90 days of curing.

Figure 5: Comparison of Stress-Strain Graph for M60 Grade and M25 Grade.

CONCLUSIONS

- The trial mix number 4 of M60 grade with 10% replacement of silica fume and 0.23 water- cement ratios gave the satisfactory results with 70.9 N/mm² for 28days, 72.89 N/mm² and 77.1 N/mm² for 90 days of curing.
- The elasticity and strain observed are clearly mentioned in the below given table.

Table 2

Age	28 days			56days			90 days		
	Max stress	Strain	E(N/mm ²)	Max stress	Strain	E(N/mm ²)	Max stress	Strain	E(N/mm ²)
M25	25.60	0.0011	23387.22	30.26	0.00123	24808.86	34.29	0.0012	28740.83
M60	61.7	0.0016	35061.9	68.65	0.0019	35632.8	72.77	0.0020	37651.7

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