A BEHAVIORAL TESTING STUDY OF ULTRA HIGH PERFORMANCE CONCRETE

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Abstract - Concrete is the most widely used building material developed in the last century. It has a depressing power but no conflict. In IS / 456-2000 cement concrete is designated with its 150mm cubic pressure with 28 days in N / mm2. Mark separation has been done as standard concrete for M-10 to M-20, standard concrete for M-25 to M-55, high performance concrete for M-60 to M-80 and now a new grade has been developed such as Ultra High Performance Concrete. High-performance concrete, lasts much longer than conventional concrete due to the strength and impermeability of chloride penetration. The concrete mix is made of ordinary water materials, Portland cement, and good mixing and learning, but with admixtures that improve performance. When concrete strength is greater than M-80 it is called Ultra high performance concrete. Also called active powder concrete (RPC). It is a ductile top made of a mixture of Portland cement, silica smoke, quartz flour, fine silica sand, a water-repellent agent, water, and metal or living fibers. The material provides compressive strength and flexural strength up to 50Mpa.

If we talk about worldwide construction industry Reinforced concrete is widely used material. The use of Ultra high-strength concrete has increased due to its obvious advantages such as increased durability, chemical resistance, soluble resistance, more low shrinkage and lower penetration.

Ultra-high-strength concrete is a safe material that enhances the quality of concrete when used as a compressor. However, high-strength concrete shows more cracking than conventional strength concrete, and thus the shrinkage of the structure decreases.

UHPC demonstrates unprecedented durability in standard concrete, allowing metal dissolving in other applications. The use of UHPC allows the phase size to be reduced, utilizing advanced materials that are not associated with the rust and corrosion that is often associated with concrete and steel construction. This resistance is directly related to the long service life that can be achieved through the use of UHPC, making it an ideal asset for many construction applications, especially bridge buildings.

***Key Words* - Ultra High Performance Concrete, chemical resistance, soluble resistance, unprecedented durability, low shrinkage and lower penetration.**

1.INTRODUCTION

UHPC (high performance concrete) is a brand new concrete that exhibits very high mechanical properties than conventional concrete and high concrete performance. The main features that distinguish UHPC from reinforced concrete are improved strength strength, durability, the addition of steel wires, and resistance to corrosion and corrosion. The mechanical features of UHPC allow for smaller, smaller, lighter components to be built while energy is stored or upgraded. The use of UHPC is limited to a few architectural applications due to the high cost of building materials and the lack of established construction guidelines. As the construction of high-rise buildings and high-rise buildings grows around the world, the strength and durability of buildings is enhanced by the use of Ultra-high strength concrete. With such a trend, the demands of using 100Mpa or Ultra-high-strength concrete over what is expected to be widespread. The use of Ultra high-strength concrete has increased due to its obvious advantages such as increased durability, chemical resistance, soluble resistance, more low shrinkage and lower penetration.

Ultra-high-strength concrete is a safe material that enhances the quality of concrete when used as a compressor. However, high-strength concrete shows more cracking than conventional strength concrete, and thus the shrinkage of the structure decreases.

CONTENT

In the following section, the results obtained from testing of fourteen specimens of beams casted for flexure and shear is included in this experimental program is presented and discussed. The results recorded for each test included measurements of load, deflection, bottom steel strains and strains at four points on the beam surface at the center of the span at various load stages. The things reported after observation are load propagation, crack pattern and failure at ultimate load.

The testing of the beam specimens were grouped into three series. Series-1 consisted of total 10-beam :8-beams with dimension of 150mm*200mm by 1600mm made of a concrete grade of 2-beam of M-30, 2-beam of M-60 ,2-beam of M-80 and 2-beams with dimension of 150mm*300mm by 2100mm 1-beam is made of M-100 and 1-beam is made of M-80 and series-2 consisted of 4-beams with dimension of 150mm*200mm by 2000mm 2-beam is made of M-80.

- **Mechanical properties of concrete from which the beam is made**

In this experiment, specimen was produced by using 100mm by 100mm mould for cube compressive strength test of ultra high strength concrete along with the other mix is done and the results are shown in the following table.

Mix	7-day Compressive Strength Cubes	28-day Compressive Strength Cubes	FLEXURAL STRENGTH MPa $fb = \frac{pl}{b*d*d}$ Beams 100x100x500 mm
CCB1	27.5	42.33	5.10
CCB2	27.5	39	4.70
HRCB1	56.33	67	10.60
HRCB2	51.55	73	9.30
H-RCB1	53.66	76	9.60
H-RCB2	65.75	89.5	12.20
URCB	86.00	101	15.30

Table 1. showing Compressive strength and flexural strength of 7 days and 28 days

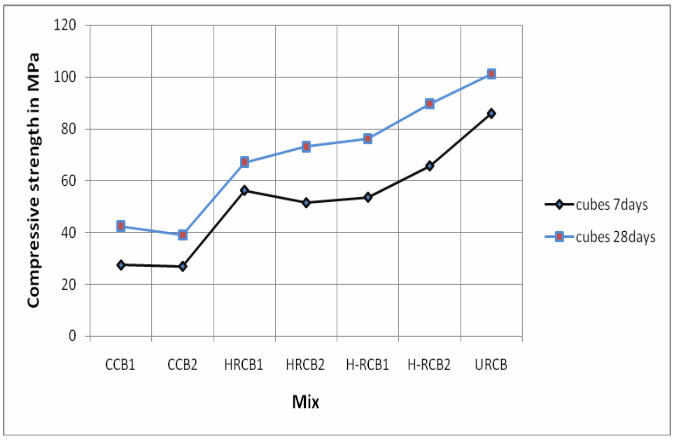

Fig.1. 7 days and 28 days compressive strength vs. Mix

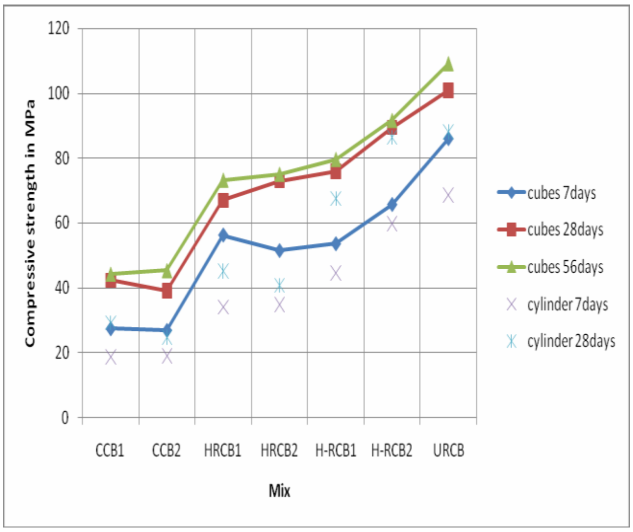

Fig. 2. Graphs of compressive strength (Daniel)

The tables and graphs given below represents the outcome of the mixes used. These values are results from test on new machine UTM-Heico, capacity 300 tonnes. The compressive stress- strain responses of different concrete varies because concrete is a heterogeneous material and the test method used in some specimen are different i.e. load control mode and displacement control mode. In load control mode the load capacity of IS-456-200 which is 140Kg / cm / min of cubes and 120 kg / cm / min of cylinder is accepted. The compressive failure of UHPC was found to be similar to the compressive failure of any fibre-reinforced concrete. In common terms, UHPC fails under compressive axial load through strong lateral expansion. This lateral expansion is slightly restricted by the tightening of the inner steel plate, thus allowing more ductile failure than expected. As illustrated, fibres reinforced substantially enhance the toughness and ductility of concrete. If the materials were classical brittle, the loading curve would be linear till peak load and drop sharply, however cementations material are not classical brittle, rather, their response is quasi-brittle, showing inconsistency with the line before reaching the maximum load and decreasing gradually after the maximum load. It can be also seen that with the decrease of water/cement ratio and the introduction of pozzolanic materials like fly ash and silica fumes strength tends to increase.

Plot of stress vs. strain of each mix are shown. From the graph, the stress versus strain behaviour of concrete under uniaxial compression is initially linear, in this stage, stress is proportional to strain and elastic strain is recovered at unloading. With the production of small fragments, the behavior becomes inconsistent and ineffective. As the sample attains the ultimate stress i.e. in the failure of the load, the pressure resists the decrease with increasing weight. For High strength and UHPC under uniaxial compression, the ascending and descending branches are steep slopes. The slope of linear portion of the curve is the modulus of elasticity. The modulus of elasticity of UHPC is significantly higher than normal concrete and high strength concrete.

Table 2. Test sample and result of M-30 Concrete

SAMPLE DESCRIPTION		TEST RESULTS	
Test Type	CTM	**Peak Load(kN)**	393.46
Test Mode	Load	**Max. strain at peak load %**	0.001234
Sample ID	C		
Sample Type	Cuboidal	**Compressive Strength (N/Sq.mm)**	39.34
Age days	28	**Modulus(N/Sq.mm)**	2750
Sample dimension in mm	100x100x100		
Area Sq.mm	10000		

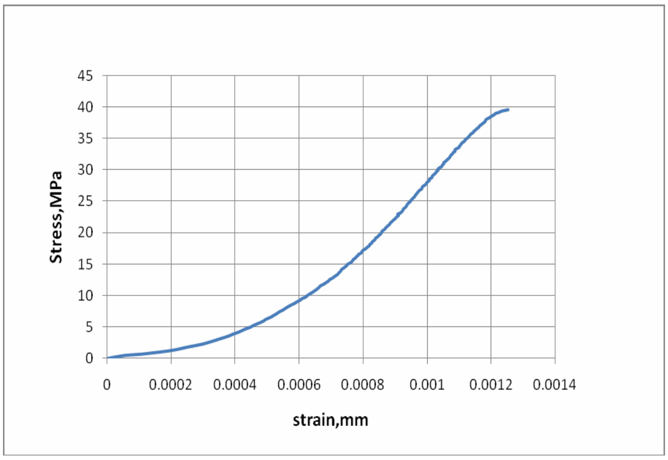

Fig. 3. Stress-strain of M-30 concrete

Table 3. Test sample and result of M-60 concrete

SAMPLE DESCRIPTION		TEST RESULTS	
Test Type	CTM	**Peak Load(kN)**	524.6
Test Mode	load	**Max. strain at peak load %**	0.001405
Sample ID	H1		
Sample Type	cuboidal	**Compressive (N/Sq.mm)**	59.03
Age days	28	**Modulus(N/Sq.mm)**	6666.67
Sample dimension in	100x100x100mm		

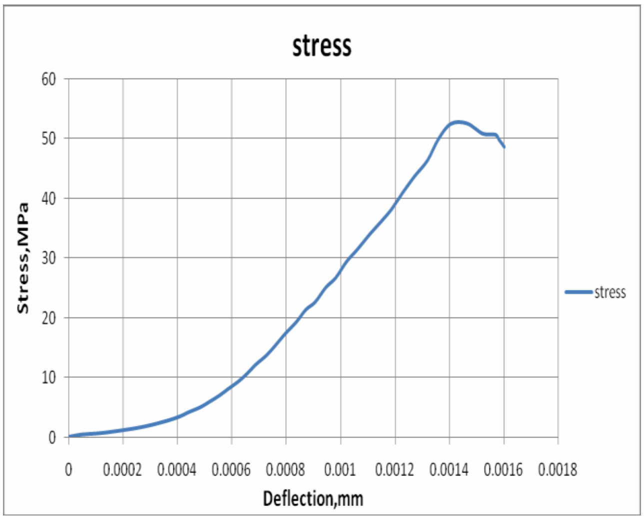

Fig.4. Stress-strain Curve of M-60

Table 3. Test sample and result of M-80 Concrete

SAMPLE DESCRIPTION		TEST RESULTS	
Test Type	CTM	**Peak Load(kN)**	790.2
Test Mode	load	**Max. strain at peak load %**	0.001785
Sample ID	H1		
Sample Type	cuboidal	**Compressive (N/Sq.mm)**	59.03
Age days	28	**Modulus(N/Sq.mm)**	6666.67
Sample dimension in	100x100x100mm		

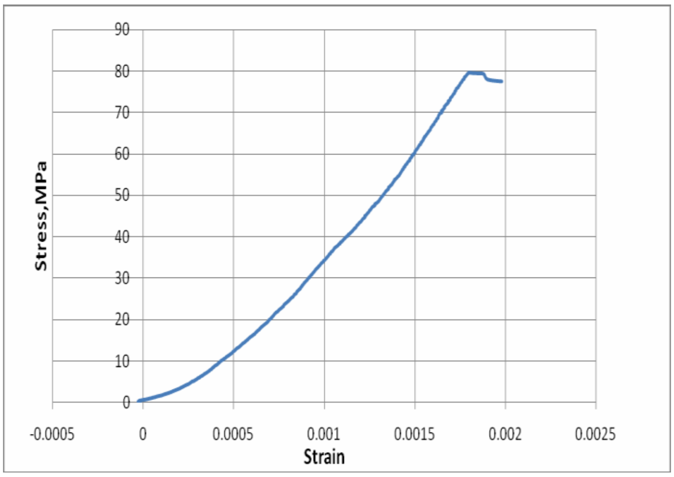

Fig.5. Stress-strain Curve of M-80

Table.5. Test result of M-100

SAMPLE DESCRIPTION		TEST RESULTS	
Test Type	CTM	**Peak Load(kN)**	1128.8
Test Mode	Load	**Max. strain at peak load**	0.002 602
Sample ID	U2		
Sample Type	cuboidal	**Compressive (N/Sq.mm)**	109.9
Age days	56	**Modulus(N/Sq.mm)**	7000
Sample dimension in mm	100x100x 100		
Area Sq.mm	10000		

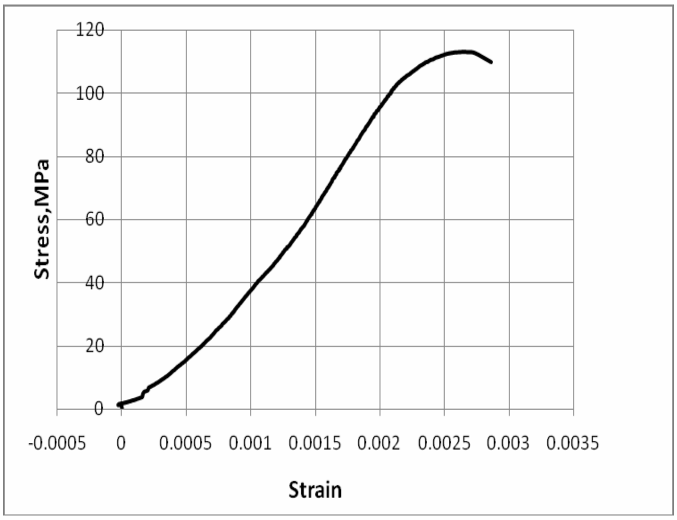

Fig.6. Stress-strain Curve of M-100

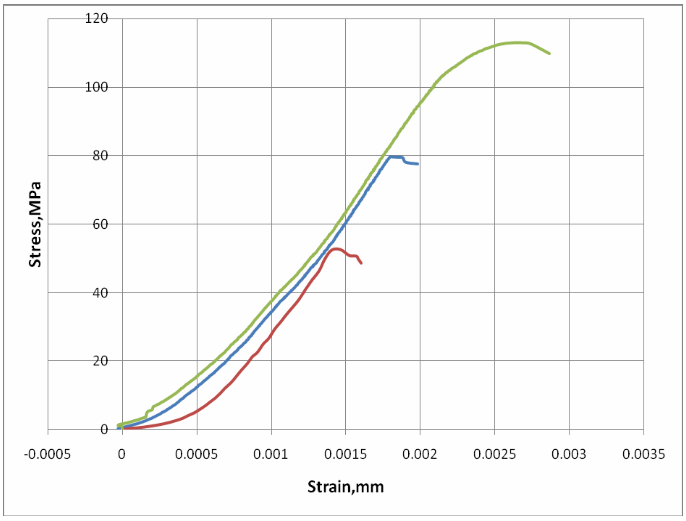

Fig.7. Comparison of Stress-strain Curve of the concretes

CONCLUSION

1.UHPC is new technology of concrete that constitutes a breakthrough in concrete mix design is characterized by a very high dense microstructure and very high compressive strength achieving.

2.The strong strength of UHPC, before and after hardening cracks, is much higher than the strength from ordinary concrete

3.UHPC displays significantly improves visual assets compared to conventional HPC.

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BIOGRAPHIES (Optional not mandatory)

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