Experimental Analysis Of High Performance Concrete With Different Case Of Silica Fume

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***Abstract:* The modern concept of HPC has been broadened to include strength and durability. Applications for high-performance concrete (HPC) in civil engineering are quite diverse and include everything from thin pavements to large constructions like bridges and high-rise skyscrapers. When better mechanical and/or durability qualities are required, HPC is frequently selected. In this research, three cases taken, one is normal case without any change in concrete design, which named HPC and remaining two cases the steel fiber percentage taken 0.7% and percentage of silica fume are added 10 and 20 percentage which named HPC1 and HPC2 respectively. then compare their results in term of compressive strength for 7th day, 14th day and 28th day for M45 grade.**

***Keywords* :- Steel fiber, silica fume, concrete design and compressive strength etc.**

I. INTRODUCTION

The use of High Strength concrete is used in the construction of Earth-quake resistant structures, long-span bridges, off-shore structures and other mega structures will result in lighter sections, leading to cost effectiveness of structures. The above benefits of HSC has been used more widely in the recent years for the construction of important structures like tall buildings, bridges , viaducts, etc.

"High Performance Concrete is concrete that has been specifically chosen to meet its intended use." It's not mysterious, doesn't require strange substances, and doesn't require the usage of specialized equipment. To create a concrete mix within strictly regulated tolerances, all we need is an awareness of the behavior of the concrete.

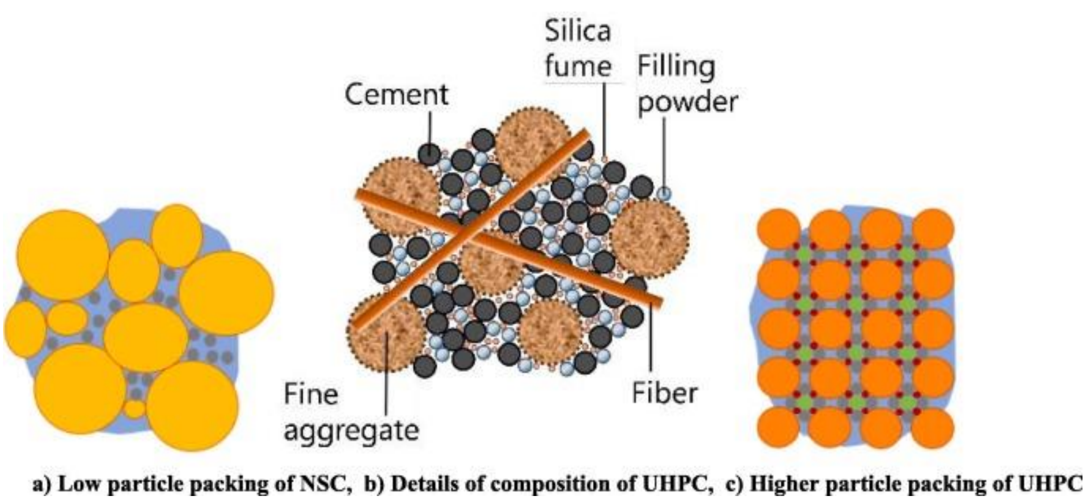


Figure 1 Composition

II. METHODOLOGY

The step by step procedure of mix proportioning is as follows: The target mean strength is determined is as follows

$$F_t = F_{CK} + K.S$$

Where
F_t = Target mean compressive strength at 28 days
F_{CK} = Characteristic compressive strength at 28 days
S =Standard deviation, upon the accepted proportion of low result
And the no. of tests (see table 4.1)
K = A statically value depending upon the accepted proportion of low results and
The no. of tests (see table 4.2)
Note- As per IS: 456- 1978, the characteristic strength defined as that value below
Which is not more than 1 in 5 of the test results is expected to fall. In such case,
k=1.28

Table: 1 Assumed standard deviation

Grade of concrete	Assumed standard deviation N/Sq.mm
M 10	4.0
M 15	4.0
M 20	3.5
M 25	4.5
M 30	4.5

Table 2 VALUE OF K

Accepted proportion of low results	K
1 in 5	0.79
1 in 10	1.15
1 in 15	1.58
1 in 20	1.74
1 in 40	1.89
1 in 100	2.11

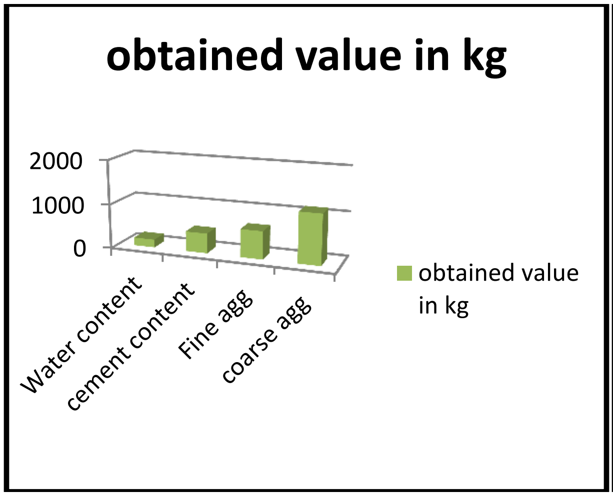
MIX DESIGN IN ACCORDANCE WITH IS: 10262-1982

Step 1
Design Stipulations

1. Characteristic compressive strength required in the field at 28 days = 45 N/mm2
2. Maximum size of aggregate = 20mm
3. Degree of workability = 0.9(compacting factor)
4. Degree of quality control = very good
5. Type of exposure = mild
6. Minimum Cement (As per contract) =450kg/m^3
7. Maximum water cement ratio (As per contract) = 0.45

Table 3 Results table

Details	Water cement ratio	Cement content	Fine aggregate content	Coarse aggregate content
Obtained values	180 lit	450 kg	630 kg	1133 kg
Ratio as per cement content	0.4	1	1.4	2.51



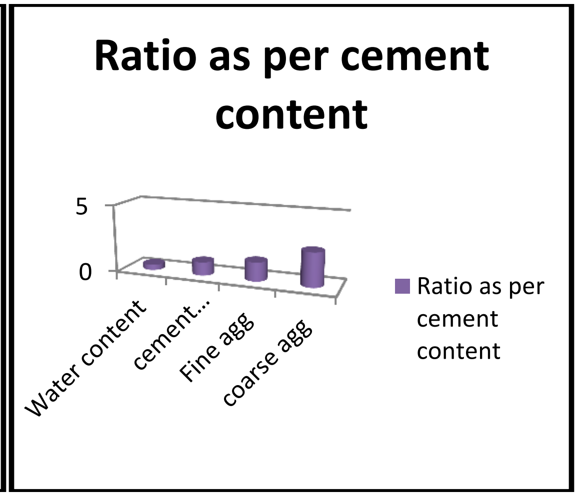


Figure 2 Results values

Table 4 Casting of Specimens

S.No	Type	% of silica fume added in F.A	% of steel fiber added in C.A	% of super plasticizers added in water
1	**HPC**	**NIL**	**NIL**	**NIL**
2	**HPC1**	**10**	**0.75**	**1**
3	**HPC2**	**20**	**0.75**	**1**

III. RESULT AND DISCUSSION

The design concrete mix involves the determinate of the most rational proportion of ingredients of concrete to achieve a cone which is workable in its plastic state and will developed the rare qualities when hardened. A properly designed concrete mix should have minimum possible cement content without sacrificing the concrete quality in order to make it concrete mix.

Table: 5 7 Days Compressive Strength Of Concrete Cubes

S .No	Specimen	Applied load (kN)	Average Load (kN)	c/s area sq.mm	Stress N/sq.mm	% increase Strength
HPC	1 2 3	310 320 325	318.33	10000	31.83	---
HPC1	1 2 3	330 335 340	335	10000	33.5	5.14
HPC2	1 2 3	345 350 360	351.66	10000	35.16	10.09

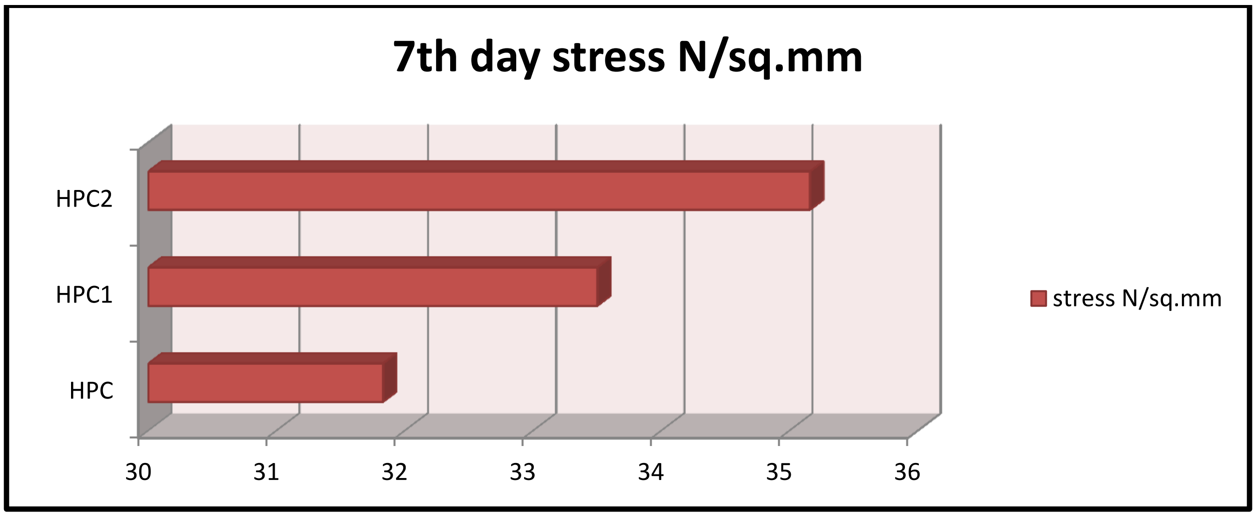


Figure 3- 7 Days Compressive Strength Of Concrete Cubes

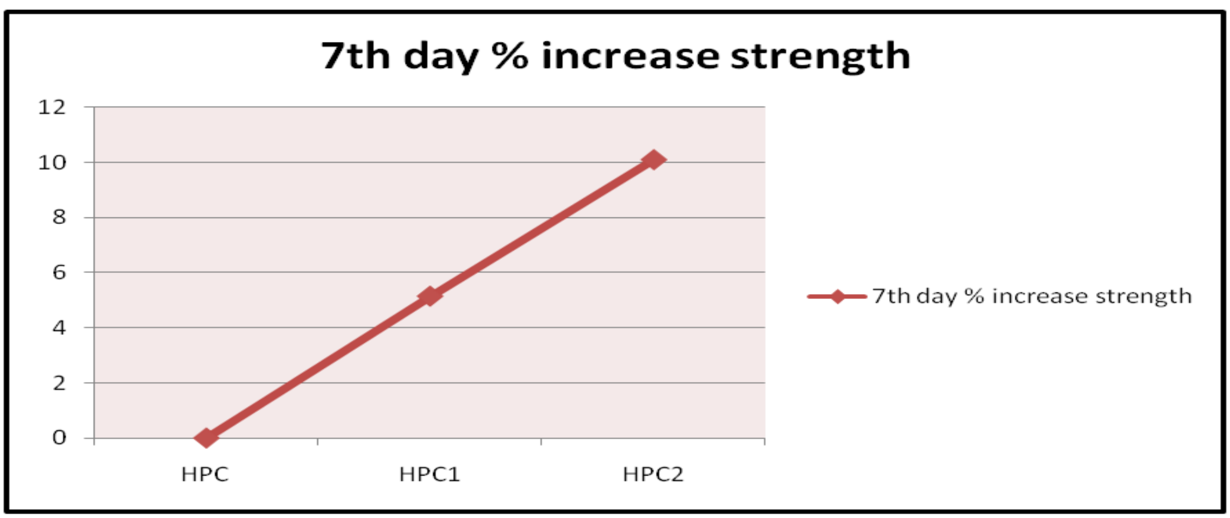


Figure: 4- 7 Days % increase Strength Of Concrete Cubes

Table: 6- 14-Days Compressive Strength Of Concrete Cubes

SI.No	Specimen	Applied load (kN)	Average Load (kN)	c/s area sq.mm	Stress N/sq.mm	%strength increase
HPC	1 2 3	370 380 390	380	10000	38	---
HPC1	1 2 3	400 410 420	410	10000	41	7.89
HPC2	1 2 3	430 440 450	440	10000	44	14.61

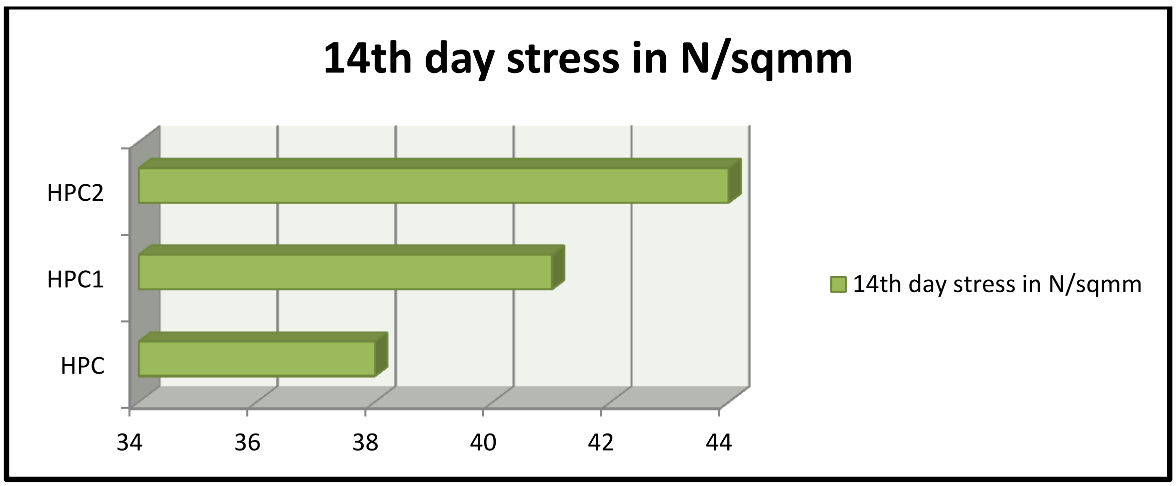


Figure: 5- 14-Days Compressive Strength Of Concrete Cubes

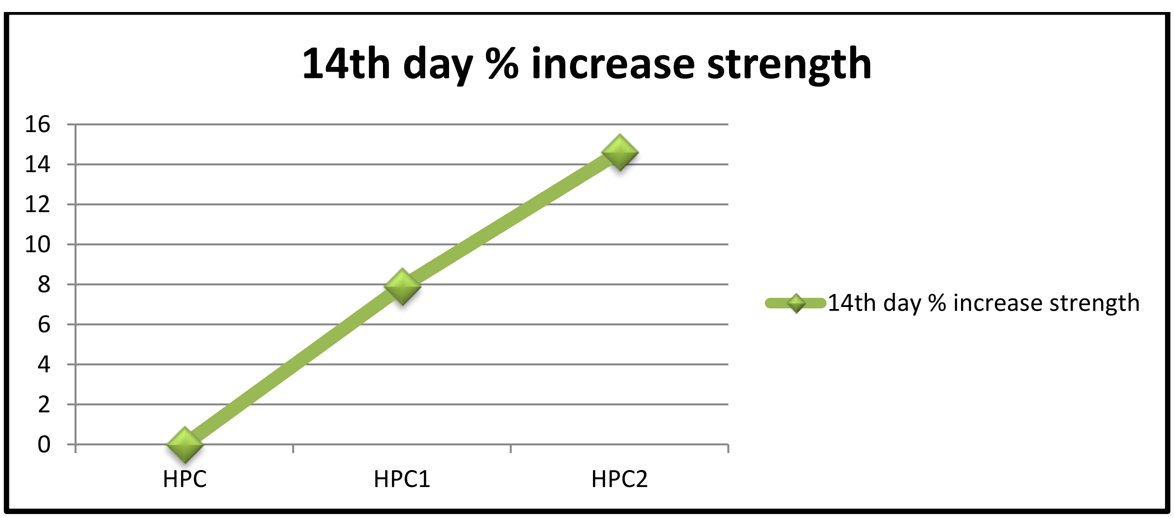


Figure 6- 14 Days % increase Strength Of Concrete Cubes

Table 7- 28-Days Compressive Strength Of Concrete Cubes

SI.No	Specimen	Applied load (kN)	Average Load (kN)	c/s area sq.mm	Stress N/sq.mm	% strength increase
HPC	1 2 3	435 440 445	440	10000	44	---
HPC1	1 2 3	450 455 460	455	10000	45.5	3.40
HPC2	1 2 3	465 470 480	471.66	10000	47.16	7.04

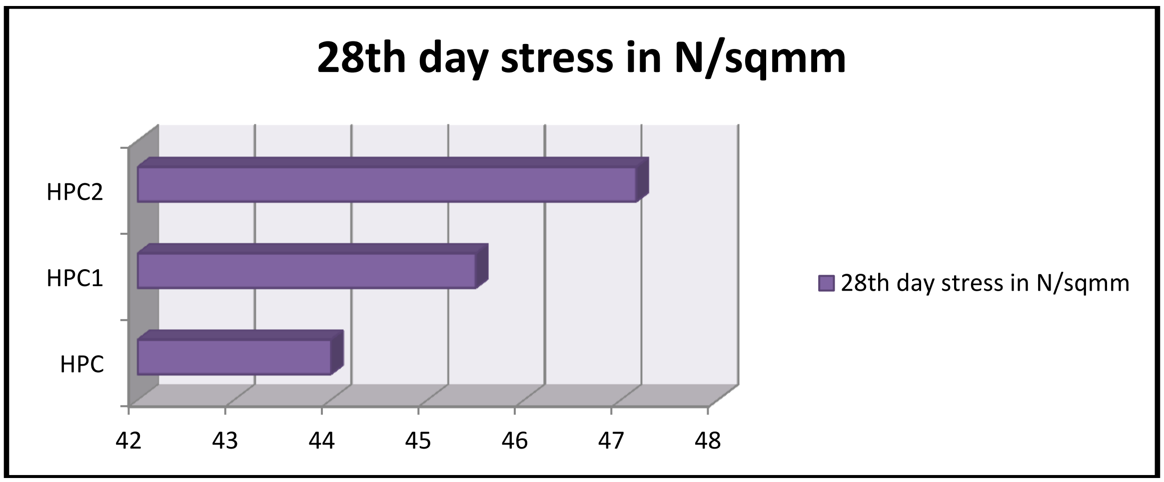


Figure: 7 28-Days Compressive Strength of Concrete Cubes

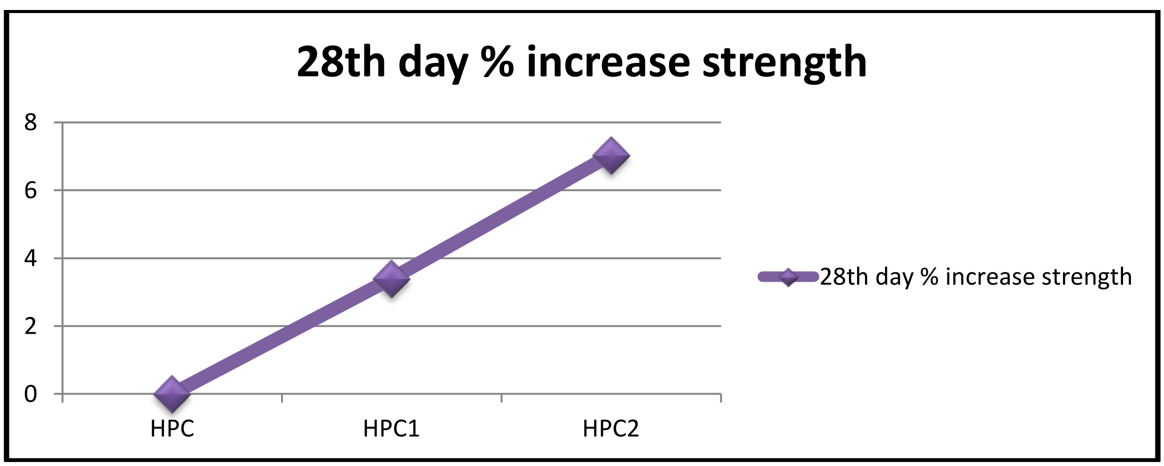


Figure: 8 28-Days % increase Strength of Concrete Cubes

IV. CONCLUSION

The experimental research lead to the following conclusions.
• Adding fiber and silica fume to concrete increases its compressive strength; however, adding only 0.75% and 20% of silica fume to the concrete shows some improvement in strength.
• Super plasticizer increases the concrete's strength, workability, and resistance to chlorides.
• There is no doubt that adding fibers to concrete increases its capacity to arrest cracks. • Concrete cubes' compressive strength also rises in response to fiber addition. 19.07% more compressive strength is obtained after 28 days of adding 20% silica fume and 0.75% fiber.

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