Stage -2 By considering the optimum percentage of admixture, preceding to find the Maximum percentage of steel fibers (0.5 %, 0.75 %, 1 %, 1.5 %, 1.75 %, 2 %).

Stage -3 By keeping the admixture content at optimum, finding out the optimum metakaolin Percentage (1 %, 2 %, 3 %, 4 %, 5 %).

Stage -4 Now, by taking optimum values of admixture, steel fiber and metakaolin

(a) Making a trail (C.G), using general water

(b) Making a trail (C.M), using magnetic water

The mix design for self-compacting concrete M40 grade is made according to code of practice ASTM C-904.

Table 9. Proportions of mix design

Si. No	Cement	Fine aggregate	Coarse aggregate	W/C ratio	Super plasticizer
1	550	770.47	948.90	165	4.4
	1	1.400	1.172	0.30	0.8%

5. RESULTS AND DISCUSSIONS

Test series consisted of 108 cubes and 54 cylinders of 18 different mixes at 18 different ratios of materials. The dimensions of cube specimens are 150 mm × 150 mm × 150 mm and cylinder specimen having dimensions of 300 mm height, 150 mm diameter Tests were conducted after curing the specimens for 7, 14 and 28 days respectively.

Graphs are plotted between compressive strength and % of Admixture added to the mix proportion. Here the compressive strength values varied in 7 Days, 14Days and 28-days is shown in Figure 1.

Graphs are plotted between compressive strength and % of steel fibers added to the mix proportion. Here the compressive strength values varied in 7 Days, 14 Days and 28Days is shown in Figure 2.

Table 10. S.C.C test results for admixture trials where AM is the admixture

Mix design	% AD	Slump test (mm)	T50 slump (sec)	L- Box (sec)	V- funnel (sec)	J-ring (mm/ sec)	U- funnel (sec)
AM-1	0.6	610	2.0	8	9	620/9	22
AM-2	0.7	600	1.6	9	8	640/8	18
AM-3	0.8	640	1.8	10	10	600/7	20
AM-4	0.9	620	1.7	8	8	610/8	24

Note: AM is the admixture; same as below.

Table 11. Admixture optimum test results of compressive strength

Si. No	Mix design	% Admixture	7-Days Mpa	14-Days Mpa	28-Days Mpa
1	AM-1	0.6	33.4	42.2	45.2
2	AM-2	0.7	35.7	44.4	47.5
3	AM-3	0.8	40.6	46.2	50.7
4	AM-4	0.9	36.2	42.2	46.7

Table 12. S.C.C test results for steel fiber trails

Mix design	% Steel fiber	Slump test (mm)	T50 slump (sec)	L- Box(sec)	V-funnel(sec)	J-ring(mm/sec)	U- funnel(sec)
SF-1	0.5	620	1.8	9	8	600/7	24
SF-2	0.75	640	1.7	8	8	620/9	18
SF-3	1	650	2.0	8	9	610/8	19
SF-4	1.5	700	2.0	9	9	640/9	23
SF-5	1.75	680	1.9	9	8	620/8	20
SF-6	2	650	1.8	8	9	640/9	24

Note: SF is the steel fiber; same as below.

Table 13. Steel fibers test results of compressive strength

Si. No	Mix design	% Steel fiber	7-Days Mpa	14-Days Mpa	28-Days Mpa
1	SF-1	0.5	41	48.1	52
2	SF-2	0.75	42.5	50.2	53.4
3	SF-3	1	44	50.8	55
4	SF-4	1.5	48	51	56.2
5	SF-5	1.75	45.1	49	52
6	SF-6	2	43.6	45.4	51.2

Table 14. S.C.C test results for metakaolin trails

Mix design	%Mk	Slump test (mm)	T50 slump(sec)	L- Box(sec)	V-funnel(sec)	J-ring(mm/sec)	U-funnel(sec)
M-1	1	630	1.2	8	8	630/8	22
M-2	2	650	1.3	9	9	640/9	20

M-3	3	640	1.5	8	8	610/8	24
M-4	4	650	1.8	10	8	620/7	23
M-5	5	660	2.0	9	9	640/8	22

Note: MK is the metakaolin

Table 15. Metakaolin test results of compressive strength

Si. No	Mix design	% Metakaolin	7-Days Mpa	14-Days Mpa	28-Days Mpa
1	M-1	1	40.8	49.2	51
2	M-2	2	41.6	50	53.2
3	M-3	3	44	50.4	54.5
4	M-4	4	46.2	54	55.2
5	M-5	5	45.2	51.2	52.1

Table 16. S.C.C test results on combination trail with general and magnetic water

Mix design	Slump test (mm)	T50 slump (sec)	L- Box (sec)	V- funnel (sec)	J-ring (mm/ sec)	U- funnel (sec)
CG	630	1.2	8	8	630/8	22
CM	650	1.3	9	9	640/9	20

Note: CG = combination with general water; CM = combination with magnetic water.

Table 17. Compressive strength on combination trail with general and magnetic water

Si. No	Mix design	7-days Mpa	14-days Mpa	28-days Mpa
1	CG	55.2	66	70.2
2	CM	58.3	69.9	77.5

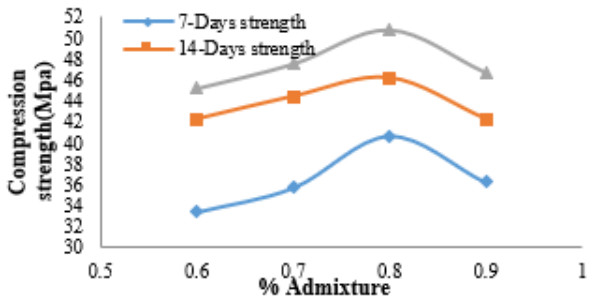

Figure 1. Graph between % admixture and compression strength

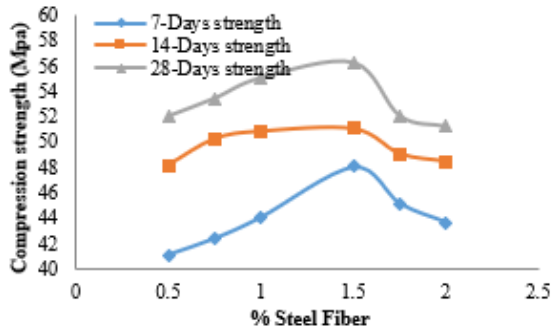

Figure 2. Graph between % steel fiber and Compression strength

Table 18. S.C.C test results for cylinder trails

Sample	Slump test (mm)	T50 slump(sec)	L- Box(sec)	V-funnel(sec)	J-ring(mm/sec)	U- funnel (sec)
Admixture	630	1.2	8	8	630/8	22
Steel fiber	650	1.3	9	9	640/9	20
Metakaolin	640	1.5	8	8	610/8	24
Comb + general water	650	1.8	10	8	620/7	23
Comb + Magnetic water	660	2.0	9	9	640/8	22

Table 19. Tensile strength results

Sample	7-days		14-days		28-days	
	Load(N/mm^2)	T.S Mpa	Load (N/mm^2)	T.S Mpa	Load (N/mm^2)	T.S Mpa
AD	210	2.97	265	3.74	285	4.03
Steel fiber	235	3.24	300	4.24	322	4.55
Meta kaolin	220	3.11	280	3.96	291	4.11
Comb + General water	260	3.67	320	4.52	348	4.92
Comb + Magnetic water	282	3.98	345	4.88	365	5.16

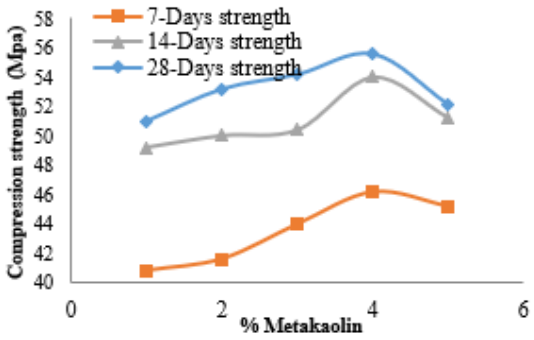

Figure 3. Graph between % metakaolin and compression strength

Graphs are plotted between compressive strength and % of metakaolin added to the proportion of mix. Here the compressive strength values shown at is shown in Figure 3.

6. COST ANALYSIS

Table 20. Cost analysis for magnetic water self compacting concrete

Materials	Rate	Unit	Quantity	Amount
Cement	INR 270	Bag (50 kg)	10	INR 2700
Sand	INR 800	MT	0.770	INR 616
Aggregate	INR 650	MT	0.948	INR646.2
water	INR 250	8000 lt	165	INR 5.15
Plasticizer	INR 20	Lt	4.4	INR 44
Steel fiber	INR 8.5	Kg	20	INR 170
MetaKaolin	INR 15	Kg	5.5	INR 82.5
Miscellaneous chargers				INR 400
Total				INR 4663

In general M40 grade self compacting concrte on market price is 5000.

In cost comparision wise Magnetic water self compacting concrete is less compair to Self Compacting Concrete.

Table 21. Cost comparsion of SCC & MWSCC

Si. No	Mix Design	Cost of SCC	Cost of MWSCC	Excess (%)	Less (%)
1	M40	INR 5000	INR 4663	---	6.74

Note: SCC means Self Compacting Concrete; MWSCC means Magnetic Water Seelf Compacting Concrete.

7. CONCLUSIONS

This paper explains how the influence of magnetic water influences self compacting and how it strengthens the characteristics of concrete. Due to this purpose, 985 gauss magnetic strength is used to prepare magnetic water. The conclusions based on the above research on this paper are stated as given below:

- The workability of SCC made by magnetic water is observed to be moderately more than that of general water at same water cement ratio. It may be due to the fact that by keeping magnets with water, inter molecular changes occurs, which results in the decrease of pH, hardness and turbidity.
- It is evident from the test results that the Compressive strength of SCC made by magnetic water is higher than that of non magnetic water by 10 %.
- It is also observed that the Tensile strength of SCC with magnetic water is increased by 5 % than SCC with normal water.
- In cost comparison wise Magnetic water self compacting concrete is less than 6.74 % when compare to self compacting Concrete.

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REFERENCES

[1] Domone, P.L. (2007). A review of the hardened mechanical properties of self-compacting concrete. Cement and Concrete Composites, 29(1): 1-12. https://doi.org/10.1016/j.cemconcomp.2006.07.010

[2] Ministry of Housing and Urban-Rural Development of the People's Republic of China. (2012). Technical Specification for Application of Self-Compacting Concrete.

[3] Wu, Z.W., Lian, H.Z. (1999). High Performance Concrete. China Railway Press, Beijing.

[4] Hajime, O., Ouchi, M. (2003). Self-compacting concrete. J. Adv. Concr. Technol., 1(1): 5-15.

[5] State Construction Committee of Russia. (1993). Application of Magnetic Fields in National Economy, Issued No.1058.

[6] Su, N., Wu, C.F. (2003). Effect of magnetic field treated water on mortar and concrete containing fly ash. Cement and Concrete Composites, 25(7): 681-688. https://doi.org/10.1016/S0958-9465(02)00098-7

[7] Singh, S.P., Kaushik, S.K. (2001). Fatigue strength of steel fibre reinforced concrete in flexure. ACI Material Journal, 98(4): 306-312. https://doi.org/10.1016/s0958-9465(02)00102-6

[8] Mehta, P.K. (1993). Sulfate attack on concrete - A critical review. Materials Science of Concrete III, American Ceramic Society, Westerville, OH, pp. 105-130.

[9] Sabir, B.B., Wild, S., Bai, J. (2001). Metakaolin and calcined clay as pozzolans for concrete: A review. Cement and Concrete Composite, 23(6): 441-454. https://doi.org/10.1016/S0958-9465(00)00092-5

[10] Wang, Y.K., Wei, H.N., Li, Z.W. (2017). Effect of magnetic field on the physical properties of water. Results in Physics, 8: 262-267. https://doi.org/10.1016/j.rinp.2017.12.022

[11] Kotb, A., Abd El Aziz, A.M. (2013). Scientific investigations on the claims of the magnetic water conditioners. Scientific Investigations on the Claims of the Magnetic Water Conditioners, 2(1): 16-27.