A Research Paper on Self-Compacting Concrete with Glass Power

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Abstract— In this research paper we discussing about the self-concrete and the fundamental which is related to the self-compacting concrete. In the following paper we mainly Focused on the basis of self-compacting of concrete. We discuss about the fluidity which is allowed self-compacting concrete without external energy and flow easily through reinforcement. The paper present the progress of the research on different harden properties of self-compacting concrete using the Ordinary Portland Cement. The hardened properties like compressive strength, split tensile strength, flexural strength and impact strength are found in experimental work are compared with M25 grade of concrete. Which play an important role in the present time of construction?

Keywords: Self-compacting concrete, glass powder, SBR latex, super plasticizer, self-compatibility

I. INTRODUCTION

Self-compacting concrete which is defined as a mixture which is compact through its own weight is called self-compacting concrete. Self-compacting concrete does not want any type of vibration or external force to settle on its basic position. Self-compacting concrete was developed in Japan in 1980 by the early 1990 Japan has developed and used SCC that does not required vibration to achieve full compacting. The hardened concrete is dense, homogeneous and has the same engineering properties and durability as traditional vibrate concrete. It is industrial waste are used and concreting is noise free, as environmental friendly.
There are following fundamental

A. Properties of self-compacting concrete which is point out as below.

1) Self-compacting concrete have a fluidity that allow self-compacting concrete without external energy.
2) Its remaining homogeneous in a form during and after the process.
3) Its flow easily through reinforcement.
4) Concept of self-compacting concrete-

Self-compacting concrete has high flow ability to under goes compaction by its own weight and heaving high workability. Basic concept of self-compacting concrete is based on the fineness of material (cement and aggregate) and low water content. It's having ability to self-compacting quality of concrete mixture. It's have low viscosity due to high fineness. That's why it is use full in construction and gives an appropriate result for construction.

II. EFFECT OF SELF-COMPACTING CONCRETE

There are following effect of self-compacting concrete which is point out as below.

1) Having self-compacting concrete quality so external forced are not required in the construction that's why it's taking lesser time to settle down.
2) High workability improves its structural quality.
3) Less water content is worked for less bleeding fundamentals.
4) High fineness of material increases the viscosity of materials that's why construction time is reduced.
5) Fineness of materials provides aesthetic finish for the construction.

Trial	Cement (kg)	W/C (kg)	F.A. (Kg)	C.A. (Kg)	C.A. /F.A. ratio	Admixture (%)	Admixture (kg)	Slump Value (mm)	V funnel (sec)	L box (H2/HI)	J ring (mm)
CC	440	0.45	1003.71	726.82	0.7241	1.1	4.84	600	20	0.5	18
CC	440	0.45	1003.11	726.39	0.7241	1.2	5.28	610	16	0.6	17
CC	440	0.45	1002.53	726.00	0.7241	1.3	5.72	630	15	0.5	15
CC	440	0.45	1002.00	725.55	0.7241	1.4	6.16	650	13	0.7	11
CC	440	0.45	1001.37	725.13	0.7241	1.5	6.60	700	10	0.9	8

Table 3.5: Mix Design Trial of Self-Compacting Concrete for 1 m3 of Concrete:

Trial	SBR Latex %	Cement (kg)	W/C ratio	F.A. (kg)	C.A. (kg)	Admixture (%)	Slump Value (mm)	V funnel (sec)	L box (H2/HI)	J ring (mm)	Remark
LMSCC 1	5	440	0.45	1001.37	725.13	1.5	Not measurable	7	0.8	16	Bleeding
LMSCC 2	5	440	0.45	1002.00	725.55	1.4	Not measurable	7	0.6	18	Segregation
LMSCC 3	5	440	0.45	1002.53	726.00	1.3	850	8	0.5	11	Flow is more
LMSCC 4	5	440	0.45	1003.11	726.39	1.2	700	10	0.9	9	Flow is good

Table 3.5: Mix Design Trial of latex modified self-compacting Concrete for l m3 of Concrete:

A. Preparation for Compressive strength

To study the Compressive strength of conventional self-compacting concrete, Latex (5% by weight of cement) modified self-compacting concrete and using glass powder as a partial replacement of cement in various fraction (2.5%, 5%, 7.5% and 10%) in LMSCC mix. There are three cubes of

size 150mm* 150mm* 150mm were made for each set. The testing was done according to IS 516-1959 [30]

Fig. 3.6.: Testing of cube under compression testing machine

B. Specimen for Split tensile strength

The split tensile strength of conventional self-compacting concrete and latex modified self-compacting concrete by partial replacement of cement with glass powder in different fraction (2.5%, 5%, 7.5% and 10%) is determined at 28 days on cylinders measuring 150 mm diameter and 300 mm height. These specimens will be cured in water until the date of test according to IS: 5816-1999 [31]. Three specimens of each mixture are to be tested and the mean value is to be reported.

Fig. 3.7.: Testing of Cylindrical Specimen under Split Tensile Strength Test

C. Specimen for Flexural strength

To study the flexural strength of conventional self-compacting concrete, Latex (5% by weight of cement) modified self-compacting concrete and using glass powder as a partial replacement of cement in various fraction (2.5%, 5%, 7.5% and 10%) in LMSCC mix. There are three beam of size 500mm* 100mm* 100mm are made for each set. The testing was done according to IS 9399:1979 [32].

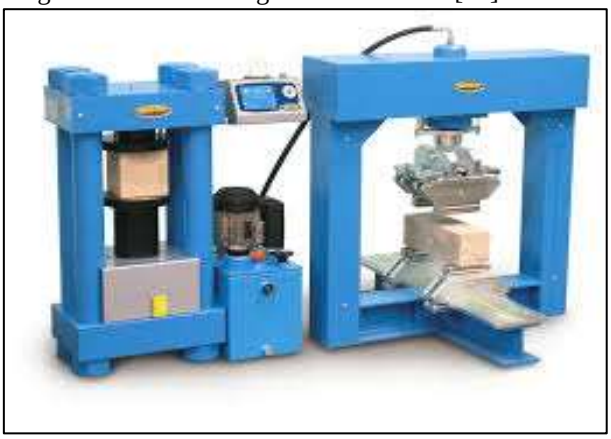

Fig. 3.8.: Testing of specimen under flexure

D. Latex modified self-compacting concrete by partial replacement of cement with Glass power.

Cement was partially replaced by glass powder in different proportions (0%, 2.5%, 5%, 7.5% and 10%). Details of replacements are tabulated in the table below.

S.N.	% replacement of glass powder	SBR latex%	Cement (kg)	Fine aggregate (kg)	Coarse aggregate (kg)	Glass powder (kg)	Water (w/c = 0.45) (kg)	Admixture (gm)
1	0	0	440	1003.11	726.39	0	198	5.28
2	0	5	440	1003.11	726.39	0	198	5.28
3	. 2.5	5	429	1003.1 1	726.39	11	198	5.28
4	5	5	418	1003.1 1	726.39	22	198	5.28
5	7.5	5	407	1003.11	726.39	33	198	5.28
6	10	5	396	1003.11	726.39	44	198	5.28

Table 3.8: LMSCC by partial replacement of cement with glass powder

1) Main Test Compressive Strength of Concrete (M_{25}) Latex Modified Self- Compacting Concrete with 0% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	AREA (mm²)	STRENGTH (N/mm²)	STRENGTH OF MEAN LOAD (N/mm²)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	740.78 x 1000	741.98 x1000	22500	32.92	32.98	25 N/mm²	OK
2.	738.87 x 1000		22500	32.84			OK
3.	746.27 x 1000		22500	33.18			OK

2) Compressive Strength of Concrete (M25) Latex Modified Self- Compacting Concrete With 2.5% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	AREA (mm²)	STRENTGH (N/mm²)	STRENGTH OF MEAN LOAD (N/mm²)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	787.03x1000	785.47x1000	22500	34.97	34.91	25 N/mm²	OK
2.	781.25x1000		22500	34.72			OK
3.	788.14x1000		22500	35.028			OK

3) Compressive Strength of Concrete (M_{25}) Latex Modified Self- Compacting Concrete With 5% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	AREA (mm²)	STRENTGH (N/mm²)	STRENTGH OF MEAN LOAD (N/mm²)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	792.57 x1000	787.72x1000	22500	35.22	35.01	25 N/mm²	OK
2.	789.42 x1000		22500	35.07			OK
3.	781.15 x1000		22500	34.73			OK

4) Compressive Strength of Concrete (M_{25}) Latex Modified Self- Compacting Concrete With 7.5% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	AREA (mm²)	STRENGTH (N/mm²)	STRENTGH OF MEAN LOAD (N/mm²)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	791.72x1000	797.62x1000	22500	35.18	35.45	25 N/mm²	OK
2.	801.57x1000		22500	35.62			OK
3.	799.56x1000		22500	35.53			OK

5) Compressive Strength of Concrete (M_{25}) Latex Modified Self- Compacting Concrete With 10% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	AREA (mm²)	STRENTGH (N/mm²)	STRENGTH OF MEAN LOAD (N/mm²)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	763.28x1000	758.25x1000	22500	33.92	33.70	25 N/mm²	OK
2.	753.17x1000		22500	33.47			OK
3.	758.26x1000		22500	33.70			OK

6) Split Tensile Strength of Cylinder latex Modified Self- Compacting Concrete With 0% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	STRENTGH (N/mm²)	STRENGTH OF MEAN LOAD (N/mm²)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	262.38 x 1000	260.80 x1000	3.71	3.69	6 N/mm²	OK
2.	261.57 x 1000		3.70			OK
3.	258.46 x 1000		3.65			OK

7) Split Tensile Strength of Cylinderlatex Modified Self- Compacting Concrete With 2.5% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	STRENTGH (N/mm²)	STRENGTH OF MEAN LOAD (N/mm²)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	264.37 x 1000	261.63 x1000	3.74	3.70	6 N/mm²	OK
2.	262.54 x 1000		3.71			OK
3.	258.00 x 1000		3.66			OK

8) Split Tensile Strength of Cylinder latex Modified Self- Compacting Concrete With 5% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	STRENGTH (N/mm²)	STRENGTH OF MEAN LOAD (N/mm²)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	269.00 x 1000	264.57 x1000	3.80	3.74	6 N/mm²	OK
2.	264.36 x 1000		3.74			OK
3.	260.18 x 1000		3.68			OK

9) Split Tensile Strength of Cylinderlatex Modified Self-Compacting Concrete With 7.5% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	STRENTGH (N/mm²)	STRENGTH OF MEAN LOAD (N/mm²)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	269.69 x 1000	272.07x1000	3.81	3.84	6 N/mm²	OK
2.	275.36 x 1000		3.87			OK
3.	271.18 x 1000		3.83			OK

10) Split Tensile Strength of Cylinderlatex Modified Self- Compacting Concrete With 10% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	STRENTGH (N/mm²)	STRENGTH OF MEAN LOAD (N/mm²)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	266.87 x 1000	260.80 x1000	3.77	3.69	6 N/mm²	OK
2.	259.68 x 1000		3.67			OK
3.	255.86 x 1000		3.62			OK

11) Flexural Strength of Beam Self- Compacting Concrete With 0% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	STRENTGH (N/mm^2)	STRENGTH OF MEAN LOAD (N/mm^2)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	6.88 x 1000	6.786 x1000	5.16	5.09	10 N/mm^2	OK
2.	6.63 x 1000		4.97			OK
3.	6.85 x 1000		5.14			OK

12) Flexural Strength of Beam Self- Compacting Concrete With 2.5% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	STRENTGH (N/mm^2)	STRENGTH OF MEAN LOAD (N/mm^2)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	6.94 x 1000	6.90 x1000	5.21	5.17	10 N/mm^2	OK
2.	6.87 x 1000		5.15			OK
3.	6.90 x 1000		5.17			OK

13) Flexural Strength of Beam Self- Compacting Concrete With 5% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	STRENTGH (N/mm^2)	STRENGTH OF MEAN LOAD (N/mm^2)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	7.17 x 1000	6.03 x1000	5.37	5.27	10 N/mm^2	OK
2.	6.96 x 1000		5.22			OK
3.	6.98 x 1000		5.23			OK

14) Flexural Strength of Beam Self- Compacting Concrete With 7.5% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	STRENTGH (N/mm^2)	STRENGTH OF MEAN LOAD (N/mm^2)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	7.37 x 1000	7.36 x1000	5.79	5.61	10 N/mm^2	OK
2.	7.46 x 1000		5.59			OK
3.	7.26 x 1000		5.45			OK

15) Flexural Strength of Beam Self- Compacting Concrete With 10% Glass Powder

SL. NO.	LOAD (N)	MEAN LOAD	STRENTGH (N/mm^2)	STRENGTH OF MEAN LOAD (N/mm^2)	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	6.91 x 1000	6.85 x1000	5.17	5.13	10 N/mm^2	OK
2.	6.88 x 1000		5.16			OK
3.	6.76 x 1000		5.06			OK

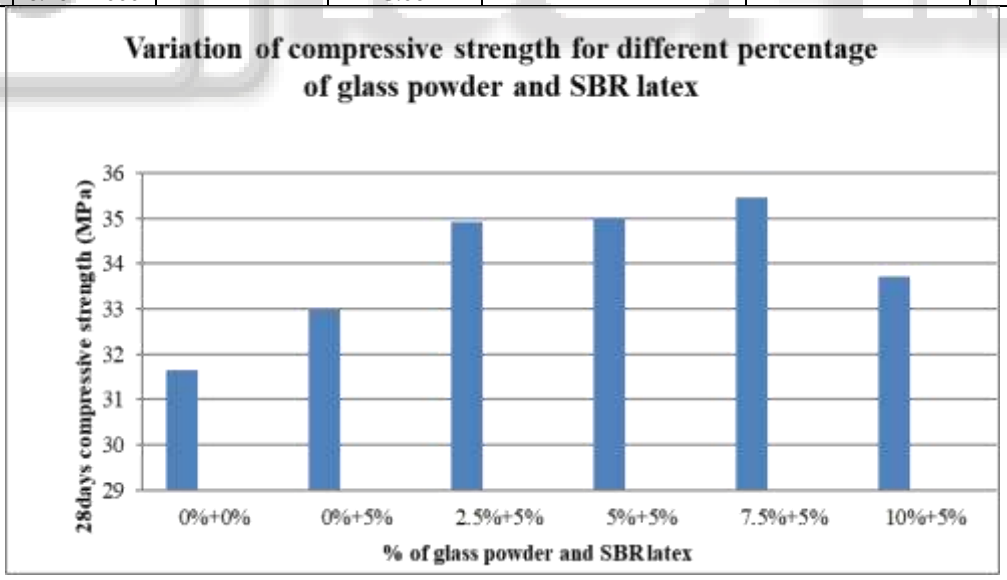

Fig. 4.1: Compressive Strength For different %age of glass powder and SBR latex

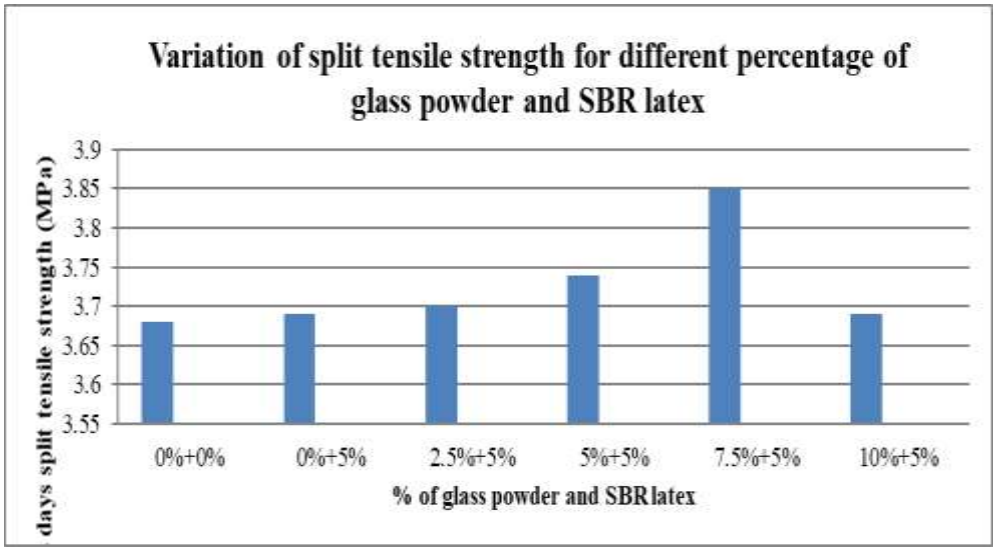

Fig. 4.2: Split tensile strength for different percentage of glass powder and SBR latex

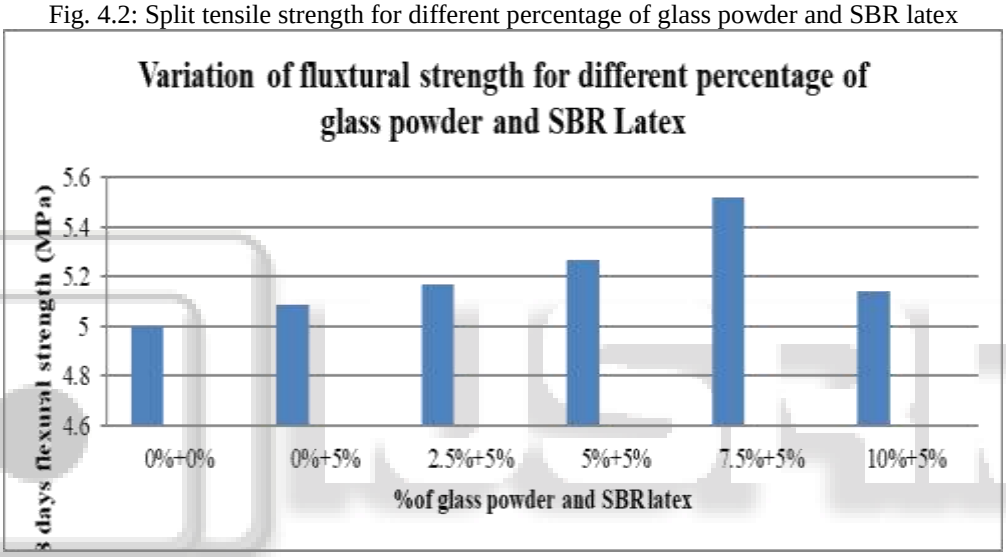

Fig. 4.3: Flexural strength for different percentage of glass powder and SBR latex

III. Conclusion

1) The following important result can be summarized by the investigation carried out on the SCC made by using SBR latex and glass powder: The SCC made with 5% of SBR latex replaced by weight of cement gave satisfactory result after the 28 days of testing. Compressive strength for M25 grade of SCC was found to be 32.98MPa, split tensile strength as 3.69MPa and flexural strength as 5.09 MPa.
2) On the above mix glass powder was added in various percentages (2.5%, 5%, 7.5% & 10%) to enhance the properties of SCC and it was found that when 5% SBR latex is added along with 7.5% Glass powder dosage, maximum strengths are obtained. The compressive strength is increased by 12%, split tensile strength by 6.35%, & flexural strength by 10.4% when compared to their nominal strength.
3) The maximum strength was achieved for 7.5% replacement of cement with glass powder in latex modified self-compacting concrete. Further addition of glass powder reduces the strength.
4) One of the main disadvantage of SCC is its high cost, and in this work cement has been replaced by glass powder which has reduce the cost of production of SCC in comparison to conventional SCC.
5) SBR latex has been extensively used in this work because we know that crack plays an important role as they change concrete structures into permeable elements and consequently with a high risk of corrosion. Cracks not only reduce the quality of concrete and make it aesthetically unacceptable but also make structures out of service. If these cracks do not exceed a certain width, they are neither harmful to a structure nor to its serviceability. Therefore, it is important to reduce the crack width and this can be achieved by adding SBR latex to concrete.
6) SCC given good finishing as compared to ordinary concrete without any external mean of compaction.

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