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EXPERIMENTAL STUDY ON PULL OUT BEHAVIOUR OF THE HIGH STRENGTH SELF COMPACTING CONCRETES

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ABSTRACT: Self-Compacting Concrete(SCC) is a highly fluid yet stable concrete that can flow consistency of the own balance without any vibration effort and the same time is cohesive enough to be handled without segregation. The result showed that SCC specimens higher bond to reinforcing bars than normal Concrete specimens between the bond strength and compressive strength of NC is more consistent flow.

KEY WORDS

Pull Out Behavior, bond strength, load caring capacity, compressive strength, tensile strength.

I.INTRODUCTION

The research in the field of SCC has an accelerated growth in the recent years. The study on the various stages of SCC are studied by many researchers, reveal the fact about SCC, thus making it a practically wide applicable. many research papers were published by various researchers, which show the engineering significance of SCC are studied workability and durability of recronfibers.

OBJECTIVE

1. Investigate the workability characteristic, hardened properties of Self-Compacting Concrete.
2. Ensure the strength properties of Self Compacting Concrete with the effect of filler materials will be experimentally compared with nominal Self Compacting Concrete.
3. Demand of natural M-sand is very high, so we adopt alternate materials in high strength Self Compacting Concrete.

II.LITERATURE REVIEW:

M. Shahul Hameed et al., "Strength and Permeability Characteristics Study of SELF-Compacting-Concrete using Crushed Rock Dust and Marble Sludge Powder", Arabian Journal of Science and Engineering (2012):

Self-Compacting Concrete (SCC) is one of the most significant advances in concrete Technology over the past decades.

SCC was developed to ensure adequate compaction through self-consolidating and facilitate placement of

concrete in structures with congested reinforcement and in restricted area.

MSP an used as filler and it helps to reduce the total voids content in concrete.

The study of combined addition of MSP and CRD on the durability of SCC.

M. Shahul Hameed et al, "Self – Compaction Concrete Using Marble Sludge and Crushed Rock Dust", Arabian Journal Of Science and Engineering (2012)

Self-Compaction Concrete (SCC) has had a remarkable impact on the concrete construction industry, especially the precast concrete industry.

Crushed Rock Dust (CRD) and Marble Sludge Powder (MSP) are discard in the nearby land and soil is spoiled.

MSP and CRD can be used as filler materials to reduce the total voids content in concrete.

An experimental investigation has been carried out to study the combined effect of addition of MSP and CRD on the strength and durability of

M.T.Nageswararo et al "Experimental Study On Use of Crushed Stone Dust and Marble Sludge Powder as replacement To natural Sand In Self Compaction Concrete" International Journal of Engineering Science and research Technology.

The crushed rock dust and marble sludge powder as replacement to natural sand in preparation of Self compaction concrete.

The crushed rock dust and marble sludge powder with three different proportion of super plasticizer (0.35,0.3,0.25) were used for making concrete flow.

Tests carried out from evaluation of mix design are compressive, split tensile, flexural strength and acid immersion tests of 5% of $H2SO_4$ and HCL solutions.

The crushed rock dusk and marble sludge powder can be used as substitute for natural sand replacement.

Ronak Malpanl et al, "Effect Of Marble Sludge Powder and Quarry Rock Dust As Partial replacement for fine aggregates on properties concrete" International Journal of Innovation technology and engineering.

Concrete sustainability involves continuously choosing low impact building materials, use alternate aggregate materials has greater potential because 75% of concrete is composed of aggregate.

The experimental study has been carried out to investigate the suitability of marble sludge powder and quarry rock dust as partial replacement for fine aggregate.

The properties of concrete mixture portion of sand is replaced by marble sludge powder and quarry rock dust and mixtures of both.

During this experiment, the properties of concrete were studied for eight series of concrete mixture by replacing the portion of fine aggregates by marble sludge and quarry rock dust and mixtures of both.

Sara Irico et al, "Severe Sulphuric Acid Attack on SCC with Granulometrically optimized blats Furnace Slag Comparison" Journal of civil engineering and management.

The corrosion by severe sulfuric acid attack at pH_2 of two Self Compacting Concrete types based on the Ordinary Portland Cement (OPC) and granulometrically optimized blast furnaces slag cement was evaluated by three complementary tests that were performed by the different research institutes.

The relevance and practical advantages of the different tests protocols and the influence of the experimental parameters are discussed.

It appears that the frequency of renewing the acid solution during the exposure periods is the main parameter between the volume of the solution and concrete surface had no clear influences.

This difference in comparison with OPC-SCC was rather limited shows the influence of the cement type becomes less relevant in the case of concrete with low W/C ratio and optimized concrete technology.

III.EXPERIMENTAL INVESTIGATION

Materials testing is essential for the mix design of concrete. It gives the optimum amount of material required for a given strength and workability of concrete. Hence the properties of the following materials were found.

CEMENT

The ordinary Portland cement conforming to IS 4031 was used for the preparation of specimens. OPC 53 grade was we used. Physical and chemical characteristics of cement play a vital role in developing strength and controlling theology of fresh concrete. The water requirements are affects Fineness consistency.

Cement to be used in high performance concrete containing as little C3A as workable because the lower amount of C3A, then easier to control the theology and lesser the problems of cement super plasticizer compatibility. Finally, from strength point of view, this cement should be finally ground and contains a fair amount of C3S.

SI.NO	PROPERTIES	CEMENT
1	Fineness	3%
2	Specific Gravity	3.15
3	Consistency	34%
4	Initial Setting	30 minus

FINE AGGREGATE

In the present work the concrete mixes were prepared work the concrete mixes were prepared using locally available river sand free from silt, organic matter are passing away 4.75mm sieve. The sand used confining to zone 2 of IS 383-1970. In those present, we use crushed aggregate. In crushed gravel, the amount of clay, fine silt, and fine dust should not be more than 4% by weight and in crushed stone it should not be greater than 10%.

TESTS FOR FINE AGGREGATE

SI.NO	PROPERTIES	M-SAND
1	Specific gravity	3.15
2	Fineness modulus	3%
3	Bulk Density	1581kg/m^3

COURSE AGGREGATE:

Crushed granite aggregate particles passing through 12.5mm and retained on 10mm sieve used as the aggregate which met the grading requirement of IS 383-1970. The coarse aggregate is the strongest and least porous component of concrete.

SI.NO	PROPERTIES	COARSE AGGREGATE
1	Specific Gravity	2.72
2	Impact Value	18.86%
3	Bulk Density	1546 kg/m^3

WATER

Water is then mixed with dry composite, which produces a semi-liquid that workers can shape (typically by pouring it into a from). In general, water fit for drinking is suitable for mixing the concrete. the water may affect setting time, strength, shrinkage of concrete or promote corrosion of reinforcement. This locally available potable water which was free from concentrated of acid and organic substances was used for mixing the concrete.

MARBLE SLUDGE POWDER

MSP was obtained in wet form directly taken deposits of Marble factories. MSP available several Marble types and Marble particles. The waste Marble Sludge powder sieved was 1mm sieve. The high content of Cao the original stones of Marble and limestone. The sludge was also tested to identify the absence of organic matter, thus confirming that it could be used in concrete mixtures.

SI.NO	PROPERTIES	MARBLE SLUDGE POWDER
1	Specific Gravity	2.4
2	Fineness	4.97

MASTER GLENIUM SKY 8233

It is an admixture of a generation based on modified polycarboxylic either. The application of product is high performance is required. It is free from chloride and low alkali.

Aspect	Dark brown free flowing liquid
Relative Density	1.80 0.02 at 25°C
pH	>6
Chloride ion content	<0.2%

MIX PROPROTION

Cements(Kg/m³)	Fine Aggregate (Kg/m³)	Coarse Aggregate (Kg/m³)	Water (liters/m³)
1	1.41	1.32	0.26

TEST FOR FRESH CONCRETE

SLUMP FLOW TEST

1. About 6 liters of concrete is needed to perform the test, sample normally
2. Moisture the base plate and inside of slump cone.
3. base plate placed on level stable ground and the slump cone centrally on the base plate and hold down.

4. the cone are fill with scoop. Do not tamp, simply strike off the concrete level with the top of the cone with the trowel.
5. Remove any surplus concrete from around the base plate of the cone.
6. the cone vertically allow the concrete to flow out freely raise.
7. Measure the final diameter of the concrete flow in two perpendicular directions.
8. Calculate the average of the two measured diameter. (This is the slump flow in mm).

V-FUNNEL TEST

1. About 12 liter of concrete is needed to perform the test, sampled normally.
2. Set the v-funnel on ground.
3. Moisten the inside surface of the funnel.
4. the trap door keep open to allow any surplus water to drain.
5. the trap door close and place a bucket underneath.
6. Fill the apparatus completely with concrete do not compacting or tamping, strike simply off the concrete level with the top with the trowel.
7. Open within 10 secs after filling the trap door and allow the concrete to flow out under gravity.
8. the stopwatch is start when the trap door is opened, and record the time for the discharge to complete (the flow time). This is taken to be when light is seen from above through the funnel.
9. The whole test has to performed within 5 minutes.

TEST FOR T50 SLUMP FLOW

1. Do not clean or moisten the inside surface of the funnel again.
2. Close the trap door and refill the V-funnel immediately after measuring the flow time.
3. A bucket placed underneath.
4. Fill the apparatus completely with concrete do not compaction or tapping, strike simply off the concrete level with the top with the trowel.

5. Open the trap door 5 minutes after the second fill of the funnel and allow the concrete to flow out under gravity.
6. Simultaneously start the stopwatch when the trap door is opened, and record the time for the discharge to complete (the flow time at T5 minutes). This is taken to be when seen is light from above through the funnel.

SI .NO	TEST FOR FRESH SCC	RESULT	EFNARC LIMITS
1	Slump flow mm	710	600 to 800
2	J-ring mm	3.2	< 10
3	V-funnel mm	12 sec	8 to 12

L-BOX TEST

1. Above 14 liter of concrete is needed to perform the test, sampled normally.

2. Set the apparatus level on ground, ensure that the sliding gate can open freely and then close it.

3. the inside has moisten surface of the apparatus, remove any surplus water.

4. Fill the section vertical of the apparatus with the concrete sample.

5. Leave it to 1 minute for stand.

6. start the stopwatch and record the times taken for the concrete to reach 200 and 400 mm marks.

7. When the concrete stops flowing, the distance “H1” and “H2” are measured.

8. Calculate the ratio of H2/H1 blocking.

9. The whole test has to be performed within 5 minutes.

RESULTS AND DISCUSSION

The compressive strength and flexural strength, split tensile strength test and bond strength test conventional and Marble sludge powder and master Glenium sky 8233 concrete has been conducted and its results have been discussed in this chapter.

TEST FOR HARDENED CONCRETE

COMPRESSIVE TEST

The determination of compressive strength has received a large amount of attention because the concrete is primarily meant to with sand compressive stresses. Generally, cubes are usually of 150 x 150 x 150 mm size. In the compressive test, the cube while cleaned to wipe of the surface water, is placed with the cast faces in contact with the plates of the testing machine, i.e., the position of the cubes when tested is at right angles to the as cast. The test specimens are tested in

MIX	M-SAND	MARBLE SLUDGE POWDER	COMPRESSIVE STRENGTH (N/mm²)	
			7 DAYS	28 DAYS
1	100	-	45.20	74.56
2	95%	5%	46.35	72.40
3	90%	10%	47.46	74.65
4	85%	15%	49.52	75.94
5	80%	20%	51.86	76.65
6	75%	25%	53.68	78.89

accordance with IS 516-1959. The plates are cleaned, checked the oil level and kept ready in all respects for testing. After the minimum period of curing, the cube specimens are taken out from the curing tank and cleaned to wipe off the surface water. Placing the smooth surface of the specimen on bearing surface, it is brought in contact with the top plate rotating the handling. The failure of maximum load at which the specimen breaks and the pointer starts moving back is noted. The strength mean value was recorded by conducting experiment for the two specimens.

Compressive Strength

SPILT TENSILE TEST

A method of determine the tensile strength of concrete using a cylinder which spilt across the vertical diameter. It is an indirect method of testing tensile strength. The procedure of making and curing tension test specimen in respects of sampling of materials, preparation of materials, and proportioning, weighing, mixing workability, moulds, compacting and curing shall comply in all respects with the requirement given in a IS 516.

Prepared cylinder in each concrete specimen. After moulding and curing the specimen for seven days in water, they can be tested. The cylindrical specimen is placed in a manner that the longitudinal direction of axis is perpendicular to the load. Two strips of nominal thick plywood, free of imperfection, approximately (25mm) wide, and length equal to slightly longer than that of the specimen should be provided for each specimen. The bearing strips are

placed between axis of the specimen both upper and lower bearing blocks of the testing machine. The load shall be applied without shock and increased continuously at a nominal rate within the rang 1.2 N/mm^2 to $2N/mm^2$.

the maximum applied load record to indicated by the testing machine at failure. The type of failure and appearance of fracture are noted.

Split Tensile Strength

MIX	M-SAND	MARBLE SLUDGE POWDER	SPLIT TENSILE STRENGTH (N/mm^2)	
			7 DAYS	28 DAYS
1	100%	-	4.63	7.23
2	95%	5%	4.56	6.87
3	90%	10%	5.23	7.42
4	85%	15%	5.67	7.65
5	80%	20%	5.80	7.80
6	75%	25%	5.99	7.89

BOND STRENGTH

Pull Out Tests

In a study dealing with pull-out tests on SCC, Chan et al, that as compared to NC, SCC exhibits higher bond to reinforcing bars and lower reduction in bond strength due to top-bar effects. It performed bonds tests(pullout) with 12mm and 20mm deformed bars placed in concrete specimens of a 100x100x150 mm to study the performance of SCC compared to NC. The test result showed 10%-40% higher normalized bond strength in SCC compared to NC it performed pullout tests with 10mm diameters bars placed centrally in the off specimens failed form pulling out, no visible cracks in the concrete measured at 7 days and 28 days and was report as all specimen failed from pulling out. The ultimate bond stress is also some greater difference between SCC and NVC are reduced considerably, and even disappear completely from concretes of more than 50 MPa.

Pull Out test

BOND STRESS OF NORMAL CONCRETE (NC)

WATER CEMENT RATIO	7 DAYS	28 DAYS
0.4	7.22	9.50
0.5	5.70	7.80

0.6	3.70	4.50

BOND STRESS OF SELF COMPACTING CONCRETE

WATER CEMENT RATIO	7 DAYS	28 DAYS
0.4	8.3	10.53
0.5	6.56	7.23
0.6	4.42	4.49

CONCLUSION

This experimental study brief details of Self Compacting Concrete (SCC) with the effect of filer materials such as condensed Marble Sludge powder (MSP). The work represents the summary of literatures, parametric study of materials and collection of materials, mix design of Self Compacting Concrete as per EFNARC guidelines. Thus the materials properties are well studied for producing Self Compacting Concrete.

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