A STUDY OF SELF COMPACTION HIGH PERFORMANCE GREEN CONCRETE FOR SUSTAINABLE DEVELOPMENT

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Abstract: Self Compacting high performance concrete as the name implies that there is no vibration vibration to fill the form homogeneously. SSC is a high performance concrete that can be compacted into every corner of a formwork, purely by means of its own weight and without the need for vibrating compaction. SCC is defined by two primary properties: Ability to flow or deform under its own weight and the ability to remain homogeneous while doing so. Cement and concrete industry has a sustainable growth in many respects in construction industry has environment impact due to more consumption of energy..An important issue is the use of environmental-friendly concrete ("green concrete") to enable worldwide infrastructure growth

I. INTRODUCTION

Aggregate may contains of fine aggregate, coarse aggregate and various sizes and shapes of gravel or stones. Even we have aggregate typically accounts for 70% to 80% of the concrete volume, it is commonly thought of as inert filler having little effect on the finished concrete properties.

Aggregate have fact role to determining workability, strength, dimensional stability, and durability of the concrete. The demand of natural sand is quite high in developing countries owing to rapid growth. Quarry dust and marble sludge are dumped in the nearby land and the natural fertility of the soil is spoiled. Aggregate used a waste material to avoid pollution. Concrete and the environment. There is an increasing concern now that the choice of construction materials must also be governed by ecological considerations. In the beginning of the 20Century, the world population was 1.5 billion; by theend of the 20Century it had risen to 6 billion.. Considering that it took 10,000 years after of the last iceage for the population to rise to the 1.5 billion mark,the rate of growth from 1.5 to 6 billion people. In thebeginning of the 20th Century, approximately elevenpercent of the people lived in cities; in the year 2001nearly three of the six billion inhabitants live in and around the cities (Jochen and Wicht, 2000).Future demand for concrete Ordinary concrete is mixture of cement ,sand and fine and coarse aggregate, typically, contains about 12 percent cement, 8 percent mixing water, and 80 percent aggregate by mass. Self Compacting Concrete (SCC) has been developed to ensure to compaction and have facilitate placement of concrete in structure with given reinforcement and in restricted area. Concrete that is able to flow in fill the formwork even in the presence of heavy reinforcement, whilst maintaining homogeneity and without the need for any additional compaction. It is also referred as self-leveling concrete, high workable concrete, self-consolidating concrete, more flowableconcrete, more non-vibrating concrete, etc.Self-compacting high performance concrete. The concrete has drying and hardening shrinkage, heat of hydration, denseness after hardening, and other properties and was named "High Performance Concrete." Since then, the term high performance concrete has been used whole world to refer to high durability concrete. Therefore for the proposed concrete to "Self-Compacting High Performance Concrete" (SCHPC) and was defined as follows at the three stages of concrete:

(1) Fresh : Self – Compactable.
(2) Early age : avoidance of initial defects.
(3) After hardening : Protection against external factors.

SCHPC can be described as a high performance material which flows under its own weight without requiring vibrators to achieve consolidation by complete filling of formworks even when access is hindered by small gaps between reinforcement bars green concrete .A sustainable industrial growth will influence the cement and concrete industry in many respects as theconstruction industry has environmental impact dueto high consumption of energy and eco friendly concrete (green concrete) to enable worldwide infrastructure growth without affecting the environment. Green concrete has nothing to do with color. Its concept is about eco friendly environment considering all aspects from raw over mixture design to structural design, construction, and service life. Green concrete is also very cheapbecause , waste products are used in cement with some amount charges for the disposal of waste are avoided, energy consumption in production is lower, and durability is greater. large development of concrete industry during last some decades, society has become aware of the problems associated with land filling of residual products, and limits, Disposal of wastes material become a big issue in many areas of india especially CRD produce from stone crusher industry and Marble Slurry Powder(MSP) produced from the stone industry in the country.

II. EXPERIMENTAL PROGRAM MATERIAL

OPC of 43 grade having specific surface of 412.92 m2 /kg and conforming to IS:8112-1989 was used. The cement was kept in an air-tight container and stored in the humidity-controlled room to prevent cement from being exposed to moisture. The chemical composition of river sand, crusher rock dust and marble sludge and cement.

(A)sand

The sand used in this study was natural sand conforming to

Zone II with specific gravity 2.68, fineness modulus as 3.42. This material is dried at room temperature for 24 hours to control the water content in the concrete. Fine aggregate of 4.75mm used. Testing of sand was done on the basis of IS specification IS:383-1970. Table2 represents the combined grading of CA and F.A(River sand, CRD and MSP).Marble Sludge Powder (MSP)Madurai district crusher industry.

(B)Course aggregate

Coarse aggregate of angular shape are used with rough surfaces from crushed natural rock stone aggregate of nominal size of 20 mm was used. Coarse aggregate Specific gravity is 2.74; bulk density is 1636 kg/m3.WaterIn this study, normal tap water available in the concrete laboratory was used. Water requirement fulfill on the basis of Indian standard for concreting and curing as per IS: 456-2000.Super Plasticizer Commercially available Super plasticizer ConplastSP430A1 from Forsook Chemicals (India) Ltd., Bangalore was used to produce high workable concrete and low water cement ratio.

III. FRESH PROPERTIES

(A)Slump flow test

For each mix, slump flow, J-ring test, U- Box, L-box and V-funnel test were carried out. Slump test is a field test. This test does not give direct measure of workability. This test consists of a mould with bottom diameter 200mm,top diameter 100mm and height of mould 300mm and temping rod used for ramming of concrete. The concrete is filled in this mould in 4 layers, height of each layer is about ¼ the height of mould. Each layer of concrete is rammed uniform by tampering rod 25 times . After the complete filling of concrete extras concrete is struck out from the top of mould It is the most commonly used test for determine the workability After this, the cone is raised vertically and the concrete isallowed to flow out freely. Theaverage of the two measured diameters is calculated. This is the slump flow in mm. If more the slump flow then its ability to fill formwork is more under its weighty. As per EFNARCguide, the range is from 655mm to 795 mm.

(B)-ring test

The J-ring test is based on a J-ring developed in Japan(in fact, J-ring means Japanese ring) and is to be carried out together with the slump flow test. This involves the slump cone being placed inside a 300 mm diameter steel ring attached to vertical reinforcing bar sat appropriate spacing (the J-ring itself. The J-rings used by different researchers are basically similar except for the clear spacing between the steel bars, which varies from 30 to 122 mm. The J-ring test is an improvement upon the Slump Flow test on its own as It aims to also assess the passing ability of the fresh mix.. The vertical section is filled with concrete, and then gate lifted to let the concrete flow into the horizontal section.

(C)-funnel test

The test measures flow ability and segregation resistance of concrete. At first, the test assembly is set firmly on the ground and the inside surfaces are moistened. Then apparatus is filled without compaction. After Concrete filled , trap door is opened and discharge is recorded at that time. It should be taken when light seen from above through funnel. Compressive strength and tensile strength are determined. Compressive strength and split tensile strength test were conducted for SCHPGC, NCRS and NCCRD. Compressive Strength test gives a picture about quality of good concrete because strength indirectly related to the structure of the hydrated cement paste. The compression test is an accurate concrete test to determine the strength developed of the concrete specimen in compression zone. Compressive strength tests were performed on the cube at the ages of 7,14, 28 and90 days. Tensile Strength test is method of applied tension in the form of splitting was conducted to evaluate the effect of MSP and CRD on tensile properties of concrete. The split tensile strength of 150 mm diameter and 300 mm high concrete cylindrical specimens was determined to assess the effect of CRD and MSP on the tensile properties of the concrete.

IV. RESULTS AND DISCUSSION

A total of 288 trial concrete mixes have been produce and tested for their workability, filling ability, passing ability and strength using the slump flow test, Jing test, U-box test, cube compression test to study the combined effects of the W/P ratio.

Compression Test

The SCHPGC79, NCCRD6 and NCCRD9 achieved highest 7 days compressive strength of 18.15 N/mm^2, 25.15 N/mm^{2}and 34.10 N/mm^{2}for M20, M30 andM40 grade of concrete respectively. The SCHPGC79, SCHPGC164 and SCHPGC254 achieved highest 28days compressive strength of 26.85 N/mm^2, 37.25 N/mm2and 49.60 N/mm^2 for M20, M30 and M40 grade of concrete respectively. Similarly, the SCHPGC79,SCHPGC164 and SCHPGC254 achieved highest 90days compressive strength of 33.15 N/mm2, 45.35 N/mm^2, and 55.42 N/mm^2 for M20, M30 and M40 grade of concrete respectively. The test results of 7 days,14 days, 28days and 90 days compressive strength are given days.

V. CONCLUSION

All the experimental data show that its possible to use waste in manufacturing self compacting high performance green concrete. Furthermore, in many cases the addition of the wastes improves the physical and mechanical properties. These results are of great importance because this kind of innovative concrete required more amount of fine particles. Due to its high fineness of the Marble sludge it provided to be very effective in assuring more good cohesiveness of concrete used . From the above study, it is concluded that the Crusher dust and Marble sludge may be used as a replacement material for fine aggregate. Fresh properties of the manufacturing self compacting high performance green concrete Selected mixes were compared with the recommended range given by EFNARC,"Specifications and Guidelines for Self.

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