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A STUDY OF SELF COMPACTION HIGH STRENGTH GREEN CONCRETE

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ABSTRACT: Self Compacting Concrete (SCC) as the name implies that the concrete requiring a very little or no vibration to fill the form homogeneously. 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. A sustainable industrial growth will influence the cement and concrete industry in many respects as the construction industry has environmental impact due to high consumption of energy and other re you can mention the introduction about your research.

I. INTRODUCTION

Conventional concrete aggregate consists of sand (fineaggregate) and various sizes and shapes of gravel orstones. However, there is a growing interest in substitutingalternative aggregate materials. Even thoughaggregate typically accounts for 70% to 80% of theconcrete volume, it is commonly thought of as inertfiller having little effect on the finished concrete properties.

However, research has shown that aggregatein fact plays a substantial role in determining workability,strength, dimensional stability, and durabilityof the concrete. The demand of natural sand is quitehigh in developing 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. Con-
sidering 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, typically, contains about 12 percent cement, 8 percent mixing water, and 80 percentaggregate by mass. Self-compacting concreteSelf Compacting Concrete (SCC) has been developedto ensure adequate compaction and facilitate placement of concrete in structures with congested reinforcement and in restricted areas. It is
also referred as self-leveling concrete, super workableconcrete, self-consolidating concrete, highly flowableconcrete, non-vibrating concrete, etc.Self-compacting high performance concrete

The prototype of SCC was first completed in 1988 using materials already on the market. The prototypeperformed satisfactorily with regard to drying andhardening shrinkage, heat of hydration, densenessafter hardening, and other properties and was named“High Performance Concrete.” Since then, the termhigh performance concrete has been used around the
world to refer to high durability concrete. Therefore Okamura[4] has changed the term for the proposed
concrete to “Self-Compacting High Performance Concrete” (SCHPC) and was defined as follows at the threestages 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 performancematerial which flows under its own weight withoutrequiring vibrators to achieve consolidation by complete filling of formworks even when access is hindered by narrow gaps between reinforcement barsSelf compacting high performance green concreteA 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 other resources.One important issue is the use of environmentalfriendly concrete (green concrete) to enable worldwideinfrastructure growth without affecting the environ-
ment.Green concrete has nothing to do with color. It is aconcept of thinking environment into concrete considering every aspect from raw materials manufacture over mixture design to structural design, construction, and service life. Green concrete is very often also cheap to produce, because, for example, waste products are used as a partial substitute for cement, chargesfor the disposal of waste are avoided, energy consumption in production is lower, and durability i
products, and limits, restrictions and taxes have beenimposed. Disposal of wastes has become a major problem in metropolitan areas in India especially the disposal of Crusher Rock Dust (CRD) generated fromstone crusher industry and Marble Slurry Powder(MSP) generated from the stone processing Industryin the country.

II. EXPERIMENTAL PROGRAM MATERIALS

CementOrdinary Portland cement (OPC) of 43 grade having a specific surface of 412.92 m^2
/kg and conforming to IS:8112-1989 was used. The cement was kept in an air-tight container and stored in the humidity-controlledroom to prevent cement from being exposed to mois-
ture. The chemical composition of river sand, crusherrock 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, finenessmodulus as 3.42. This material is dried at room tem-perature for 24 hours to control the water content inthe concrete. The maximum size of fine aggregate wastaken to be 4.75 mm. The testing of sand was done asper Indian Standard Specifications IS: 383 - 1970 . Table
2 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
The type of coarse aggregate used is angular aggregates with rough surfaces from crushed natural rockstone aggregate of nominal size of 20 mm was used.Coarse aggregate Specific gravity is 2.74; bulk densityis 1636 kg/m3.WaterIn this study, normal tap water available in the concrete laboratory was used. Water conforming to therequirements of water for concreting and curing asper IS: 456-2000.Super PlasticizerCommercially available Super plasticizer ConplastSP430A1 from Fosroc Chemicals (India) Ltd., Bangalore was used to produce high workability in concreteand reduce the water cement ratio. The Specific grav-ity of the Conplast SP430A1 is 1.18 to 1.20 at 20^oC.

III. FRESH PROPERTIES

(A)Slump flow test
For each mix, slump flow, J-ring test, U- Box, L-boxand V-funnel test were carried out. It is the most com-monly used test and gives a good assessment of fill-ing ability. At first, the inside of slump cone and thesmooth leveled surface of floor on which the slumpcone is to be placed are moistened. The slump cone isheld down firmly. The cone is then filled with con-crete. No tamping is done. Any surplus concrete isremoved from around the base of the concrete. After
this, the cone is raised vertically and the concrete isallowed to flow out freely. The diameter of the con-crete in two perpendicular directions is measured. Theaverage of the two measured diameters is calculated.This is the slump flow in mm. The higher the slump
flow value, the greater its ability to fill formwork un-der its own weight. As per EFNARC, (2002) guide,the range is from 650 mm to 800 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 mmdiameter steel ring attached to vertical reinforcing barsat appropriate spacing (the J-ring itself. The J-ringsused by different researchers are basically similar ex-
cept for the clear spacing between the steel bars, whichvaries from 30 to 122 mm. The J-ring test is an improvement upon the Slump Flow test on its own as itaims to also assess the passing ability of the freshmix.L - box test methodIt assesses filling and passing ability of SCC. The ver-tical section is filled with concrete, and then gate liftedto let the concrete flow into the horizontal section.When the flow has stopped, the heights ‘H1’ and ‘H2’are measured.Closer to unity value of ratio ‘H2/H1’indicates better flow of concrete (Zhu et al. 2001)..
(C)-funnel test
The test measures flowability and segregation resis-tanceof concrete. At first, the test assembly is set firmlyon the ground and the inside surfaces are moistened.The trap door is closed and a bucket is placed under-neath. Then the apparatus is completely filled with
concrete without compacting. After filling the concrete,the trap door is opened and the time for the dischargeis recorded. This is taken to be when light is seen fromabove through the funnel.Mechanical PropertiesMechanical properties such as compressive strength and split tensile strength are evaluated. Compressivestrength and split tensile strength test were conductedfor SCHPGC, strength tests were performed on the cube specimens at the ages of 7, 28 and90 days.
Splitting Tensile StrengthThe indirect method of applying tension in the form of splitting was conducted to evaluate the effect of MSP and CRD on tensile properties of concrete. Thesplit tensile strength is a more reliable technique toevaluate tensile strength of concrete.
of variation) compared to other methods. The split tensile strength of 150 mm diameter and 300 mm high concrete cylindrical specimens was determined toassess 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 produceand tested for their workability, filling ability, passing ability and strength using the slump flow test, Jring test, U-box test, V-funnel test, sieve segregationtest and cube compression test to study the combinedeffects of the W/P ratio.

Compression Test
The SCHPGC79, NCCRD6 and NCCRD9 achievedhighest 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 gradeof 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 gradeof concrete respectively. The test results of 7 days, 28days and 90 days compressive strength are given.

V. CONCLUSION

All the experimental data show that it is possible touse both the wastes in the manufacturing of SCHPGC.Furthermore, in many cases the addition of the wastesimproves the physical and mechanical properties.These results are of great importance because this kind of innovative concrete requires large amounts of fineparticles. Due to its high fineness of the Marble sludgeit provided to be very effective in assuring very goodcohesiveness of concrete. From the above study, it isconcluded that the Crusher dust and Marble sludge may be used as a replacement material for fine aggre-gate. Fresh properties of the Selected SCHPGC mixeswere compared with the recommended range givenby EFNARC, “Specifications and Guidelines for Self.

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