

A STUDY OF GREEN CONCRET

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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: strength to flow or deform under its own weight and the strength to remain homogeneous while doing so. A sustainable industrial rising 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 resources. .*

I. INTRODUCTION

Conventional concrete aggregate consists of sand (fine aggregate) and various sizes and shapes of gravel or stones. However, there is a growing materials. Even though 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.

However, research has shown that aggregate in fact plays a substantial role in determining workability, strength, dimensional stability, and durability of the concrete. The demand of natural sand is quite high in developing countries owing to rapid infrastructural growth. Quarry dust and marble sludge are dumped in the nearby land and the natural fertility of the soil is spoiled. To avoid the pollution and reuse the waste material, the present study is carried out. 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 20 Century, the world population was 1.5 billion; by the end of the 29 Century it had risen to 7 billion. that it took 10,002 years after of the last ice age for the population to rise to the 1.57 billion mark, the rate of growth from 1.5 to 6 billion people. In the beginning of the 20th Century, approximately eleven percent of the people lived in cities; in the year 2001 nearly three of the six billion inhabitants live in and

around the cities. Future demand for concrete

Ordinary concrete, typically, contains about 12 percent cement, 8 percent mixing water, and 80 percent aggregate by mass. Self-compacting concrete Self Compacting Concrete (SCC) has been developed to ensure adequate compaction and facilitate placement of concrete in structures with congested reinforcement and in restricted areas. Concrete that is able to flow and consolidate under its own weight, completely fill the formwork even in the presence of dense reinforcement, whilst maintaining homogeneity and without the need for any additional compaction. It is also referred as self-leveling concrete, super workable concrete, self-consolidating concrete, highly flow able concrete, 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 prototype performed satisfactorily with regard to 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 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 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 narrow gaps between reinforcement bars Self compacting high performance green concrete 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 resources. One important issue is the use of environmental friendly concrete (green concrete) to enable worldwide infrastructure growth without affecting the environ. Green concrete has nothing to do with color. It is a concept 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, charges for the disposal of waste are avoided, energy consumption in production is lower, and durability is greater. Sustainable development of concrete industry During the last few decades, society has become aware of the problems associated with land filling of residual

products, and limits, restrictions and taxes have been imposed. Disposal of wastes has become a major problem in metropolitan areas in India especially the disposal of Crusher Rock Dust (CRD) generated from stone crusher industry and Marble Slurry Powder (MSP) generated from the stone processing Industry in the country.

II. EXPERIMENTAL PROGRAM MATERIALS

Cement Ordinary Portland cement (OPC) of 43 grade having a 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

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 2.69, fineness modulus as 3.46. This material is dried at room temperature for 24 hours to control the water content in the concrete. The maximum size of fine aggregate was taken to be 4.75 mm. The testing of sand was done as per Indian Standard Specifications IS: 383 - 1973 . Table

2 represents the combined grading of CA and F.A (River sand, CRD and MSP).

(B) Course aggregate

The type of coarse aggregate used is angular aggregates with rough surfaces from crushed natural rock stone aggregate of nominal size of 20 mm was used. Coarse aggregate Specific gravity is 2.76; bulk density is 1636 kg/m³. Water In this study, normal tap water available in the concrete laboratory was used. Water conforming to the requirements of water for concreting and curing as per IS: 456-2000. Super Plasticizer Commercially available Super plasticizer Complots SP430A1 from Forsook Chemicals (India) Ltd., Bangalore was used to produce high workability in concrete and reduce the water cement ratio. The Specific gravity of the Complots SP430A1 is 1.18 to 1.20 at 20

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. It is the most commonly used test and gives a good assessment of fill-in ability. At first, the inside of slump cone and the smooth leveled surface of floor on which the slump cone is to be placed are moistened. The slump cone is held down firmly. The cone is then filled with concrete. No tamping is done. Any surplus concrete is removed from around the base of the concrete. After this, the cone is raised vertically and the concrete is allowed to flow out freely. The diameter of the concrete in two perpendicular directions is measured. The average 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 under its own weight. As per EN 12607, (2002) guide, the range is from 550 mm to 700 mm.

J-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 bars at 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. L - box test method It assesses filling and passing ability of SCC. The vertical section is filled with concrete, and then gate lifted to 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)..

V-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. The trap door is closed and a bucket is placed underneath. Then the apparatus is completely filled with concrete without compacting. After filling the concrete, the trap door is opened and the time for the discharge is recorded. This is taken to be when light is seen from above through the funnel. Mechanical Properties Mechanical properties such as compressive strength and split tensile strength are evaluated. Compressive strength and split tensile strength test were conducted for SCHPGC, NCRS and NCCRD. Compressive Strength Test Compressive strength test usually gives an overall picture of the quality of concrete because strength is directly related to the structure of the hydrated cement paste. The compression test is an important concrete test to determine the strength development of the concrete specimens. Compressive strength tests were performed on the cube specimens at the ages of 7, 28 and 90 days.

Splitting Tensile Strength The 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. The split tensile strength is a more reliable technique to evaluate 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 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 produced and tested for their workability, filling ability, passing ability and strength using the slump flow test, J-ring test, U-box test, V-funnel test, sieve segregation test and 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/mm², 25.15 N/mm² and 34.10 N/mm² for M20, M30 and M40 grade of concrete respectively. The SCHPGC79, SCHPGC164 and SCHPGC254 achieved highest 28 days compressive strength of 26.85 N/mm², 37.25 N/mm² and 49.60 N/mm² for M20, M30 and M40 grade of concrete respectively. Similarly, the SCHPGC79, SCHPGC164 and SCHPGC254 achieved highest 90 days compressive strength of 33.15 N/mm², 45.35 N/mm², and 55.42 N/mm² for M20, M30 and M40 tradeoff concrete respectively. The test results of 7 days, 28 days and 90 days compressive strength are given.

V. CONCLUSION

All the experimental data show that it is possible to use both the wastes in the manufacturing of SCHPGC. 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 requires large amounts of fine particles. Due to its high fineness of the Marble sludge it provided to be very effective in assuring very good cohesiveness of concrete. 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 Selected SCHPGC mixes were compared with the recommended range given by EFNARC, "Specifications and Guidelines for Self.

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