



ASSESSMENT OF SELF-COMPACTING CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH TRADITIONAL ROOF TILE POWDER

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ABSTRACT

Concrete occupies unique position among the modern construction materials, Concrete is a material used in building construction, consisting of a hard, chemically inert particulate substance, known as a aggregate (usually made for different types of sand and gravel), that is bond by cement and water. Bad reinforcement concrete works could generate building failures after earthquake. Concrete pouring and compacting on structural element with dense reinforcement and beam column joint are difficult. Suitable solution on this problem is the use of Self-Compacting concrete that has flow ability, filling ability and passing-ability. Traditional roof tile waste is available in rural areas. The use of traditional roof tile powder in Self-Compacting concrete is an effort to recycle waste and new development in environmental friendly concrete material technology. This research tends to understanding contribution of traditional roof tile powder in development of workability and strength of Self-Compacting concrete. The process of selecting suitable ingredients of concrete and determining their relative amounts with an objective of producing a concrete of required strength, durability, and workability as economically as possible is termed as concrete mix design. One main objective of this work is to study the effects of Roof Tile powder on properties of Self-Compacting concrete of M 25 grade. The roof tile powder percentage for replacement of SCC is varied as 0%, 5%, 10%, 15%, 20% & 25%. M 25 grade concrete cubes, cylinders and beams were casted for conducting compressive strength test, Split tensile test and for flexural test. From the experimental studies 10% of partial replacement of cement with traditional roof tile powder improved hardened concrete properties. The Mix Design for concrete M25 grade is being done as per the Indian Standard Code IS: 10262-1982.

KEYWORDS : - Self Compacting Concrete, Roof Tile Powder.

INTRODUCTION:-

Self-compacting concrete (SCC) is a fluid mixture, which is suitable for placing difficult conditions and also in congested reinforcement, without vibration. Recently, development on concrete technology grows to satisfy the needs to make higher performance concrete. Self-compacting concrete (SCC) is well known as an innovation on concrete technology. SCC capability to flow with high flow-ability makes the fresh concrete is not need compaction and then suitable to use in structure elements which have dense reinforcement. This characteristic also generates easier workability, reduce the need of large number workmanships, and reduce duration of concrete construction stage. Self compacting concrete has small volume of pore in concrete then could minimize amount of captured air in concrete. Refer to its name; self compacting concrete could be defined as concrete which could compact by its self-weight without vibrator help. Self compacting concrete has different material composition and visual appearance compared with normal concrete.

REQUIREMENTS OF SELF COMPACTING CONCRETE:-

SCC exhibits following properties in its plastic state.

Filling Ability:- It is the ability of SCC to flow into and fill completely all spaces in the formwork and encapsulate reinforcement while maintaining homogeneity.

Passing Ability: It is the ability of concrete mix to pass through obstacles like narrow sections in form work, closely spaced reinforcement bars without getting blocked by interlocking of aggregate particles.

Resistance to segregation: Segregation resistance of self compacting concrete is its capability to retain homogeneity in the distribution of ingredient in fresh state during both static and moving condition i.e., during mixing, transportation and placing. It is dependent on viscosity of mix in fresh state.

S.No.	SCC Requirements	Range
1	Diameter of Slump Flow	650-800mm
2	T50cm Slump Flow	2-5 sec
3	V-Funnel Test	8-12 sec
4	V-Funnel at T5mins	6-15 sec

5	L-Shaped Box(H2/H1)	0.8-0.1
6	U-Box Test	30mm
7	w/p Ratio	0.25-0.40

MIX DESIGN AND TRIAL MIX PREPARATION

Mix design is the process of determining the required and specified characteristics of a concrete mixture. The required or specified concrete characteristics can be fresh concrete properties, mechanical properties of the hardened concrete such as strength and durability requirements and the inclusion or exclusion of specific ingredients. Mix proportioning on the other hand is the process of determining the quantities of concrete ingredients, a properly proportioned concrete mix should possess the following qualities:

- Acceptable workability of the freshly mixed concrete
- Durability, strength, and uniform appearance of the hardened concrete
- Economy

Therefore the key for producing a strong, durable and economical concrete rests on the careful proportioning and mixing of the ingredients. The quantity of cement, fine and coarse aggregates, Roof tile powder, water and SP for each batch of proportion is prepared as mentioned in mix design of SCC.

Mixing of concrete:-

Mixing of concrete was carried out by machine. Machine mixing is not only efficient but also economical. Before the materials are loaded in to drum about 25 percent of the total quantity of water required for mixing is poured in to the mixer drum and to prevent any sticking of cement on the bodies or at the bottom of the drum. Then discharging all the materials i.e. coarse aggregate and cement in to the drum. Immediately after discharging the dry material in to the drum the remaining 75 percent of water is added to the drum .The time is counted from the moment all the materials are placed particularly the complete quantity of water is fed in to the drum.

Moulds:-

The concrete is casted in to cube moulds of size 150 mm×150 mm, Beam moulds of size 100×100×500mm and Cylindrical moulds of 300 mm height ×150 mm dia. The moulds used for the purpose are fabricated with steel seat.. Moulds are provided with base plates, having smooth to support. The interior surfaces of the assembled

mould shall be thinly coated with mould oil to prevent adhesion of concrete.

Placing of Mix in Moulds:

After mixing the proportions in the mixing machine, it is taken out into the bucket. The concrete is placed in to the moulds (cubes, beams & cylinders), which are already oiled simply by means of hands only without using any compacting devices.

Curing:

After 24 hours the specimens were removed from the moulds and immediately submerged in clean fresh water and kept there until taken out just prior to testing.

TESTS TO BE CONDUCTED

The European guidelines for self compacting concrete were the first to codify the various testing methods on SCC. As there is no specific test method suggested by BIS for SCC, They are as follows:

- A. Slump Flow Test
- B. V-funnel Test
- C. L-shaped box Test
- D. U-box Test

MATERIALS:-

Fine aggregates:-

Locally available natural sand with 4.75 mm maximum size is used as a fine aggregate. According to IS 383-1970 sand conforming zone for the given fine aggregate is zone-2.

Course Aggregate:-

The crushed coarse aggregate of 12.5 mm maximum size rounded obtained from the local crushing plant. The physical properties of coarse aggregate like specific gravity, bulk density, gradation and fineness modulus are tested in accordance with IS; 2386.

Cement:-

In this experimental study, 43 Grade Ordinary Portland cement (OPC) with brand name PENNA is used for all concrete mixes. The cement used is fresh and without any lumps. The testing of cement is done as per IS: 8112-1989.

Physical property	Results
Fineness (retained on 90-µm sieve)	5%
Normal Consistency	34%
Vicat initial setting time(minutes)	64mins
Vicat final setting time (minutes)	573mins
Specific gravity	3.06
Soundness test	2mm

Roof tile powder:-

Powder has particle dimension of 0.125 mm and potentially has capabilities to be a binder and filler. The physical properties of Roof tile powder is given in below table.

Physical property	Results
Fineness (retained on 90-µm sieve)	5.5%
Specific gravity	2.03

Super-plasticizers:- The admixture CONPLAST SP 430 G8 was used a super plasticizer with a density of 1.2 kg/lit. is used to provide necessary workability.

Water:-

This is the least expensive but most important ingredient of concrete. The water, which is used for making concrete, should be clean and free from harmful impurities such as oil, alkali, acid, etc.; in general, the water which is fit for drinking should be used for making concrete.

MIX DESIGN:-

Mix design can be defined as the process of selecting suitable ingredients of concrete and determining with the object of producing concrete of certain minimum strength and durability as

economically as possible. The Mix Design for concrete M25 grade is done as per Indian Standard Code IS: 10262-1982.

Cement	Sand	Coarse aggregate	Water
524.31kg	803.22KG	797.23KG	199.24
1	1.53	1.52	0.38

Fresh Properties of SCC

Observations:

Percentage Replacement of Tile Powder	Slump Flow in mm	T50cm Slump Flow in Sec	V-Funnel in Sec	V- Funnel T5min in Sec	L-Box (H2/H1)	U-Box in mm
0%	710	2	6	6	0.8	30
5%	710	2	6	6	0.8	30
10%	700	3	7	7	0.8	30
15%	700	3	7	8	0.8	30
20%	680	3	9	10	0.9	30
25%	650	3	10	11	0.9	30

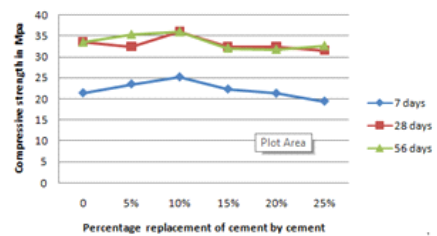
From the table it has been observed that fresh properties of SCC such as Slump flow and T50cm slump flow, V-Funnel and V-funnel T5min, L-box and U-Box test for replacement to cement by roof tile powder is within their limits.

HARDENED PROPERTIES OF SCC:-

The following are the tables give the test results of Self compacting concrete, when cement is partially replaced by Roof Tile powder, for Compressive strength, Split tensile strength and Beam flexure strength

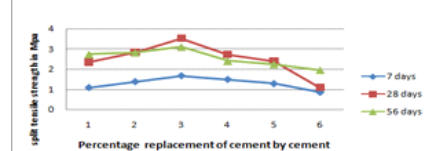
COMPRESSIVE STRENGTH RESULTS:-

Comparison of compressive strength for various replacement level at 7 days, 28 days and 56 days



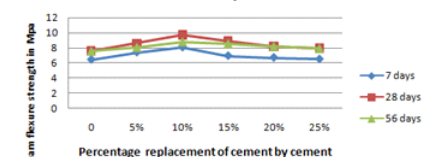
Split tensile strength results:-

Comparison of split tensile strength for various replacement level at 7 days, 28 days and 56 days



Flexure strength results:-

Comparison of beam-flexure strength for various replacement level at 7 days, 28 days and 56 days



CONCLUSION:-

Based on the investigation conducted for the study of behavior of self compacting concrete the following conclusions are arrived.

- As no specific mix design procedures for SCC are available mix design can be done with conventional BIS method and suitable adjustments can be done as per the guidelines provided by different agencies.
- Self compacting concrete mixes can make with Roof tile powder, without sacrificing the strength.
- Trial mixes have to be made for maintaining flow ability, self compatibility and obstruction clearance.

- Super plasticizers are necessary to full fill the fresh property of SCC.
- Roof tile powder can be effectively used as replacement up to 10% by weight of cement, without decreasing the strength compared to controlled concrete, thereby reducing the consumption of cement, with turn reduces the cost.
- Increase the percentage of Roof tile powder (0%, 5%, 10%, 10%, 15%, 20% and 25%) reduces the flow of concrete.
- Self compacting concrete with 10% replacement of cement with Roof tile powder showed good results.
- It can be seen from fresh properties results of SCC with Roof tile powder improves the filling ability and segregation resistance compare to controlled concrete.

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