Effect of Silica Fume and Lime Stone on Self Compacting Concrete Under Axial Compression

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***Abstract*—The project title of "EFFECT OF SILICA FUME AND LIME STONE OF SELF COMPACTING CONCRETE UNDER AXIAL COMPRESSION" itself explains the sequence of work undergone in the project. We used the OPC43 grade cement, due to adding admixture of Silica Fume and lime stone. The silica fume was added in 5%,10%,15%and 20%. The lime stone was added in 10%, 20%, 30%, 40% and 50%. Then combination of both the materials are added with certain percentage as we required. The Fine Aggregate are in the size of 1.12mm ,within dry condition. Both CA&FA are tested with the basic tests such as Specific Gravity and Sieve Analysis test. The Chemical Admixtures such as Super Plasticizer and VMA are used. Super Plasticizer was chemically named as Sulphonated Phenophthalin, with Specific gravity of 1. 1 and added with concrete in 2.5% with cement value. VMA is the Viscosity Modifying Agent with chemically named as Polyethylene Ether with the Specific gravity of 1 and added with concrete in 0.34% with cement value. Both Super plasticizers and VMA are Water reducing agents as well as gives high workability without change in properties of concrete. Concrete was tested both in Fresh and Hardened state. In fresh concrete the following test are conducted T50, slump test, J-ring, and L-box. Those test are to find out the passing and filling ability of concrete. In Hardened state, Compressive Strength test is conducted with the cube of size 150mm x 150mm x 150mm. The Mix design for SCC is on accordance with the code book of IS-10262 2009 and Concrete Technology, For SCC, Finer materials must be higher than the larger size of materials, for that based on, EFNARC, FA should be 60% and CA should be 40% during mixing. The other proportions SP and VMA are also based on EFNAC specification.We used the OPC43 grade cement,due to adding admixture of Silica Fume and lime stone. The silica fume was added in5%,10%,15%and 20%. The lime stone was added in 10%, 20%, 30%, 40% and 50%. Then combination of both the materials are added with certain percentage as we required. The Fine Aggregate are in the size of 1.12mm, within dry condition. Both CA&FA are tested with the basic tests such as Specific Gravity and Sieve Analysis test. The Chemical Admixtures such as Super Plasticizer and VMA reused. Super Plasticizer was chemically named as Sulphonated Phenolphthalin, with Specific gravity of 1.We used the OPC43 grade cement, due to adding admixture of Silica Fume and lime stone. The silica fume was added in 5%,10%,15%and 20%. The lime stone was added in 10%, 20%, 30%, 40% and 50%. Then combination of both the materials are added with certain percentage as we required. The Fine Aggregate are in the size of 1.12mm, within dry condition. Both CA&FA are tested with the basic tests such as Specific Gravity and Sieve Analysis test. The Chemical Admixtures such as Super Plasticizer and VMA are used. Super Plasticizer was chemically named as Sulphonated Phenolphthalin, with Specific gravity of 1.**

I. INTRODUCTION

The Concrete is the widely used bonding material in construction. But, in that normal concrete, compaction process is need to settle down the concrete. Also, in heavy reinforcement areas, it is not possible to compact easily; it is one of the main drawbacks, to avoid such drawbacks, we using Self Compacting Concrete.

Based on that, we are doing "EFFECT OF SILICA FUME AND LIME STONE OF SELF COMPACTING CONCRETE UNDER AXIAL COMPRESSION" Concrete occupies unique position among the modern construction materials concrete is a material used in STONE OF SELF COMPACTING CONCRETE UNDER AXIAL COMPRESSION" Concrete occupies unique position among the modern construction materials concrete is a material used in building construction, consisting of hard, chemically inert particulate substance ,known as an aggregate that is bond by cement and water. Self Compacting Concrete(SCC) is a high performance concrete that can flow under its own weight to completely fill the formwork and self-consolidates without any mechanical vibration. Such concrete an accelerate the placement, reduce the labour requirements needed for consolidation, finishing and eliminate and environmental pollution. The so called first generation SCC is used mainly for repair application and forcasting concrete in restricted areas, including sections that present limited access to vibrate. Such valued added construction material has been used in application justifying the higher material and quality control cost when considering the simplified placement and handling requirements of the concrete.

The successful production of self compacting concrete(SCC) for use, is depended on arriving at an appropriate balance between the yield stress and the viscosity of the paste. Specially formulated high range water reducers are used to reduce the yield stress top into allow the designed free flowing characteristics of the concrete. However, this stone may result in segregation if the viscosity of the paste is not sufficient to support the aggregate particles in suspension. Since Silica fume is being accumulated as waste material in large quantity from the by product of manufacturing process of Silicon and Ferrosilicon alloys, which also create serious problems in environment. Its

utilization as main raw material in the manufacture of concrete will not only create ample opportunities for its proper and useful disposal but also help in environmental pollution control.

II. MATERIALS

A. *Limestone*

Limestone is a sedimentary rock composed largely of the minerals **CALCITE, ARAGONITE** which are different crystal forms of calcium carbonate . Most limestone is composed of skeletal fragments of marine organisms such as coral , forms and mollusks. It also used as building material , aggregate for the base of roads . For e.g GREAT PYRAMID

B. *Silica Fume*

Silica fume is an ultrafine material with spherical particles less than 1 micro in dia. The average being about 0.15 micrometer. This makes it approximately 100 times smaller than the average cement particles . The main field of application is as pozzolanic material for high performance concrete.

C. **Super plasticizers**

Superplasticizers also known as high range water reducers, are chemical admixtures used where well-dispersed particle suspension is required. These polymers are used as dispersants to avoid particle aggregation and to improve the flow characteristics for suspensions such as in concrete applications. The chemical name of Super plasticizer which we used was Sulphanated Phenopthalin.

D. ***VMA***

VMA is the Viscosity Modifying Agent admixture, tends the concrete to flow freely without segregate and change in properties in concrete. It is the ready to use liquid admixture. Additionally ,their effect on the early development of concrete strength is determined. The addition of VMA causes a increase of flow time.

III. METHODOLOGY

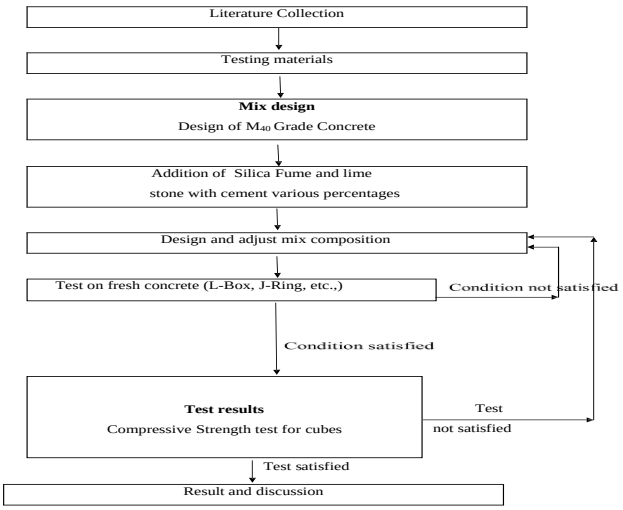

Figure 1. Methodology

a) **Slump test**: Slump flow test is used to find the filling ability of the SCC. The SCC sample is poured in to the slump cone then the slump flow diameter is measured. The flow time is measured & that is know as T50 slump time. The higher the slump flow value, the greater its ability to fill formwork under its own weight.

b) **J Ring test**: This test can be used for determine the passing ability (measured by blocking step). It is made up of stainless steel. It consists of crown with 16 bar and 18mm dia. Weight is approximately 10kg. This test is used for both mixture qualification and quality control testing. And it also used to measure the distance lateral flow of SCC. It can be mainly designed for durability

c) **L Box test:** The L-Box test is used to find the passing ability of SCC. The SCC sample is poured in to the L-Box apparatus, now the plate is removed to allow flow. The L-box ratio is calculated as H2/ H1. According to EFNARC , when the ratio of h2 to h1 is larger than 0.8, self compacting concrete has good passing ability.

IV. RESULT AND DISCUSSION:

a) ***FILLING ABILITY***

- slump flow
- T50 Test

b) ***PASSING ABILITY***

- L box
- J ring

c) ***SEGREGATION RESISTANCE***

- Both filling and passing ability with uniform composition through out the process of transport and placing.

A. MIX DESIGN

M40 grade – IS 10262- 2009

Cement = 350 kg/m³

Water = 140 kg/m³

Fine Aggregate = 896 kg/m³

Coarse Aggregate = 1140 kg/m³

Chemical Admixtures = 7kg/m³

Water/ Cement Ratio = 0.4

Proportion = 1: 2.56 : 3.25

B. QUANTITY CALCULATION:

Volume of 1 cube

Cement Content =(350 × 0.15³) + 0.20

= 1.5 kg

Fine Aggregate =(896 × 0.15³) + 0.20

= 3.10kg

Coarse Aggregate $=(1140 \times 0.15^3) + 0.20$

$= 4$ kg

Number of casted cubes = 135 cubes + 9 cubes

Table 1. Quantities of Cement and Silica

PERCENTAGE	CEMENT	SILICA FUME
5%	1.5kg	75gm
10%	1.3kg	150gm
15%	1.25kg	230gm
20%	1.13kg	300gm
Total silica fume		1kg

Table 2. Quantity Of Cement and Lime Stone

PERCENTAGE	CEMENT	LIME STONE	
10%	1.3kg	150gm	
20%	103kg	300gm	
30%	1kg	450gm	
40%	0.85kg	570gm	
50%	0.7kg	710gm	
Total lime stone		2.2kg	

C. PROCEDURE FOR MIX DESIGN

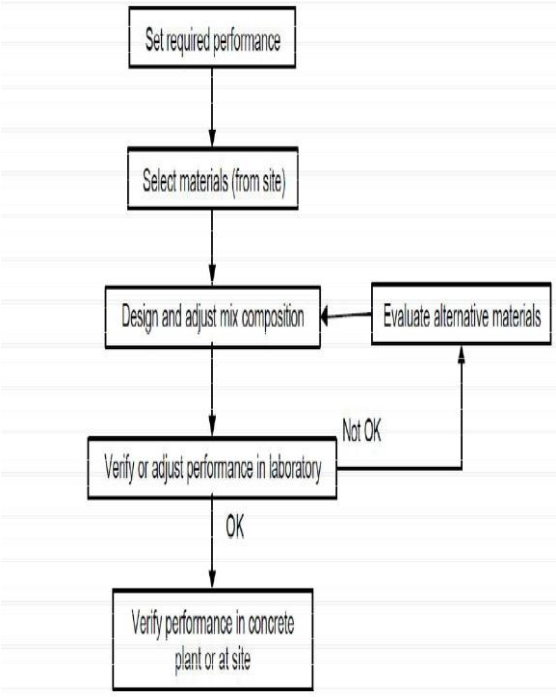

Figure 2 . Procedure for Mix Design

D. APPLICATIONS

- Bridges
- Box culvert
- Buildings
- Tunnels
- Dam
- Fire proof
- Concrete Filled Steel Column

V. CONCLUSION

As we conclude compression test result as 28 days the conventional concrete has 39.9N/mm². So adding of silica fume at 10% we obtained as 42.52N/mm². The addition of limestone at 40% we obtained as 47.50N/mm². The combination of silicafume and limestone as 44.33n/mm². so for our investigation the result will be increased at 90% strength as compared to the conventional concrete.

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