

## Application of Industrial Waste in Manufacturing of Self Compacting Concrete

**Adil Bashir, Vivek Kumar Tiwari, Anand Mohan Singh, Momin Khan**

Department Of Civil Engineering  
SRM University NCR Campus  
Modinagar

### ABSTRACT-

Self-compacting concrete (SCC) is an innovative concrete that does not require vibration for placing and compaction. It is able to flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement. The hardened concrete is dense, homogeneous and has the same engineering properties and durability as traditional vibrated concrete.

Due to industrialization there is huge amount of red mud and foundry waste sand created. Aluminum is now consume during manufacture red mud which is used Red Mud and Foundry waste Sand are industrial waste and causing threat to environment so the reduce the cost of the construction also to make structure more durable, reduce problem of this material the project has been undertaken so that it can be used for construction fashion following points attempted.

- To study the properties of foundry waste sand.
- To blend to mix or to replace cement by different % by foundry waste sand.
- To study properties of Red mud
- To prepare the concrete by blending or replacing the cement by Red mud
- To study the comparativeness.
- Facing lot more problem of foundry waste.

Very close to the Kolhapur there is project of steel industry, sand used for the formation of mould when the molds are opened the waste sand is dumped for the filling the low lying areas while doing this the agriculture areas is converted into barren area Because there is no. space for the waste other than the land filling similar case is in case of Aluminum industry where red mud is concluded to be waste. Which contains lot amount of bauxite and that is why red mud is also dump in the nearby areas here it is causing big threat for the society and it is disturbing the eco system of the environment.

So it is the dire need to use this particular otherwise waste material for the constructive in such fashion in the case of concrete so that concrete which became cost effective as well as eco friendly. And hence this project is attempted.

**Key Words-**Red Mud, Foundry Sand Waste, Viscosity Modifying Agent (VMA), Fly Ash, Glenium

### INTRODUCTION-

The development of new technology in the material science is progressing rapidly. In last three decades, a lot of research was carried out throughout globe to improve the performance of concrete in terms of strength and durability qualities. Consequently concrete has no longer remained a construction material consisting of cement,

aggregate, and water only, but has become an engineered custom tailored material with several new constituents to meet the specific needs of construction industry. The growing use of concrete in special architectural configurations and closely spaced reinforcing bars have made it very important to produce concrete that ensures proper filling ability, good structural performance and adequate durability. In recent years, a lot of research was carried out throughout the world to improve the performance of concrete in terms of its most important properties, i.e. strength and durability. Concrete technology has undergone from macro to micro level study in the enhancement of strength and durability properties from 1980's onwards. Till 1980 the research study was focused only to flow ability of concrete, so as to enhance the strength however durability did not draw lot of attention of the concrete technologists. This type of study has resulted in the development of self compacting concrete (SCC), a much needed revolution in concrete industry. Self compacting concrete is highly engineered concrete with much higher fluidity without segregation and is capable of filling every corner of form work under its self weight only (Okamura 1997). Thus SCC eliminates the needs of vibration either external or internal for the compaction of the concrete without compromising its engineering properties.

This concrete was first developed in Japan in late 80's to combat the deterioration of concrete quality due to lack of skilled labors, along with problems at the corners regarding the homogeneity and compaction of cast in place concrete mainly with intricate structures so as to improve the durability of concrete and structures. After the development of SCC in Japan 1988, whole Europe started working on this unique noise free revolution in the field of construction industry. The last half of decade 1991-2000 has remained very active in the field of research in SCC in Europe. That is why, Europe has gone ahead of USA in publishing specifications and guidelines for self compacting concrete (EFNARC 2002). Now, all over the world, a lot of research is going on, so as to optimize the fluidity of concrete with its strength and durability properties without a drastically increase in the cost. The first North American conference on design and use of self-consolidation concrete was organized in November 2002. At present many researchers are working in numerous universities and government R&D organizations due to benefits of the use of this concrete. A very limited work is reported from India, where the future for concrete is very bright due to scarcity of skilled man power, non-mechanization of construction industry, abundant availability of construction materials available at very low cost. Therefore, it can be said that SCC is still quite unknown to many researchers, builders, ready mix concrete producers, academia etc.

Self compacting concrete is basically a concrete which is capable of flowing in to the formwork, without segregation, to fill uniformly and completely every corner of it by its own weight without any application of vibration or other energy during placing. There is no standard self-compacting concrete. Therefore each self-compacting concrete has to be designed for the particular structure to be constructed.

However working on the parameters which affect the basic properties of self-compacting concrete such as plastic viscosity, deformability, flowability and resistance to segregation, self-compacting concrete may be proportioned for almost any type of concrete structure.

To establish an appropriate mixture proportion for a self-compacting concrete the performance requirements must be defined taking into account the structural conditions such as shape, dimensions, reinforcement density and construction conditions. The construction conditions include methods of transporting, placing, finishing and curing. The specific requirement of self-compacting concrete is its capacity for self-compaction, without vibration, in the fresh state. Other performances such as strength and durability should be established as for normal concrete.

To meet the concrete performance requirements the following three types of self-compacting concretes are available.

- a) Powder type of self-compacting concrete: This is proportioned to give the required self-compatibility by reducing the water-powder (material < 0.1mm) ratio and provide adequate segregation resistance. Super plasticizer and air entraining admixtures give the required deformability.
- b) Viscosity agent type self-compacting concrete: This type is proportioned to provide self-compaction by

the use of viscosity modifying admixture to provide segregation resistance. Super plasticizers and air entraining admixtures are used for obtaining the desired deformability.

- c) Combination type self-compacting concrete: This type is proportioned so as to obtain self-compatibility mainly by reducing the water powder ratio, as in the powder type, and a viscosity modifying admixture is added to reduce the quality fluctuations of the fresh concrete due to the variation of the surface moisture content of the aggregates and their gradations during the production. This facilitates the production control of the concrete.

### NEED FOR SCC

Now having a look over history of SCC, question arises that what is needed to go for SCC? So, here are some of the important aspects to go with SCC:

Foundry sand and red mud has pozzolanic properties hence increasing the binding properties and gives the better strength at the same time it reduces the cost problems. And also reduces the following problems.

1. Foundry waste dumping
2. Red mud dumping.

In dumping land become useless. It starts polluting the groundwater.

So it should be used in some constructive fashion. This is going to cater in two ways Help in getting better quality of concrete.

For several years, the problem of the durability of concrete structures has been a major problem posed to engineers. To make durable concrete structures, sufficient compaction is required. Compaction for conventional concrete is done by vibrating.

Over vibration can easily cause segregation. In conventional concrete, it is difficult to ensure uniform material quality and good density in heavily reinforced locations.

If steel is not properly surrounded by concrete it leads to durability problems. This is the problem mainly with heavily reinforced sections where a very high congestion of reinforcement is seen. In this case, it becomes extremely difficult to compact the concrete. Then what can be done to avoid honeycombing,

The answer to the problem may be a type of concrete which can get compacted into every corner of form work and gap between steel, purely by means of its own weight and without the need for compaction. The SCC concept was required to overcome these difficulties.

The SCC concept can be stated as the concrete that meets special performance and uniformity requirements that cannot always be obtained by using conventional ingredients, normal mixing procedure and curing practices. The SCC is an engineered material consisting of cement, aggregates, water and admixtures with several new constituents like colloidal silica, pozzolanic materials, chemical admixtures to take care of specific requirements, such as, high-flowability, compressive strength, high workability, enhanced resistances to chemical or mechanical stresses, lower permeability, durability, resistance against segregation, and possibility under dense reinforcement conditions.

### ADVANTAGE-

#### 1. Improved Concrete Quality:

SCC yields homogeneous concrete in situations where the castings are difficult due to congested reinforcement, difficult access etc.

SCC shows a good filling ability especially around reinforcement

SCC is very well suited for special and technically demanding structures such as tunnel linings, as the possibility to compact the concrete is limited in the closed space between formwork and rock.

Shows narrow variation in properties on site.

Most suitable for concrete filled tubes (CFT) technology construction for high rise buildings.

It ensures better quality of in-situ pile foundation.

## 2. Environmental & Human Health Protection:

Reduces noise at sites, the pre cast factory, and neighborhood; hence, it is a silent concrete.

Eliminates problems with blood circulation leading to “white fingers” caused by compacting equipment, hence called a healthy concrete.

SCC gives noise protection in precast industry, by introducing no restrictive measures like ear protection, marked areas, safety instructions are necessary. Shortens the construction time by accelerating construction process, especially in pre cast industry.

## 3. Economy & Time Reducing:

Its ease of placement improves the productivity and the cost saving through reduced equipment and labor equipment.

Reduction in wear and tear of forms, therefore, it extends the service life of forms.

Reduction in the number of worker. Normally one cum requires 1.5 man-hours; with SCC this is reduced to 0.35 man-hours.

It reduces the consumption of resources and cost, even considering a higher price per cubic meter for the concrete. Okamura has reported that it is possible to reduce the overall bridge cost by 5-15%.

Because of its high fluidity, this concrete does not need any vibrations so that it allows to save energy and ensure suitable cost in place.

Reduction of expenses and manpower needed for patching finished precast elements.

It can enable the concrete supplier to provide better consistency in delivering concrete, which reduces the interventions at the plants or job sites

4. Construction with SCC is not affected by the skill of the workers, and shape and arrangement of reinforcing bars of the structures

5. SCC use at construction sites reduces the chance of accident by reducing number of cables needed for the operation of compacting equipment, hence, reduces the workers compensation premiums.

6. It gives wide opportunity for the use of high-volumes of by products materials<sup>15-18</sup> Such as fly ash, lime stone powder, quarry dust etc., (Yahia et al. 1999, Bouzoubaa, and Lachemi 2001, Persson 2002, Naik and Kumar 2003) since a higher volume of powder material is required for enhancing the cohesiveness and reducing the amount of superplasticizer and viscosity modifying agents.

## DISADVANTAGE-

The production of SCC places more stringent requirements on the selection of materials in comparison with conventional concrete.

An uncontrolled variation of even 1% moisture content in the fine aggregate will have a much bigger impact on the rheology of SCC at very low W/C (~0.3) ratio. Proper stock piling of aggregate, uniformity of moisture in the batching process, and good sampling practice are essential for SCC mixture,

A change in the characteristics of a SCC mixture could be a warning sign for quality control and while a subjective judgment, may some times be more important than the quantitative parameters.

The development of a SCC requires a large number of a trial batches. In addition to the laboratory trial batches, field size trial batches should be used to simulate the typical production conditions. Once a promising mixture has been established, further laboratory trial batches are required to quantify the characteristics of the mixture.

SCC is costlier than conventional concrete initially based on concrete materials cost due to higher dosage of

chemical admixtures, i.e. high range water reducer and viscosity enhancing admixture (VEA). Increase in material cost can be easily offset with improvement in productivity, reductions in vibration cost and maintenance and proper uses of mineral admixtures.

## CONCLUSIONS-

In present scenario there is a greater need for self compacting concrete due to sickness of member and architectural requirement, also to improve durability of the structure.

Now the world is going to facing greater need of high performance concrete, durability point of view and SCC where the conventional way of compacting may not be always useful under different site condition. So instead of going for the conventional concrete let us mix the concrete compacting on its own which is called as self compacting concrete.

Now due to industrialization there is greater increase in the foundry activity in at around Satara district, mainly in case of Kolhapur area. Similarly there is big project near Kolhapur of foundry sand. Hidalgo there is huge amount of Red mud is produced every day and dumped on the ground it is threat environment.

This waste is used for dumping for filling the low lying areas causing the environment in deterioration in long run, so this mix should be used for the construction activity it will reduce the problem of environmental pollution at the same time it reduces the cost of the construction and add it makes the concrete high performing from the durability point of view. So from these three points the project is under taken.

Based on the experimentation conducted, the following observations were made and hence some conclusions.

It has been observed that the compressive strength of self compacting concrete produced with the combination of admixtures such as (SP+VMA) goes on increasing up to 2% addition of red mud. After 2% addition of red mud, the compressive strength starts decreasing, i.e. the compressive strength of self compacting concrete produced with (SP+VMA) is maximum when 2% red mud is added. The percentage increase in the compressive strength at 2% addition of red mud is +9.11 Thus, it can be concluded that maximum compressive strength of self compacting concrete with the combination of admixtures (SP+VMA) may be obtained by adding 2% red mud which is a waste material from aluminum industry.

It has been observed that the compressive strength of self compacting concrete produced with the combination of admixtures such as (SP+VMA) goes on increasing upto 2% addition of foundry waste sand. After 2% addition of foundry waste sand, the compressive strength starts decreasing, i.e. the compressive strength of self compacting concrete produced with (SP+VMA) is maximum when 2% foundry waste sand is added. The percentage increase in the compressive strength at 2% addition of foundry waste sand.

Thus, it can be concluded that maximum compressive strength of self compacting concrete with the combination of admixtures (SP+VMA) may be obtained by adding 2% foundry waste sand which is a waste material of ferrous industry (foundry).

## SCOPE FOR FURTHER STUDY-

The following experimental studies can be conducted in future with respect to self compacting concrete-

The effect of addition of red mud/foundry waste sand on the durability characteristics of self compacting concrete containing more than three admixtures.

The effect of high temperature on the properties of self compacting concrete containing more than three admixtures with red mud/foundry waste sand.

The effect of addition of red mud/foundry waste sand on the shrinkage and the creep properties of self compacting concrete containing more than two admixtures.

Similarly there are lot more mineral admixtures which are the wastage of the industry. The other type of ingredients wastages used for manufacturer of concrete to reduce the problems of environmental attack.

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