ANALYTICAL INVESTIGATION OF FLEXURAL BEHAVIOUR OF SCC BEAM USING ECO SAND

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Abstract: *In this project work the main objective is to replace the fine aggregate partially with eco sand as the scarcity of fin aggregate is more nowadays, the demand is more for the fine aggregate which increases the cost of the fine aggregate. Eco sand is the by product of cement manufacturing industry which are abundantly available in the society since there is no ways to dispose those by product effectively. The project work comprises of analytical, numerical and experimental part in order to verify the mechanical property such as flexure strength. Beam is a vital structural component in any moment resisting frames or any other type of structure. So the partial replacement of Fine aggregate with eco sand is done in a simply support beam of dimension 150 x200 mm with a span of 1200 mm. The numerical work is done using ANSYS software so that the deflection of the beam and Von mises stress analysis is done and the results are obtained, those results are compared with the analytical results and the results are interpolated. Graph is plotted with the obtained results and the conclusion is drawn.*

Keywords: *Ecosand ,by product of cement, flextural strength, von mises,.*

1 INTRODUCTION:

Self-compacting concrete (SCC) is characterized by high fluidity and moderate viscosity. It is able to move in the formworks and fill them uniformly under its own weight. Moreover, the use of SCC is cost- effective because this concrete does not give rise to any mechanical vibrations, it requires some construction workers during the casting stage, and the noise level due to mechanical vibration equipment is lower at the construction site, thereby reduces sound effects on the environment and improves the working conditions. The SCC has been widely used to produce beams of complex shapes and with high density of reinforcement structures.

1.1 NEED FOR SCC:

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. 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. Use of SCC overcomes the problem of concrete pla cement in heavily reinforced sections and it helps to shorten construction period. Self-compacting concrete is growing rapidly, especially in the precast market where its advantages are rapidly understood and utilized. Super plasticizer enhances deformability and with the reduction of water/powder segregation resistance is increased.

High deformability and high segregation resistance is obtained by limiting the amount of coarse aggregate. However, the high dosage of super-plasticizer used for reduction of the liquid limit and for better workability, the high powder content as 'lubricant' for the coarse aggregates, as well as the use of viscosity-agents to , as well as the use of viscosity-agents to increase the viscosity of the concrete have to be taken into account.

1.2 ECO SAND:

Eco sand are very fine particles, a bi-product from cement manufacture which can be used to increase efficiency in concrete.

Its micro filling effect reduces pores in concrete and provides better moisture content resistivity and durability.

2 INTRODUCTIONS TO FLEXURAL BEHAVIOUR:

The hardened SCC is dense, homogeneous and has the same engineering properties and durability as traditionally vibrated concrete. SCC is more brittle than NC under loading . Ductile design of reinforced concrete beams is generally related to flexural failure in bending, but very often the presence of high shear force reduces their flexural capacity.

Concrete structural components exist in buildings and bridges in different forms. Understanding the response of these components during loading is crucial to the development of an overall efficient and safe structure. Different methods have been utilized to study the response of structural components. Experimental based testing has been widely used as a means to analyze individual elements and the effects of concrete strength under loading. Creation of durable concrete structure requires adequate compaction by skilled labourers. The gradual reduction of skilled workers in construction industry has led to a similar reduction in the quality of construction work.

Successful self-compacting concrete must have high fluidity (for flow under self-weight), high segregation resistance (to maintain uniformity during flow) and sufficient passing ability so that it can flow through and around reinforcement without blocking or segregating. Super plasticizers added to concrete provide a better workability. One of the disadvantages of SCC is its cost, associated with the use of chemical admixtures and use of high volumes of Portland cement. The water demand and workability are controlled by particle shape, particle size distribution, particle packing effects and the smoothness of the surface texture. One alternative to reduce the cost of SCC is the use of additions.

3 FINITE ELEMENT ANALYSES

3.1 INTRODUCTION

The finite element method is a numerical analysis technique for obtaining approximate solutions to a wide variety of engineering problems. ANSYS is a general purpose finite element (FE) model in ANSYS. Here a linear analysis is considered throughout is considered through the study by assuming that there is a perfect bonding between reinforcement and steel.

3.2 FINITE ELEMENT MODELLING

Concrete modelling

Behaviour of the concrete

SOLID 65 element was used to model the concrete. SOLID 65 element is an eight node soild element and has 3 displacement and 3 rotation degrees of freedom at each node. In other words, six degree of freedom at each node . The element took the shape of a rectangular prism. The most important aspect of the SOLID 65 element is the treatment of nonlinear material properties. The response of concrete under loading is characterized by a distinctly nonlinear behavior. The typical behavior expressed in the stress-strain relationship for concrete subjected to uniaxial loading. SOLID 65 element considers smeared crack in tension and crushing in compression, and its failure criterion is given by: F/fc - S P 0 *(1)* Where *F* is a function of the principal stresses, *S* is the] failure surface, and *fc* is the material compressive strength. When eq.1 is satisfied, the material will crack if any principal stress is tensile and will crush when all principal stresses are compressive. The Willam and Warnke failure surface used in ANSYS® is defined by five parameters, which are the concrete uniaxial compressive strength (*fc*), concrete tensile strength (*ft*), concrete biaxial compressive strength (*fcb*), concrete biaxial compressive strength superimposed on a hydrostatic stress state (*f1*), concrete uniaxial compressive strength superimposed on a hydrostatic stress state (*f2*).

3.3 ELEMENT PROPERTIES

SOLID65 is used for 3-D modelling of solids with or without reinforcing bars (rebar). The solid is capable of cracking in tension and crushing in compression. In concrete applications, for example, the solid capability of the element may be used to model the concrete while the rebar capability is available for modelling reinforcing behaviour. Other cases for which the element is also applicable would be reinforced composites (such as fibre glass), and geological material 9such as rock). The element is defined by eight nodes having three degree of freedom at each node: translations in the nodal x, y, z directions.

3.4 STEEL REINFORCEMENT

To model concrete reinforcing, discrete modelling is used by assuming that bond between steel and concrete is 100 percent. Beam column has six degree of freedom at each node. These include translations in the x, y, z directions and rotations about the x, y, z directions. This element is well-suited for linear, large rotation, and large strain nonlinear applications.

3.4 MATERIAL PROPERTIES

Linear analysis considered for modelling RC beam column, table summarizes the material linear properties and elements used in the modelling.

Materials	Concrete
Density (kg/m3)	2200
Elastic modulus(Mpa)	33185
Poison's ratio	0.15
Fc28(Mpa)	40
Element used	SOLID65
Fy (Mpa)	-

Table 1: Material Property

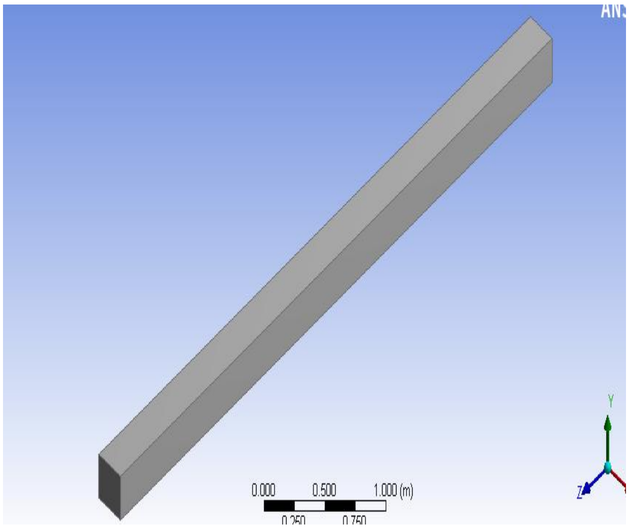

Fig 1 *Model Of A Beam*

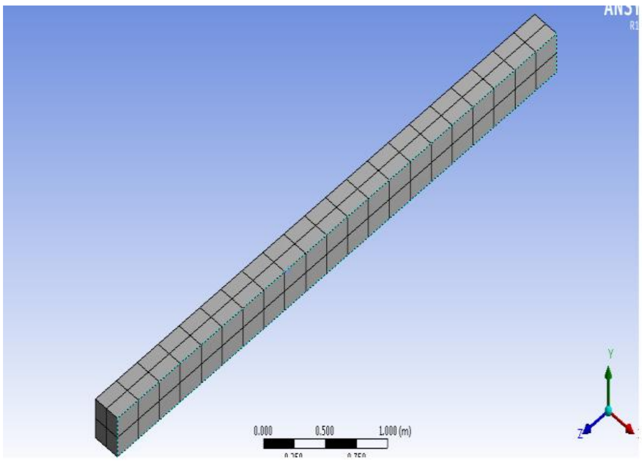

Fig 2 *Meshed model*

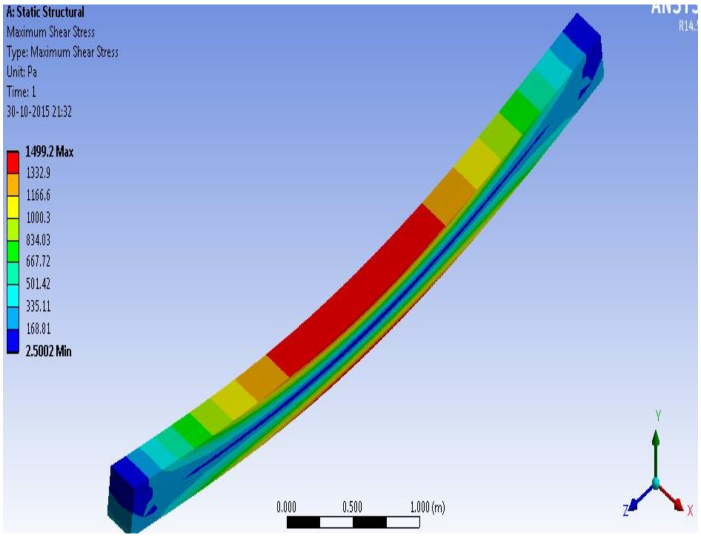

Fig 3 *Shear Stress Of A Beam*

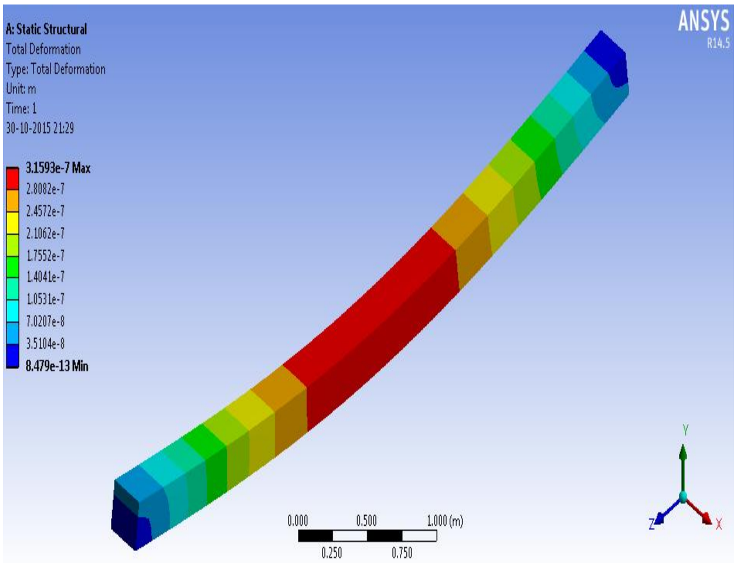

Fig 4 *Total Deformation Of A Beam*

RESULT AND DISCUSSION

GENERAL

This chapter deal with the conclusions of the analytical investigation on flexural behaviour of beam under point loading made and also some of the cope for future work. it gives the brief description about the work done. Scope for the future work gives suggestion for future researches that can be carried out the corresponding to the present area of study.

CONCLUSION

Fresh concrete properties of SCC such as workability and flowability decreased and hardened properties such as compressive strength, flexural strength and tensile strength improved by the addition of eco sand.

All the SCC mixes had a satisfactory performance in the fresh state. Among the mineral admixtures considered, the ecosand 50% series had a good workability properties compared to other eco sanh series.

In general the use of mineral admixtures improved the performance of SCC in fresh state and also avoided the use of VMAs.

Optimum W/P ratio was chosen as 0.35 by weight, the ratio greatly beyond or less than this may cause

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