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A REVIEW ON REINFORCED CONCRETE VOIDED SLAB

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ABSTRACT

The slab is load carrying structural member in building consuming concrete. The slab thickness is increasing if span and acting loads are increases. In present study attempt is made by inserting plastic bottles at middle portion of slab and reduced volume of concrete which will reduce weight of concrete directly.The comparative study is performedbetween analysis of voided and conventional slab system.This system shows that dead load of structure is reduced without any major effect on load carrying capacity of slab.

Key words—Slab, Fly ash, Plastic Bottles, and SFIS.

I. INTRODUCTION

Now a day Disposal of plastic waste and fly ash is considered to be a big problem due to its non bio-degradability properties and presence in large quantities. In recent time significant research is underway to study to disposal of these waste in concrete were strength of concrete may not be major criteria under consideration such as heavy mass of concrete in PCC pavement.

Plastic waste is one the component of municipal solid waste which is becoming major issue for its possible use self compacting concrete and light weight concrete. It is important to realize that not all waste material suitable for such use. Fly ash is environmental friendly solution that meets or exceeds performance specification. Fly ash within concrete gives greater strength, increase workability reduce segregation and bleeding.The plastic bottles and fly ash can be used in concrete work such as slab, pavement without significant effect on its properties and strength so we can reuse the plastic waste. Slab with using waste material such as plastic & fly ash is common in building due to its technical and functional point of view. The self weight of slab can be reduced by replacing middle height of cross section of slab with plastic bottles with fly ash. The main idea of behind of it to removing excess concrete from the slab by use of plastic bottle which fill up with fly ash which does not react chemically with concrete or steel. The plastic bottle and fly ash used in slab work it reduced the quantity of concrete due to this economy will be achieve.

So, main purpose of this research and study the reduction of amount of consumption of concrete and self weight of slab. Finally there is reduction of load coming on structure without any drawback.

II. LITERATURE REVIEW

Before we start with the project it is very necessary to study the current literature available in this field. The lot of researchers similar to this type of project have been contributed towards the field, a few of which related this we have studied are mentioned below Brief review of literature relevant to the study is presented below-

1. Jorgen Breuning(1990), invented a Bubble Deck technology uses spheres made of recycled industrial plastic to create air voids while providing strength through arch action. For a section cut of a Bubble Deck. As a result, this allows the hollow slab to act as a normal monolithic two-way spanning concrete slab. These bubbles can decrease the dead weight up to 35% and can increase the capacity by almost 100% with the same thickness. As a result, Bubble Deck slabs can be lighter, stronger, and thinner than regular reinforced concrete slabs.[18]

2. PrabhuTeja and P Vijay Kumar (2012):studied the durability of Bubble deck slab and is explained on the basis of creep and shrinkage. A Bubble deck element with two spherical hollows was compared with a solid concrete block of the same dimension and of the same concrete. The difference between the shrinkage strains of these two was measured. The results show that Bubble deck element has a negligible larger marginal shrinkage strain than a solid slab with equivalent dimensions and the same concrete performances, under the same exposure to environmental conditions. The influence of carbonation shrinkage can be neglected in the design of concrete structures with Bubble deck system, because only a small part of the concrete cross- section is exposed to this kind of shrinkage.[4]

3. AratiShetkarand NageshHanche (2015): Presented experimental Study on Bubble Deck Slab System with Elliptical Balls, the behavior of Bubble Deck slabs is influenced by the ratio of bubble diameter to slab thickness, the effectiveness and feasibility of the application of Bubble Deck in the construction. . In this experiment, the applied force is provided from the bottom to the top of the slab, which is opposite to the direction of gravity using hydraulic jack. By applying that kind of force, it is easier to record the strain and deformation of concrete and rebar from the top side of the slab. Until the cracks are found in the slabs and the failure modes are appeared. It shows the better load bearing capacity in Bubble Deck can be achieved using the hollow elliptical balls, reducing material consumption made it possible to make the construction time faster, to reduce the overall costs. Besides that, it has led to reduce deadweight up to 50%, which allow creating foundation sizes smaller.[17]

4.Amer M. Ibrahim, Nazar K. Ali, Wissam D. Salman (2013): Presented flexural capacities of reinforced concrete two-way bubble deck slabs of plastic spherical voids. It has been verified the flexural behavior of this Bubble Deck slab such as ultimate load, deflection, concrete compressive strain and crack pattern, two-dimensional flexural tests were tested by using special loading frame. In that six test of specimens were used. Two were a conventional RC slab and four were Bubble Deck slabs having void diameter to slab thickness ratios of (0.51, 0.64 and 0.80). It shown that the crack pattern and flexural behavior depend on the void diameter to slab thickness ratio. The ultimate load capacities for Bubble Deck slabs having bubble diameter to slab thickness of (0.ᵒ1 and 0.64) were the same of solid slabs, while when bubble diameter to slab thickness of (0.80) the ultimate capacities were reduced by about (10%). The slab was simply supported at all edges by four steel beams which had a hinge in the upper surface to minimize fixed end moment and other errors from support

condition during the test. This Specimens were tested under a five-point load system using a five hydraulic jack and a five loading plate to satisfy the actual loading condition.[2]

5.Anusha, C.H Mounika and Purnachandra (2010): conducted studies on the fire resistance of Bubble deck slabs. The analysis was first done on a hollow core slab without fire, for two charges one that leads to elastic dynamic response and the other that causes plastic behavior and severe concrete cracking. The same blast analysis had been subjected to fire. There were many difficulties in obtaining a reliable result. A discussion of the experimental setup and experimental results are compared with simplified numerical models solved with the software LS-DYNA. Fire does not change the material and structural properties that fast as compared to an explosion. The most important conclusion of the analysis is that crack patterns and blast load dynamic responses are indeed altered by fires with temperature up to 4500C. Yet within the limitations of assumptions concerning boundary conditions, the examined slabs keep their blast bearing capacity after blast load scenarios up to 1.5kg C4 with at 1m standoff distance[16].

6.Owings & Merrill (2009)SFIS targets areas of framed floors that are subject to bending rather than shear forces, and where concrete provides little structural benefit. Bundled plastic bottles, baled plastic bags, or other compressed waste materials are placed inside the formwork of yet-to-be-poured concrete slabs, thereby reducing not only the concrete required for those slabs, but also the building's overall structural weight (which means less reinforcing is needed). The SFIS system can reduce the amount of concrete, rebar, and post-tensioning used within a building's superstructure and foundations by up to 35 percent. It also finds a new use for some of the billions of plastic bottles and shopping bags that consumers discard every year.[7]

III.EXPERIMENTAL PROGRAM

3.1 Mix design.

For the slab specimens,M-20 grade of concrete are used For concrete mix ordinary Portland cement is used. Concrete mix design done as per IS10262.Mix proportion 1:1.5:3 and water cement ratio 0.45 is taken.

Table no.2 mix design

MATERIAL	KG/M^3
Cement	438
Coarse aggregate	1055
Fine aggregate	743.68
Water	197

Steel reinforcement –

Reinforcing bars of 8mm diameter of FE 500 HYSD bars are used in the specimens. The slab casted taken as two way slab as per IS456:2000 by using 8mm diameter bars with proper ductility.The details are shown in following table.

Table no.3 Reinforcement details

Slab	Thickness	Reinforcement	c/c distance	Clear cover
Conventional slab:	130 mm	8mm	150mm	15mm
voided slab:		8mm	150mm	15mm
fly ash bottle slab		8mm	150mm	15mm

Recycled Plastic bottles

Recycled plastic bottles are used to reduce the wastage of plastic instead of dumping of it and also it helps to reduction of environmental pollution .the cost of recycled plastic bottles is negligible as compare to concrete material. The plastic bottle size 3.5 and 7.5 cm diameter are Used in this research work. The purpose of utilization of recycled plastic bottles is reduce the amount of concrete.

3.2 Details of slab specimen-

for analysis of these system three types of slab are constructed during an experiment are mentioned in following table.

Table no.4

Type of slab	**Size of slab (m)**	**Slab thickness(mm)**	**Bottles type**	**Diameter of bottles(cm)**
Conventional slab:	1 x 1	130	NIL	NIL
voided slab:	1 x 1	130	Empty plastic bottles	3.5
fly ash bottle slab	1 x 1	130	Bottle filled with fly ash	7.5

1. Conventional slab: This is a slab with specifications prepared to analyze experimentally with normal concrete of grade M20 by adopting conventional methods of design according to IS 456:2000.

Photograph 1 Conventional slab

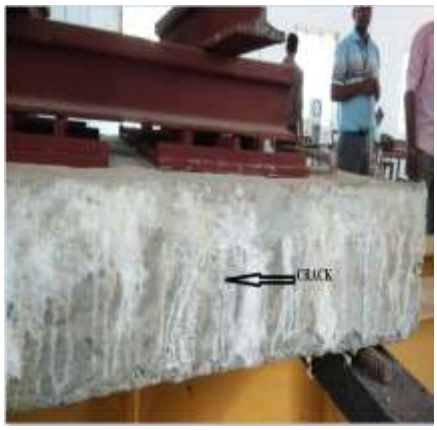
3.3 Test procedure

In this procedure Flexural test on slab was carried out to determine the strength and deflection. The test is carried out by using loading frame with a uniform distributed load. The slab were tested after 28 days of after casting with proper curing. The slab specimens were placed on the testing machine and adjusted the centre line, supports, loadand dial gauge were in their correct at best locations. When load increases observations and

measurements were recorded for deflection and crack development on slab surface.The applied load and deflection of slab specimens was measured at their mid span beneath the lower face of the tested slabs. .[11]

IV. CASE STUDY

This study carried out in Department of Civil Engineering, of Dr. Mahalingam College of Engineering and technology, Coimbatore, India. In this experiment the Bubble deck slab and Conventional were tested with the help loading frame by applying the uniformly distributed load over the slab. Slab cause a failure by applying loading uniformly distributed load and cause the deflection which was measured with the help of dial gauge.The observations are recorded at the time of load increment. The following results was recorded in testing. Conventional slab carried the load of 365kN and causes the deflection of about 14.46mm. The Bubble deck slab carried the load of 341.5kN and causes the deflection of about 18.56mm. and the crack occurs at side face of the slab due to bending.Finally results are shows that the 80% load coming capacity taken by bubble deck slab as compared to conventional slab [11].



Photograph 2 Failure of conventional slab [11]

Photograph 3 Failure of bubble deck slab [11]

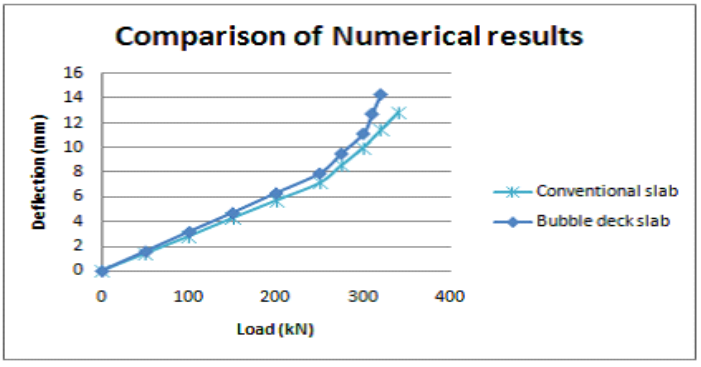


Fig no 1comparison of conventional & bubble deck slab[11]

After the comparison of results of Bubble deck and conventional slab it is observed that Bubble deck slab shows good results to strength and self-weight of slab.

V.CONCLUSION

The test was carried out to evaluate the structural behavior of the Conventional slab and Bubble deck slab. In the experiment UDL load applying over the slab to know the load carrying capacity and deflection..These results show that the Bubble Deck Slab is better in stress criteria and its weight than that of Conventional slab. Bubble Deck Slab gives better performance than that of the conventional slab.

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[17.] Jorgen Breuning(1990**)** invented a way to link the air space and steel within a voided biaxial concrete slab.