Experimental Studies on Comparison of Conventional Slab and Bubble Deck Slab Based on Strength

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Abstract— The bubble deck slab is a biaxial voided slab in which high density polythene (HDPE) hallow sphere are placed in neutral axis level of the slab, replacing the ineffective concrete, it decreases the self weight and increases the efficiency of the slab. The present work is carried out by comparing the strength and economy of normal conventional slab (NCS) and bubble deck slab (BDS) of two different void diameters such as 60mm and 70mm in size. The experimental results of the present work showed that the bubble deck slab with void of 60mm diameter showed better results than 70mm diameter void slab and achieved almost the same strength as that of normal conventional slab.

Key words: HDPE, NCS and BDS

I. INTRODUCTION

Concrete is the composite binding material composed of cement, fine aggregate, coarse aggregate and water in required proportion. Slab is the horizontal member which transfers the load to the adjacent structural members of the building.Bubble deck slab is a slab in which some amount of the concrete is replaced by the plastic polyethylene hollow bubbles which are made by waste plastic material which reduces self weight of structure. This is a process of introducing voids in the form of hollow balls at neutral axis level of slab in order to achieve concept of removing non-working concrete in the slab. Overall weight of bubble deck slab is expected to be reduced compared to normal conventional slab. As the diameter of voids (balls) increases reduction in strength of slab and reduction in amount of concrete is also increased, construction time is decreased. bubble deck slab is a green technology. When the load is act on a structure compressive force is fully taken by concrete above neutral axis and tensile force taken by steel in tension zone, so there is no sensible difference between flexural strength of solid slab and bubble deck slab. Comparison of bubble deck of two different diameters, void stiffness parameter will nearly equal.

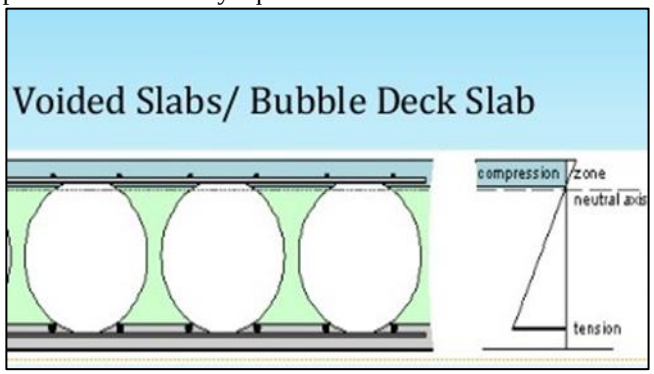

Fig. 1:

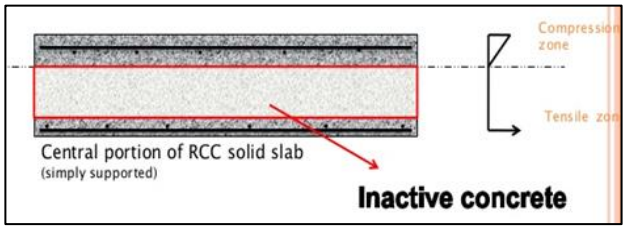

Fig. 2:

II. MATERIALS AND THEIR PROPERTIES

The materials which are used for the experimental procedure are as follows:

1) Cement— It is the most important ingredient which determines the fresh & hardened properties of concrete OPC with specific gravity 3.15 conforming IS 12269-1987 and 43 grade of cement used in experimental programme.
2) Fine aggregate---the aggregate which are passed through 4.75mm size IS sieve and conforming zoneII & specific gravity of 2.65 are used in this experimental programme.
3) Coarse aggregate---the aggregate of size 20mm down and specific gravity 2.7 are used in this experimental programme.
4) Plastic balls--- The plastic are made of recycled polyethylene hollow balls of two different diameter 70mm & 60mm are used in this experimental programme.

Fig. 3: a) 70mm dia

Fig. 3: b)60mm dia

III. METHODOLOGY

Basic tests on cement, fine aggregate and coarse aggregates were conducted, further in order to determine the hardened property for concrete, cube compression, split tensile and flexural strength on the prisms were conducted for curing period of 7 , 14 days. Using results of basic tests, mix design for M20 grade of concrete has done as per IS10262-2009. Design of bubble deck slab was done as per IS456-2000. Bubble deck slabs of dimension 1m*1m*0.1m was casted by introducing two different voids of 70mm & 60mm(balls).slabs were cured for the curing period of 14 days and further tested in UTM by applying eight point loading. The graph load vs deflection was obtained from UTM. The ultimate load of bubble deck slabs were recorded from the graph.

IV. EXPERIMENTAL ANALYSIS

The fresh and hardened properties of concrete are determined by various test:

A. Fresh concrete; Slump test

Slump test is carried out in order to determine workability of concrete. For M20 grade of concrete (slump=75mm)

B. Hardened concrete: compression, tension & flexure test

Days	7 days N/mm^2	14 days N/mm^2
Compressive strength	14.50	18.23
Tensile strength	14.75	18.44
Flexure strength	13.67	18.05

Table 1:

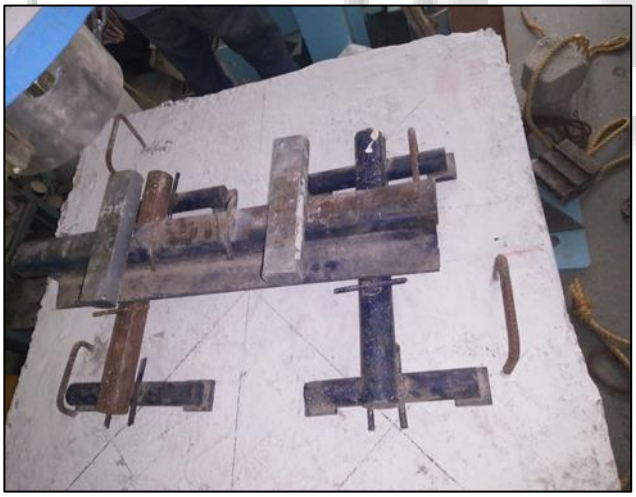

Fig. 4: Loading Arrangment

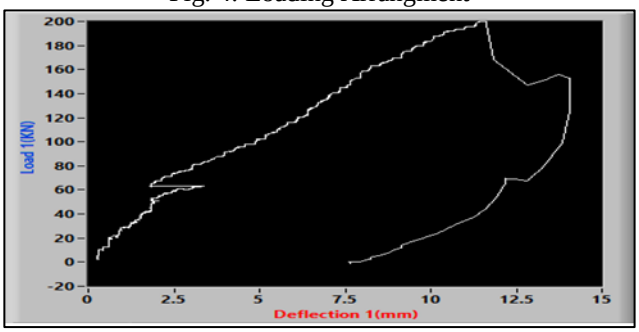

Fig. 5: Load Vs Deflection for Conventional Slab

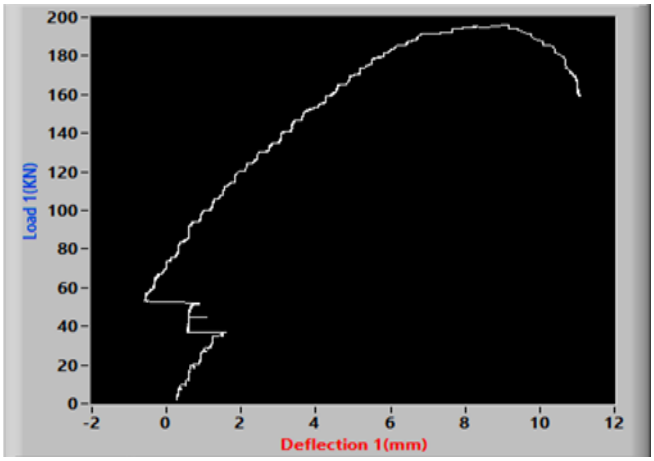

Fig. 6: Load Vs Deflection for Bubble Deck Slab of 60mm Dia Voids

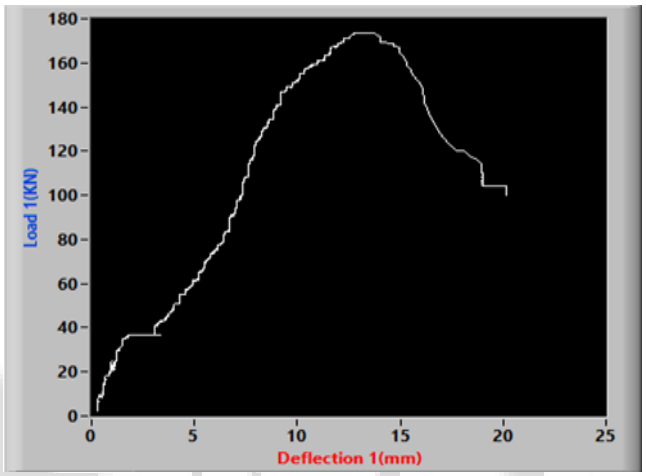

Fig. 7: Load Vs Deflection for Bubble Deck Slab of 70mm Dia Voids

Type Of Slab	Ultimate Load(Kn)	Deflection (Mm)
Conventional	199.9	11.62
Bds Of 60mm Dia	195.8	9.14
Bds Of 70mm Dia	173.7	12.93

Table 2:

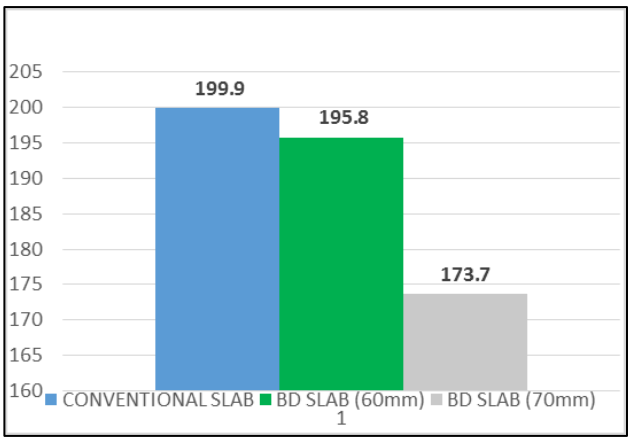

Fig. 8: Graphs for the comparison of ultimate loads of the three slabs

Fig. 9: Cracks developed in the slabs after failure

V. CONCLUSIONS

1) From this experimental studies we observed that ultimate strength of conventional slab was 199.9 KN , bubble deck slab (6cm)was 195.8KN and bubble deck slab (7cm) was 173.7 KN
2) This concludes that we can use small dia balls (6cm) instead of bigger dia balls (7cm) to obtain adequate strength as that of conventional slab.
3) It is also observed that the deflection of the
4) Conventional slab was 11.62mm, bubble deck slab (6cm) was 9.14mm and bubble deck slab (7cm) was 12.93mm.
5) This also concludes that the bubble deck slab of 60mm void is having less deflection and also results in more stiffness than compared to the other two slabs.

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