Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 06, June-2019

Experimental Study on Bubble Deck Flat Slab

Sankalp K. Sabale[1], Sandip R. Sule[2], Pranam D. Utkhede[3], Onkar S. Phalke[4], Dr. N.K. Gupta[5]
[1,2,3,4] B.E. Student,
[5] Professor,
Department of Civil Engineering, Dr.D.Y. Patil Institute of Technology,
Pimpri, Pune, Maharashtra, India

***Abstract* - Bubble Deck is a method of eliminating concrete from the conventional flat slab which does not perform any structural function, hence reducing structural dead weight and increasing efficiency of the floor. Bubble Deck slab uses hollow plastic balls. In the Bubble deck technology reduce the concrete volume by replacing plastic balls which are locally available. This system can be used for roof and ground floor slabs also it does not require beams and column heads. This technology reduces cost of construction. In this experimental study comparison between conventional flat slab and bubble deck flat slab is done. This paper presents a study on the properties and advantages of Bubble Deck flat slab system.**

Key Words: Bubble deck flat slab, Conventional slab, Hollow plastic balls, Deflection

1.INTRODUCTION

In day to day life cost of concrete increasing so to overcome this problem plastic balls are used in slabs in place of concrete which does not take any compressive load. When the load acting on the slab is large or clear span between two columns is more, the deflection of the slab is also large. Therefore, thickness of the slab increases. Increasing the slab thickness makes the slabs heavier and will increase column and foundations size. Thus, buildings consume more materials such as concrete and steel reinforcement.[1] Hollow plastic balls replace the ineffective concrete in center of slab thus decreasing dead weight increasing the efficiency of floor.[2] The proposed work carries to reduce the overall Self weight of the slab or to reduce the overall dead load of the slab. Here, bubble deck slab is designed as per Indian condition by using plastic balls which reduces the cost of the project. Finally, the comparison has been made for bubble deck slab with conventional slab over its self-weight. From the evaluation of these results, Bubble deck slab gives better performance than that of the Conventional slab.[3] Bubble deck flat slabs are used in parking decks, commercial buildings, hotels; cinema halls where span between two columns has to be more.

1.1 Objectives

- The main objective of this is to study performance of Bubble deck flat slab.
- To estimate the amount of concrete reduced as result of plastic balls introduction into flat slab.
- To analyse the results of load vs deflection.

2. MATERIALS

The following materials are used in Bubble Deck flat slab construction:

2.1 Hollow balls:

The balls are made using poly vinyl chloride materials. These are usually made with nonporous, non-toxic environmentally friendly material that does not react chemically with the concrete or reinforcement bars. The balls have enough strength and stiffness to support safely the applied loads in the phases before and during concrete pouring. Diameter of ball is 70 mm for slab thickness 120 mm is used. The distance between two balls is 36mm.

2.2 Cement:

Ordinary Portland cement of 43 grade is used.

2.3 Aggregate:

Fine aggregates:
Those fractions from 4.75 mm to 150 microns are termed as fine aggregate. The river sand is used as fine aggregate.

Coarse aggregate:
The size from 10 mm to 4.75 mm are used as coarse aggregate. The Coarse Aggregates from 4.75 mm are used.

2.4 Concrete:

The concrete used in the slab must be above grade 20 or 25. Usually conventional concrete is used for the casting of bubble deck flat slab. Manually compacted concrete of M30 grade is used.

2.5 Steel reinforcement:

The reinforcement of the plates is made at the bottom part and balls are tied by binding wires. Grade Fe500 strength is used. Nominal size of bar 10mm diameter. The centre to centre distance between the bars is 150 mm. Reinforcement is provided in both directions.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 06, June-2019

Fig-1: Reinforcement

3. METHODOLOGY

1. Conventional flat slab: This is a slab prepared with specifications with normal concrete of M30 grade by adopting conventional methods of design according to IS 456:2000.

2. Bubble deck flat slab: This is a slab is prepared with specification with normal concrete of grade M30 by using Hollow plastic balls (PVC-Poly vinyl chloride)

Experimental Procedure

Conventional Flat slab:
The conventional flat slab is prepared of M30 grade of concrete with dimensions 0.7mX0.7mX0.120m. Cover blocks of 25mm are provided to maintain the cover.

Reinforcement:
The initial step is laying the reinforcement for increase the tensile strength of the structure. The reinforcement is provided in the form of mesh consist of 5 no. of 10mm bars with spacing 150mm centre to centre in both directions.

Concreting:
Concrete is poured in three layers each of 40mm compacted manually using tamping rod.

Fig-2: Concreting of conventional slab

Curing:
Curing is done for 28 days after 24 hours of casting. Ponding method is used for curing.

Bubble deck flat slab:
The conventional flat slab is prepared of M30 grade of concrete with dimensions 0.7mX0.7mX0.120m. Cover blocks of 25mm are provided to maintain the cover.

Reinforcement:
The initial step is laying the reinforcement for increase the tensile strength of the structure. The reinforcement is provided in the form of mesh consist of 5 no. of 10mm bars with spacing 150mm centre to centre in both directions.

Bottom Concrete:
Concrete is provided at the bottom of the slab. It acts as a bonding material for ball because the ball attached with the concrete. It is compacted manually using tamping rod.

Location of Hollow Plastic Balls:
The hollow plastic balls are placed on bottom concrete as per design. 36 no. of balls having 70mm diameter and distance between two balls is 36mm for each slab.

Fig-3: Location of plastic balls

Concreting:
After placing the plastic balls concrete is poured manually and compacted by using tamping rod.

Fig-4: Concreting of Bubble deck flat slab

Curing:
Curing is done for 28 days after 24 hours of casting. Ponding method is used for curing.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 06, June-2019

Fig-5: Curing

Testing Procedure:

4 specimens were casted, 2 conventional, 2 bubble deck flat slab. Out of which one slab of each type was tested for single point load. The slab of 0.7m x 0.7m and thickness of 120mm makes it a thick slab, and the comparison is to be done accordingly. As the slab was simply supported.

The specimen was tested under UTM of capacity 1000KN, the specimen was placed in the UTM and load was applied at the centre of the slab as shown in the figure below. The reason behind using point load was to study the behaviour of slab in high shear, and the kind of failure associated with it. The deflection of the slab was calculated at centre.

RESULT:

Table-1: Result table

Type of slab	Load (KN)	Deflection(mm)	Weight (Kg)
Conventional flat slab 1	465.49	12.56	138
Conventional flat slab 2	451.44	13.34	135
Bubble deck flat slab 1	403.31	13.89	123.5
Bubble deck flat slab 2	410.69	14.01	122

3. CONCLUSIONS

1. Concrete usage was reduced, reducing material consumption. It led to reduction dead load up to 10.07%.
2. It was observed that deflection of bubble deck flat slab is higher as compared to conventional slab.
3. Ultimate load carrying capacity was reduced in bubble deck flat slab by 11.22%.
4. The bottom cracks are longitudinal as well as diagonal. Most of the cracks are longitudinal and similar in both the cases.
5. Cost was reduced to 13.39% when compared with conventional concrete.

REFERENCES

[1] B.G. Bhade and Y.R. Suryawanshi, “structural behavior on two-way bubble deck slab using hollow spherical balls”, VJER-Vishwakarma journal of engineering research volume 1 issue to, June 2017.
[2] N. Lakshmipriya, M. Karthik pandi , “Study And Model Making Of Slab Using Bubble Deck Technology” International Research Journal of Engineering and Technology Volume: 05 Issue: 02 | Feb-2018
[3] M.Surendar And M. Ranjitham, “Numerical and experimental study on bubble deck slab” volume 6 issue 5 ISSN 2321 3361 IJESC 2016.
[4] Mahalakshmi. S and Nanthini S, “Bubble Deck” Volume 5 issue 3 ISSN:2321-9653 IJRASET March 2017.
[5] Arati Shetkar And Nagesh Hanche, “An experimental study on bubble deck slab system with elliptical balls”, NCRIET-2015& Indian J.Sci.Res.12 (1):021-027,2015
[6] Mr. Muhmmad Shafiq Mushfiq, Asst. Prof. Shikha Saini And Asst Prof. Nishant Rajoria, “Experimental Study on bubble deck slab” International research journal of engineering and tech volume 4 issue 5 May 2017.
[7] P. Prabhu Teja, P. Vijay Kumar, S. Anusha, Ch. Mounika, Purnachandra Saha, “Structural Behaviour of Bubble Deck Slab”, IEEE-International Conference On Advances In Engineering, Science And Management (ICAESM -2012) March 30, 31, 2012.
[8] Sergiu Călin, Ciprian Asăvoaie And N. Florea, “Issues for Achieving an Experimental Model Concerning Bubble Deck Concrete Slab with Spherical Gaps”, Bul.Inst. Polit.Iasi, t.LV (LIX), f.2,2010.
[9] Neeraj Tiwari And Sana Zafar, “Structural behaviour of Bubble deck slab and its application” International journal of Scientific research and development volume 4 issue 2 2016.