MANTECH Publications

Journal of Ceramics and Concrete Technology
Volume 2 Issue 3

Bubble Deck Concrete

J. Mytheli
Department of Civil Engineering
Knowledge Institute of Technology, Salem
Corresponding Author's email: *2k14ce026@kiot.ac.in*

Abstract

Bubble deck slab uses hollow spherical balls made by recycled plastic and therefore it is an innovator method of virtually eliminating the concrete part in the middle of conventional slab. Bubble deck slabs are suitable for use in all building types especially in commercial, educational& institutional building. Bubble deck is usually manufactured as partly pre-cast element. The site erection and installation is simple and fast. It is one of the green and sustainable method. In this cross batching and intermediate support are also eliminated.

Keywords: *Hollow spherical balls, sustainable method*

I. INTRODUCTION

Concrete is heavy, and 5% of the world's CO2 is created during the manufacture of the cement. Bubble Deck precast concrete slabs are suitable for use in all building types especially open floor designs such as commercial, educational and institutional buildings. Although the technology can be adjusted to suit all slabs, the Bubble Deck method was conceived to achieve saving of concrete and energy in buildings construction. The composite slabs are made of Bubble Deck type slab elements with spherical gaps, poured in place on transversal and longitudinal directions. By introducing the gaps leads to a 30. . . 50% lighter slab which reduces the loads on the columns, walls and foundations, and of course of the entire building.

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”Bubble Deck” slab elements are plates with ribs on two directions made of reinforced concrete or precast concrete with spherical shaped bubbles.

The bubbles are made by embodying high density polypropylene in the concrete, arranged according to the project and placed between the reinforcement meshes. The material that are made of don’t react chemically with the concrete or the reinforcement, it has no porosity and has enough rigidity and strength to take over the loads as much as from the pouring of the concrete as from the subsequent phases of this process.

II. OBJECTIVES

1) To increases span lengths and makes floors thinner by reducing the weight

2) Maintaining the performance of reinforced concrete slabs

3) To minimize the Co2 emission from the concrete

Typical dimensions are:

Deck thickness (mm): 230, 280, 340,390
Ball Dia (mm) : 180, 225, 270, 315



Figure: 1

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Table: 1

Grade Designation	M-20
Type of cement	O.P.C-43 grade
Sp. Gravity Cement	3.15
Sp. Gravity Fine Aggregate	2.62
Sp. Gravity Coarse Aggregate	2.65
Maximum water cement ratio	0.50
Target Mean Strength	20 + (20 X 1.65)
f_{ck}	28.25 N/mm^2

Water: cement: F.A.: C.A. = 0.50: 1: 1.5: 3.0

III. EXPERIMENTAL INVESTIGATION

A. Size of the Mould

The size of the mould for cube is 15cm*15cm*15cm and for slab is 2Feet*2Feet is used. The concrete is placed in the mould.

B. Batching and Mixing

The materials required for the preparation of cubes are batched and mixed in the mixer for few minutes until the materials get mixed well.



Figure: 2

C. Placing

The concrete must be placed in systematic manner to yield optimum result. First placing of bottom reinforcement is done over that ball is placed followed by placing of upper reinforcement.

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Figure: 3

D. Compaction

Compaction of concrete is this process adopted for expelling the entrapped air from the concrete. In the process of mixing, transporting and placing of concrete air is likely to get entrapped in the concrete. The lower the workability higher is the amount of air entrapped.

E. Curing

The cubes are placed in the water for 21 days for curing. This is by far the best method of curing as it satisfies all the requirements of curing, namely promotion of hydration, elimination of shrinkage.

IV. TESTING

The experiment was conducted to find the difference in increased compressive strength; when plastic balls are added to Ordinary Cement Concrete. The tests were conducted at 7th days 14th days and 28th days. For that we followed all the procedures as per IS code specifications and tested in our college lab.

A. Compressive Strength

Compressive strength is the primary physical property of concrete and is the one most used in design. Compressive strength may be defined as the measured maximum resistance of a concrete specimen to axial loading. It is found by measuring the highest compression stress that a test cylinder or cube will support. **See Figure: 4**

B. Flexural Strength Test

Flexural testing is used to determine the flex or bending properties of the material. The specimens are tested as per IS: 516-2004. Concrete as we know is relatively strong in compression and weak in tension. Preparation of slab is shown below. **See Figure: 5**

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Figure: 4



Figure: 5

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V. RESULT AND DISSCUSION

A) Compressive Strengths

The experimental results on the characteristics of the concrete are presented in Tables. The compressive strengths of the samples on days 7, 14 and 28 days are tested and the compressive strength of BubbleDeck concrete is slightly increased,

Model Calculation:

Compressive strength = Load/Area

Load = 700 KN

Area = 100 x 100 = 10 x 103 mm2

=700 / 10 x 103

=7 N/mm2.

Table: 2

COMPRESSIVE STRENGTH (N/mm^2)		
DAYS	**Conventional Concrete**	**Bubble Deck concrete**
1.1 7	**1.2 7**	**1.3 7.3**
1.4 14	**1.5 14.2**	**1.6 14.4**
1.7 28	**1.8 28**	**1.9 27.5**

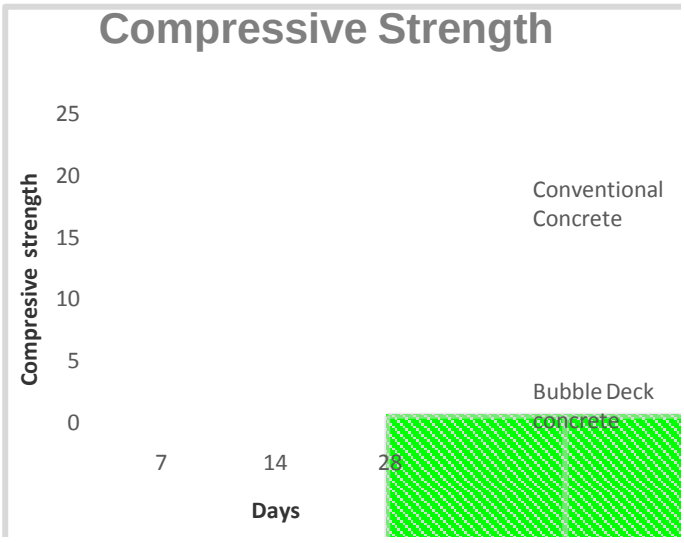


Figure: 6

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B) Flexural Strength

The flexural strength results of conventional and BubbleDeck concrete one way simply supported slab is given in Tableand the flexural strength of BubbleDeck concrete is slightly reduced.



Figure: 7

Table: 3

Flexural Strength in N/mm^2		
Days	**Conventional Concrete**	**Bubble Deck**
14	1.25	1.18
28	3.45	3.32

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MODEL CALCULATION:

Load = 96 KN

Bending moment = WL/4

= $96x10^3$/ 4

= 7.2 KN/m

Flexural strength = m/z

= $7.2x10^3$/ $20.83x10^6$

= 3.45 N/mm^2

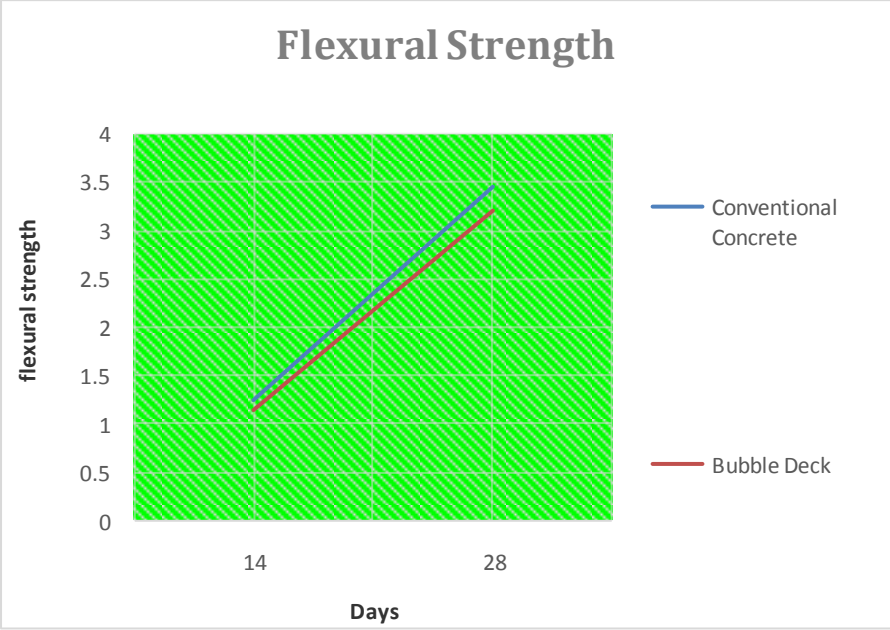


Figure: 8

CONCLUSION

- The compressive strength of Bubble Deck concrete is slightly increased when compared to conventional concrete.
- The CO2emission of Bubble Deck concrete is reduced when compared to conventional concrete.
- The Savings of materials of Bubble Deck concrete is 20% increase when compared to conventional concrete.
- Less wood-as no horizontal scaffolding is needed for semi pre cast.

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- The Density of Bubble Deck concrete is 40% reduced when compared to conventional concrete.
- Less material consumption-1kg of plastic balls replaces upto 100kg of concrete.
- Dead weight of structure reduced.
- Better total economy

Table: 4

Nominal concrete cost	Rs.1200-1500/ft^2
Bubble Deck concrete cost	Rs.840-1050/ft^2

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