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A Review on Bubble Deck Slab

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Abstract - Abstract - *A bubble deck slab, also known as voided biaxial slab, is one of the latest innovations in the construction sector. This method of slab construction is a little different from the conventional method of constructing a slab. A bubble deck slab is constructed by placing high density polyethylene hollow spheres in between the steel reinforcement placed on its top and bottom. Generating the gaps leads to a 30 to 50% lighter slab which reduces the loads on the columns, walls and foundations, and of course of the entire building. The advantages of the bubble deck slab are less energy consumption, less emission - exhaust gases from production and transport, especially CO2. The aim of this paper is to discuss about various properties of Bubble deck slab based on the various studies done abroad.*

***Key Words*: Bubble deck, carbon emission , polyethylene hollow sphere, voided biaxial slab.**

INTRODUCTION

A slab is one of the most important structural building elements for distribution of load generated in the structure. The slab is generally of two types, one-way slab, the slab that primarily deflect in one direction are referred to as one-way slabs. And, when slabs are supported by columns arranged generally in rows so that the slabs can deflect in two directions they are usually referred to as two - way slabs. In the concept of bubble deck slab, the recycled spherical hollow blocks are placed in between the steel reinforcement. This creates voids in the slab and because of which, less concrete is been used during construction of the slab. The use of spherical balls to fill the voids in the middle of a flat slab eliminates 35% of a slab self-weight compared to solid slab having same thickness without affecting its deflection behavior & bending strength.

1. TYPES OF BUBBLE DECK SLAB

As the conventional slab is generally of two types, one-way and two-way, the bubble deck slab is divided into three types which are Filigree elements, Reinforcement Modules and Finished Plank.

i) Filigree elements-

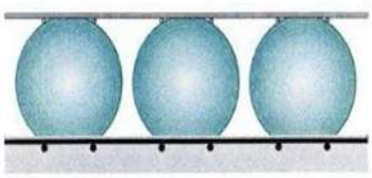

Fig.-1 Ref- theconstructor.org

This bubble deck slab is a combination of constructed and unconstructed elements. In this slab, a 60mm thick precast concrete layer is placed on the site with bubble and steel reinforcement unattached. The plastic bubbles are kept steady with the help of temporary stand on precast concrete layer and held in position by a honeycomb of interconnected steel mesh.

Some additional reinforcement may be inserted according to the design requirement.

i) Reinforcement Modules-

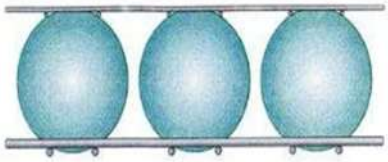

***Fig.-2* Ref- theconstructor.org**

i) Finished Plank-

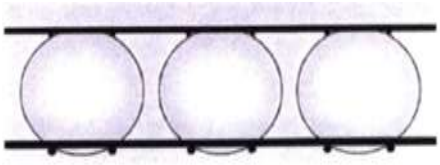

***Fig.-3* Ref- theconstructor.org**

In finished plank type of bubble deck, the slab is prefabricated in the shop, that means the reinforcement, bubbles and the concrete is placed together just like pre-casted members. This slab is then delivered directly to the site.

2. MATERIALS

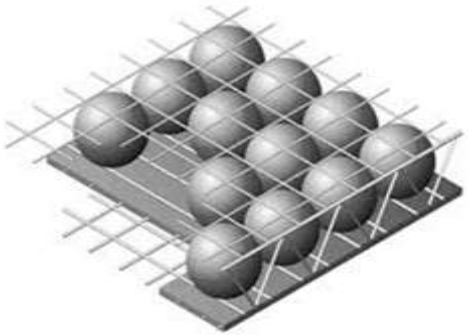

Fig.-4 **Ref- bubbledeck-uk.com**

The construction of bubble deck slab requires following materials with their specifications-

i) Concrete-

The concrete used in bubble deck slab system should be above M-25 grade. The concrete should be of self-compacting type.

ii) Reinforcement-

Fe500 and above steel reinforcement is used in the construction of bubble deck slab. Two steel meshes are to be made, one to be placed at the top and another to be placed at the bottom. The distance between the reinforcement depends upon the bubbles used and the design made for the slab.

iii) Hollow Bubbles-

The bubbles are made using high-density polypropylene materials. These hollow plastic bubbles have enough strength and stiffness. The slab depth varies from 220mm to 600mm. The distance between bubbles is greater than 1/9th of bubble diameter. The nominal diameter of the gaps can be in between 180mm to 360 mm. The bubbles may be of spherical or ellipsoidal in shape.

3. INSTALLATION

i) The general floor zone is partitioned down into a progression of arranged individual components, up to 3 m wide ward upon site get to.

ii) These components include the top and base support work, estimated to suit the venture, consolidated with vertical cross section braces with the void formers caught between the top and base work fortification to fix their ideal position which is named as an air pocket support sandwich.

iii) Firstly, the bottom layer of slab which is 60 mm pre-cast concrete is cast, bonding with the bottom mesh reinforcement, to provide permanent formwork within part of the overall finished slab depth.

iv) On-site the individual elements are then glued together with loose reinforcement simply laid centrally across the joints between elements.

v) After the site finishing, concrete is poured and cured.

vi) This method gives basic progression over the whole floor – the joints between components are then repetitive with no basic impact, to make a consistent biaxial floor slab.

4. ADVANTAGES

i) Structural-
- Less weight
- No beams required
- Only few columns required
- Free choice of shape
- Large shape

ii) Construction-
- Less weight on construction site
- Light in weight, less equipment required
- Easy and less heavy onsite work
- Faster construction time

iii) Economy-
- Materials savings are substantial (up to 50%)
- Transportation cost reduced
- 35% less concrete required
- Lower workforce, no carpentry, no beams and less skilled workers required

iv) Environmental-
- Less carbon emission
- Less energy consumption

5. COMPARISON BETWEEN BUBBLE DECK SLAB AND SOLID DECK SLAB

A. Shear strength and punching strength-

The after effects of various down to earth tests affirm that the shear quality relies upon the compelling mass of the solid. The shear limit is estimated to be in the scope of 72-91% of the shear limit of a strong deck. In computations, a factor of 0,6 is utilized on the shear limit with respect to a strong deck of indistinguishable tallness. This ensures a huge security edge. Regions with high shear loads need accordingly an exceptional consideration, for example around segments. That is understood by discarding a couple of balls in the basic territory around the segments, accordingly, giving full shear limit.

B. Bending strength and deflection behavior-

When the bubble deck slab compared to solid deck slab by the technical university of Denmark. They carried out test on stiffness of bubble deck slab. After verifying the result, they discovered, for a similar quality, bubble deck has 87% of bending stiffness of comparable strong chunk however just 66% solid volume due to HDPE circles.

C. Anchoring-

The anchoring in the two types is identical. The balls do not influence the anchoring.

D. Sound-

An examination was made between bubble deck and single direction pre-assembled empty deck of comparable stature. The noise decrease with bubble deck was 1 DB higher than the single direction pre-assembled empty deck. The principle pattern for lessening racket is the heaviness of the deck and subsequently bubble deck won't act in any case than other deck types with equivalent weight.

E. Creep-

No significant difference between bubble deck and solid deck. Differences can be since the tests only were considered in a one-way-span.

F. Cost comparison-

Just contrasts in materials concerning the sections are considered. For a similar measure of steel and solid, Bubble Deck has 40 % bigger range and is moreover 15 % less expensive. For a similar range, bubble deck lessens the measure of cement with 33 %, and diminishes the cost with 30 %.

G. Comparison in Weight between the Bubble and the same Sphere of Concrete-

Considering the HDPE Hollow Ball Thickness to be 150mm in diameter. And it replaces the middle concrete sphere of the same diameter. So, the concrete sphere is of 150 mm in diameter. The weight of the HDPE Hollow Ball weighs 154 grams.

6. FUNCTIONAL APPLICABILITY

The bubble deck slab can be constructed in various structure like residential living, offices, utility, and industrial buildings. Used in offices, apartments, villas, hotels, schools, parking, hospitals, laboratories and factories.

7. CASE STUDY

Malaysia-

Fig.-5 **Ref- bubbledeck-uk.com**

- Saves up to 40% of skilled labor.
- Reduce 40% construction time.
- Reduction of site concrete from 160m3 to 93m3 per floor (equivalent to 10 concrete trucks of concrete per floor).
- Saving in rubbish disposal.
- Cost reduction in rental of tower crane.
- Overcome the problem of space constraint at site.

CONCLUSION

In the present situation of the development businesses we need various sorts of strategies which are increasingly conservative, simple to build and condition amicable. The Bubble Deck Slab is one the innovation which causes us to accomplish the economy, simple to develop and condition neighbourly. Bubble deck technology is the creative framework that eliminates concrete in the mid-section, secondary supporting structure such as beams reinforced concrete columns or structural walls.

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