

# An Overview on: Bubble Deck Slab

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**ABSTRACT:** This project introduces the bubble deck slab its uses and advantages to constructs economical and light weight structure. To use this technique, we have reduced the total construction material and concrete by 35%. This project deals with reduction of dead load of slab by introduction of high-density polythene bubble in the middle of slab. By introducing the gap, it leads to 30 to 50% lighter slab which reduces the loads on columns, walls and foundation, thus having various advantages over the traditional slab. The aim of this project is to introduce about the various properties of bubble deck slab based on various studies done in the comparison with the conventional slab. Using bubble deck means floor cycle up to 20% faster than traditional construction method. By the Use of recycled material, lower energy consumption and reduced CO<sub>2</sub> emissions, less transportation and crane lifts that make bubble deck more environmentally friendly than other concrete construction technique.

Advantages of these project are material and weigh reduction, construction and time saving, cost saving, green design i.e. we used HDPE (High Density Polyethene) recycled balls because to reduce wastage of plastics instead of burning the plastics. The Bubble Deck slabs being entirely recyclable. Recycled balls can be recovered during the demolition of the building to meet the goal of sustainable construction)

**KEYWORDS:** Bubble Deck, Comparison, Advantages.

## I. INTRODUCTION

### 1.1 General

The Bubble Deck method for the both directions reinforced composite concrete slab with gaps was invented in Denmark, it is licensed, and it was conceived to achieve saving of concrete and energy in buildings construction. The composite slabs are made of Bubble Deck type slab elements with hollow gaps, poured in place on transversal and longitudinal directions. By inserting the gaps leads to a 30 to 50% light weight slab which are minimize the loads on the columns, walls and foundations, and of Members of the entire building. "Bubble Deck" slab elements are plates with ribs on two directions made of reinforced concrete or precast concrete with spherical or circular shaped bubble (HDPE). These slabs consist of a bottom and an upper concrete part connected with vertical ribs that go around the gaps present in the slab. The reinforcement of the slab is made of two meshes one at the bottom part and one at the upper part of on the (HDPE) balls that can be tied with MS wire or by welding. The distances between the two bars are depend on the dimensions/Diameter of the bubbles that are to be embodied and the quantity of the reinforcement from the longitudinal and the transversal ribs of the slab. The two meshes are connected after placing the spheres into places in order to form a rigid shell. The bubbles are made by high density polythene material which is inserted in the concrete, arranged according to the project or design of the slab 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.

Concrete plays a main role in the construction field as a compression load taker. The usage of concrete is very high in slab or structure construction i.e. Building, Bridges, etc. It leads to loss of concrete because the load transfers from the structure only on the column portion not throughout the slab. So that reduces the concrete from the middle/centre of the slab by using or inserting (HDPE) recycled balls in it. High density polyethylene (HDPE)hollow spheres/balls insert or

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place in-effective concrete in the middle portion or centre of the slab, thus reduce or decreasing the dead weight or load and increasing the efficiency of the floor. The method which substitute the concrete by the use of recycled balls (HDPE) with less amount of concrete is known as “The Bubble Deck Technology”. Bubble Deck, a unique light, bi-axial concrete slab, is generally designed using the conventional design method. Bubble deck slab is a method of which is eliminate or reduce some % of concrete from the middle/centre portion of a floor slab, which is not performing any structural function in the slab, thereby affected reducing structural dead weight. The highly dense polyethylene hollow spheres put back the in-effective concrete in the centre of the slab, thus decreasing the dead weight and increasing the efficiency of the floor.

This method deals mainly in two directional reinforced complex concrete slabs with gaps. It ensures was conceived to achieve saving of concrete and energy in buildings construction. It is a new patented technique and it is a direct of connecting air and steel.

By utilize Bubble Deck method, the amount of concrete and cement is reduced/decreased by 30 to 50% for the same built surface compared with the conventional slabs, fact that gives an important reduced quantity of carbon emitted.

Bubble Deck slabs with gaps is interlocked so they don't produce risks during its working period. Bubble deck has many advantages, beside it is reduced the material, the load, lower the cost and increasing the span length it is also a green technology. After all the punching shear capacity is one of the necessary properties of flat slab, the effect of the cavities due to using the plastic balls on the punching action of self-compacted concrete was study in this paper.

## II. TYPE OF BUBBLE DECK SLAB

### 1. Type A (Partially Pre-casted slab)

Filigree elements Bubble Deck Type A Partially Pre-casted slab is a combination of constructed and unconstructed elements. A 60mm thick concrete bed that acts as both the formwork and part of the finished depth is precast and bring on site with the bubbles and steel reinforcement unattached. The bubbles are then supported by temporary stands on top of the precast Layer. Further or additional steel may be introducing according to the reinforcement/steel mesh essential of the design. Fig shows the cross-section of a typical filigree element.

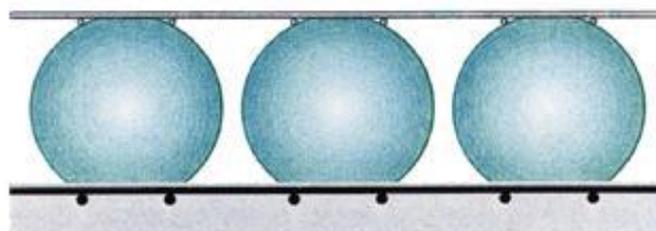


Fig.1.1 Filigree elements Bubble deck Type A

### 2. Type B (Assembly of bubbles and steel mesh)

Reinforcement modules Bubble Deck Type B Assembly of bubbles and steel mesh is a reinforcement module that consists of a pre-assembled sandwich of steel mesh and plastic bubbles, or "bubble lattice". These components are transport to the site, laid on regular or on traditional formwork, joined with any Further or additional reinforcement, and then concreted in install or deposited by using traditional methods. Fig shows the cross-section of a typical reinforcement module.

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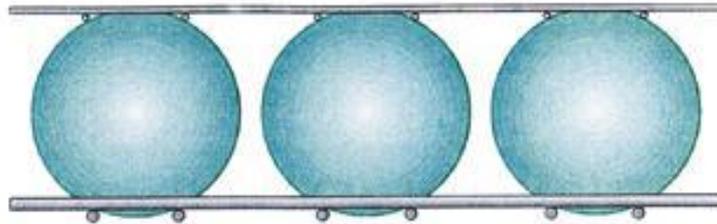


Fig.1.2. Reinforcement modules Bubble Deck Type B

### 3. Type C (Fully Pre-casted)

Finished planks Bubble Deck Type C Fully Pre-casted are a shop-fabricated module that includes the plastic spheres, reinforcement mesh and concrete in its finished form. The member is constructed to the final depth in the form of a plank and is transported on site. Unlike Type A and B, it is a one-way spanning design that requires the use of support beams or load beams. Fig shows the cross-section of finished planks.

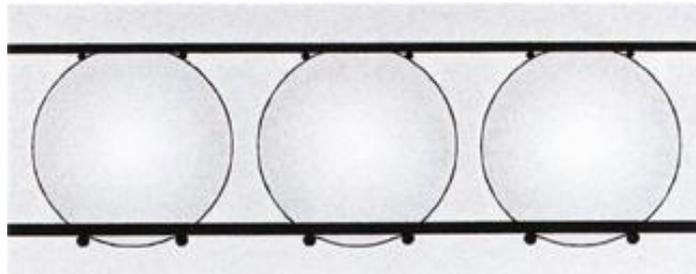


Fig.1.3. Finished planks Bubble Deck Type C

#### 1.3 Structural Properties of Bubble Deck Slabs.

##### A. Compressive strength and Flexural capacities.

Bubble deck slab is conceptualized to exclude a significant volume of concrete as compared to a solid slab in the central core where the slab is principally un-stressed in flexure. The thickness of compressed concrete is normally a small percentage of the slab thickness. The concrete between the ball and the surface so there is no reasonable difference between the behaviour of a Bubble Deck and solid slab. The only working rudiments are the steel on the tension side and the outer 'shell' of concrete on the compression side. In terms of flexural strength, the moments of resistance are the same as for solid slab.

##### B. Durability.

The staying power of bubble deck slab is not approximately different from ordinary solid slabs. The concrete is standard grade and combined with suitable bar cover provides most control of durability equal with normal standards for solid slabs. When the filigree slabs are fabricated, the reinforcement member and balls are vibrated into the concrete and produce the consistency of compaction so that a density of surface concrete is produced which is at least as impermeable and durable? Bubble deck slab elbow have a chamfer on the inside to assure that concrete surrounds each bar does not grant a direct route to air from the re-bar surface. This is mainly a fusion of the fire resistance but is also relevant to durability.

##### C. Fire Resistance

The fire resistance of the slab is a compound matter but is especially dependent on the ability of the steel to maintain sufficient strength during a fire when it will be heated and lose powerful strength as the temperature increases. The temperature of the steel is retained by the fire and the covering of the steel from the fire. In a fire, it is expected that the air would escape and the pressure consumed. If the typical bubble material is used, the products of burning are approximately benign. In an extreme prolonged fire, the ball would melt and ultimately burn without significance or

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appreciable effect. Fire protection depends on concrete cover approximately 60-180 minutes. While Bubble deck slabs are not designed to provide thermal insulation due to enclosure of the air bubbles in the middle of the concrete slab. Bubble deck obtained between 17% to 39% higher thermal resistance than an equivalent solid slab of the same depth. Bubble deck slabs can therefore make a useful improvement towards the thermal insulation obtained by the overall construction.

## D. Shear Strength

In any flat slab, design shear resistance is commonly demanding near columns. The shear stresses isolated from the columns diminishes promptly and outside the column zones it has been determined by testing and calculation the transverse and longitudinal shear stresses are in the capacity of the Bubble deck slab system. Near the columns, bubbles are left out so in these zones a Bubble deck slab is designed absolutely the same way as a solid slab. Shear support of Bubble deck slab is 0.6 times the shear support of a solid slab of the same depth. If this is exceeded by the tested shear, at a column for example, we allow out the balls and use the full solid shear values. Using Euro code 2, we would calculate the applied shear at 2d and subsequent perimeters from the column face as per the code requirements, as well as at the column face itself. We would then analyse this to our calculated resistance. If the applied shear is less than the unreinforced hollow slab resistance, no further check is required. If the tested shear is higher than the hollow slab resistance, we delete balls and make it solid and then check the solid part. The shear quantity is measured for two ratios of  $a/d$  (distance from imposed force to support divided by deck depth/thickness). The results are shown in table 6.5. If the resistance is still higher than the solid slab protection and less than the maximum grant, we implement shear reinforcement. For these reasons, it is demonstrated that the design may be carried out in every way treating the slab as a solid slab, with the provisions mentioned above, which is all appropriated account of in the design action? We therefore use Euro code 2, which is fully compatible with the system, for our design and which is somewhat more up to date than BS8110. Punching shear, the average shear capacity is measured to 91 % compared to the calculated values of a solid deck.

## E. Sound Insulation

A relation was made between Bubble Deck and one-way prefabricated hollow deck of similar height. The noise reduction with Bubble Deck was 1db higher than the one-way prefabricated hollow deck slab. The main principle for reducing noise is the weight of the deck and therefore Bubble Deck will not act differently than other deck types with equal weight. The Bubble deck slab construction is following every usual principle and can be calculated according to usual principles. Bubble deck behave acoustically in a better way than any other hollow or solid floor surfaces. Because of the three-dimensional structure and the graduated force flow, the hollow spheres have a positive influence on sound insulation. The tests reveal that the airborne sound insulation is even higher than expected. This indicates the bubbles have a positive influence on sound insulation.

## F. Vibration

Reinforced concrete slab structures are commonly less affected to vibration problems compared to steel framed and light weight skeletal structures, exclusively is not resistant from vibration in all cases so this light must be checked just as it should be in applicable solid slab operations. Where deflections are large, as indicated by the static design, it is often an indication that the structure is sensitive to vibration. The lighter weight of the bubble deck slab may be exploited if it can usefully alter the modal frequencies of a slab. The most powerful weapons across vibration particularly resonant vibration are stiffness and damping. If we consider damping to be similar to solid slabs and concentrate on stiffness, we may observe that a bubble deck slab can be provided over 2 times the stiffness obtained from a solid slab for the same quantity of concrete used. This can be exploited in vibration sensitive applications. At the present time, the static modification to the flexural stiffness is applied.

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## 1.4 Material

### 1. Recycled Balls

Generally, we used HDPE (High Density Polythene) recycled balls because to reduce/Minimize wastage of plastics instead of burning the plastics. Recycled balls can be recovered or reused during the demolition of the building to meet the goal of sustainable construction. The recycled polyethylene hollow balls are shown in fig.1.4.



Fig.1.4. Recycled Polyethylene Hollow Spheres

Table 1.1: Properties of HDPE Balls

Specific Gravity	0.96
Water absorption (for 24 hrs.)	Nil
Tensile strength at yield,100psi	4.2
Elongated at yield, %	900
Compressive strength at yield,100psi	-
Rockwell hardness	R30-60
Maximum service temperature (°f)	160
Natural color	Milky white

### 2. Steel reinforcement

(HYSD) High grade steel of Fe 550 or Fe 500 is generally used in that slab. The same grade of steel is used in both of side in top and bottom steel mesh. Reinforcement are accurately placed and secured in position in a manner that will prevent its displacement during the placement of concrete. Reinforcement provided in both directions i.e. transverse and longitudinal direction in the form of welded or by winding reinforcement mesh.

### 3. Diagonal girder

The diagonal girders keep the HDPE bubbles to fixed in between the top and bottom reinforcement. It acts as a support to the ball when the concreting work in process. Girders that are applied as shear force reinforcement have to meet the following requirements.

- The center-to-Centre-distance of the girder should be a maximum of twice the floor thickness.
- The center-to-center distance of two down running or up running diagonals should be a maximum of 2/3 of the floor thickness.

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- c) Every pair of two diagonals, existing of one up running and one down running bar, should be welded with 2 welding points to both the lower and the upper longitudinal bar.
- d) The welding points with which the diagonals are attached to the lower and upper longitudinal bar should have a resistance per welding point of at least 25% of the flow strength of the diagonal. The distance between the edge of the floor support and the connection of the first diagonal from the floor support with the upper longitudinal bar of the girder should be maximal times the height of the girder. The diagonal girder with bottom reinforcement is shown in fig.



Fig.1.5. Diagonal Girder

### 1.5 Comparison between Bubble Deck Slab and Solid Deck Slab

#### 1) Shear strength and punching shear:

The results of a number of practical tests establish that the shear strength depends on the effective mass of the concrete. The shear capacity is measured to be in the range of 72-91% of the shear capacity of a solid deck. In calculations, a factor of 0, 6 are used on the shear capacity for a solid deck of identical height. This guarantees a large safety margin. Areas with high shear loads demand therefore an Appropriate attention, e.g. around columns. That is solved by excluding a few balls in the critical area around the columns, therefore giving total shear capacity.

#### 2) Bending Strength and Deflection Behaviour:

Bubble Deck where compared to a solid deck both practically and theoretically. The results in the table below show that for the same deck thickness the bending strength is the same for Bubble Deck and for a solid deck and that the stiffness of the Bubble Deck is somewhat lower. But technical university of Denmark also carried out test on stiffness of bubble deck slab. They verified the result and they found out, for same strength, bubble deck has 87% of bending stiffness of similar solid slab but only 66% concrete volume due to HDPE spheres.

#### 3) Anchoring

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

#### 4) Sound

A relation was made between Bubble Deck and one-way prefabricated hollow deck of similar height. The noise reduction with Bubble Deck was 1 DB higher than the one-way prefabricated hollow deck. The main principle for reducing noise is the weight of the deck and therefore Bubble Deck will not act differently than other deck types with equal weight.

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### 5) Creep

No important difference between Bubble Deck and solid deck. Differences can be due to the fact that the tests only were considered in a one-way-span.

### 6) Comparison in Cost

Only differences in materials concerning the slabs are considered. For the same amount of steel and concrete, Bubble Deck has 40 % larger span and is moreover 15 % cheaper. For the same span, Bubble Deck reduces/decrease the amount of concrete by 33 %, and reduces the price of slab with 30 %.

#### (1) Bubble Deck Slab

Size of model slab =  $6.3 \times 4.5 \times 0.3 = 8.505 \text{ m}^3$

Amount of concrete replaced by bubbles is  $(\pi/4 \times 0.270^3) / 24 \times 250 = 2.6 \text{ m}^3$

Amount of concrete in bubble deck slab is  $8.505 - 2.6 = 5.905 \text{ m}^3$

#### (2) Convectional slab.

Beam in x-direction is  $3 \times (4.5 \times 0.3 \times 0.450) = 2.430 \text{ m}^3$

Beam in y-direction is  $4 \times (2.7 \times 0.3 \times 0.45) = 1.944 \text{ m}^3$

Slab portion is  $2 \times (3.9 \times 2.7 \times 0.18) = 3.7908 \text{ m}^3$

Amount of concrete in convectional slab is  $2.340 + 1.944 + 3.7908 = 8.0748 \text{ m}^3$ .

### Comparison

Concrete saving is calculated by comparing the equation = (2)-(1)

Quantity of concrete saved in model slab is  $8.0748 - 5.90 = 2.1698 \text{ m}^3$

Percentage of concrete replaced or saved or reduce from slab =  $(2.1698/8.0748) \times 100 = 26.9\% \approx 27\%$

% of concrete replaced or saved or reduce from slab = 27%

**Table 1.2. Cost and Amount Comparison between Bubble deck and Conventional Concrete Slab**

Convectional slab	Bubble deck slab
Amount of concrete = $8.0748 \text{ m}^3$	Amount of concrete = $5.905 \text{ m}^3$
Cost of concrete for construction is $8.0748 \times 8400 = 67828.32$	Cost of concrete for construction is $5.905 \times 8400 = 49602$
There is no cost saving	Cost saving is $67828.32 - 49602 = \text{Rs.}18226.32$

### 7) Comparison in Weight or Density between the Bubble and the same Sphere of Concrete.

Considering the HDPE (High Density Polythene) 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 (High Density Polythene) Hollow Ball weighs 154 grams as shown in fig.1.6

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Fig.1.6. Weight of Bubble

### Calculation and comparison of the weight of the Concrete sphere.

Unit Weight (Density) of Concrete =  $2500 \text{ kg/m}^3$

Density = Mass/Volume

So, we need Mass,

i.e. formula is Mass=Density X Volume

Volume of Sphere of 150mm diameter =  $(4/3) \pi r^3$

Radius = 0.075m,  $\pi = 3.14$ .

Volume of Sphere =  $(4/3) \times 3.14 \times (0.075)^3 = 0.001766 \text{ m}^3$

Mass =  $2500 \text{ kg/m}^3 \times 0.001766 \text{ m}^3$

Mass of 150mm Diameter Concrete Sphere = 4.415 kg.

The Difference between the weight of ball (HDPE) and weight of Concrete sphere = 4.261 Kg.

### 1.6 Advantages

#### a) Material and Weight Reduction

The main advantage of a Bubble deck slab is they can use 30-50% less concrete than normal solid slabs. The (High density Polyethene Ball) HDPE bubbles replace the non-effective concrete in the centre of the Slab or Section, that reduces the dead load of the structure by Reducing/removing unused, heavy material i.e. Concrete. Reducing or Removing concrete material and weight also leads to less structural steel since the need for reinforcement diminishes. The foundations for the structure can be designed for smaller dead loads as well. Overall, due to the lighter floor slabs, the several downstream components can be engineered for lower loads and thus save extra/additional material.

#### b) Structural Properties

Because of the lesser dead weight of the slab and its two-way spanning action, load-bearing walls become unnecessary. Bubble deck is also designed as a flat slab, which reduces and decrease the need for support beams and girder members in the structure. As a result, these features reduce some of the structural requirements for the foundations and columns. Also, Bubble deck slabs can be designed and analysed as a standard concrete flat slab according to research performed on its strength and ductility.

#### c) Construction and Time Savings

Due to precast Bubble deck slabs can reduces on site construction time. Type A (Partially Pre-casted slab) includes a 60 mm precast concrete plate as the base and formwork for the slab. This type of slab reduces the need of onsite placement of formwork, that eliminate down the time of construction. Similar to modern precast concrete flooring modules, Bubble deck Slab can be fully precast and place on the site by transporting and installation as well.

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Time savings can also be managed through the faster construction of walls, columns and MEPs due to the lack of support beams and load bearing walls for this innovative flat slab. Because of that Addition time may be saved from the early/quicker curing time since there is less concrete in the slab.

## **d) Cost Savings**

In compare to the savings in material and time, cost reductions are also important in the Bubble deck slab system. The decreased and by reducing weight and materials mean lower transportation costs and would be more economical to lift the components. With less on-site construction from the full and semi-precast slab, labor costs will be decrease because of less work. In addition, money can be saved in the design and construction of the building frame elements (i.e. Columns and walls) for lower loads. There is a little bit increase in production costs for the Bubble deck slab due to the manufacturing and assembly of the HDPE spheres. However, the other savings in material, time, transportation and labor will offset this manufacturing price increase (Stubbs).

## **e) Green Design**

The number of owners, designers and engineers who desire green alternatives is growing exponentially. Bubble deck is a fitting solution for lowering the demonstrate carbon in new buildings. According to the Bubble Deck Company, 1 kg of recycled plastic replaces/restores 100 kg of concrete. By using less concrete, designers can save up to 40% on demonstrate carbon in the slab, resulting in significant savings downstream in the design of other structural members. Carbon discharge from transportation and equipment usage will also decrease or reduce with the use of short materials. Also, the HDPE bubbles can be regained and reused for other projects or can be recycled.

## **III. METHODOLOGY**

### **3.1 Collection of data**

We collect data about bubble deck slab with help to teachers and from different research papers. From that data we have study about the difference between the bubble deck slab and conventional slab. From that study we make a model on it by step by step i.e. (design of steel for conventional slab, mix design of conventional slab, design of steel for bubble deck slab, mix design of bubble deck, etc.)

### **3.2 Construction Methodology (Bubble Deck Slab)**

#### **3.2.1 Selection of Materials**

These materials use for the research where obtained within Aurangabad city. Ordinary Portland cement (OPC) (Ambuja brand) Was used for the project, the fine aggregate (sharp sand) use was obtained from a flowing river it was dried for some days in the laboratory and then sieved to be free from deleterious material. Coarse aggregate was purchase from a quarry site. And instead of bubble we used plastic balls. Ordinary cline tap water free for drinking was used for the experiment. We used steel having 8mm diameter for the project.

#### **3.2.2 Making steel mesh for conventional slab (one way)**

We take 8mm diameter bar of 30 feet's, and cut it in to 26 inches each strip, bent the main bar in 45o from one side and place it in alternate manner in 3 inches distance on the distribution bar as shown in fig. And tied it perfectly to each other.

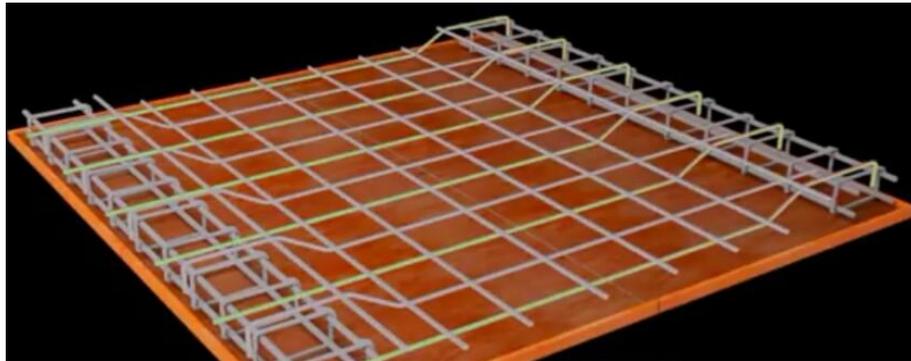


Fig.2.1. Conventional slab mesh

### 3.2.3 Making steel mesh for Bubble Deck slab

We take 8mm diameter bar of 30 feet's and cut it in to 22 inches each strip. In that system no bent up is required in a main bar, only straight bar mesh is provided in bottom and top of bubbles. The main and distribution bar is place in 2.5 inches in distance. And that these two meshes we fix a Bubble (HDPE) in proper manner.



Fig.2.2. Bubble Deck Slab Mesh

### 3.2.4 Provision Bottom Reinforcement

The initial step is laying the bottom reinforcement for increase the tensile strength of the structure. It fetches the ball and aligns it in a straight line. Bottom reinforcements are two directionally righted reinforcement meshes.

### 3.2.5 Provision of Top Reinforcement

After placing the balls, top reinforcement meshes are provided on the top of the sphere. It is positioning the ball and also acts as a cover for the balls. The two meshes are connected after placing the spheres into places in order to form a rigid shell. In order to achieve the reinforcement modules for Bubble Deck slabs with gaps. The following operations must take place:

- Making the steel reinforcement meshes.
- Placing the pipelines, cables and element of electric fittings.
- Fixing small boxes or pieces of polystyrene on reinforcement meshes for marking the position of the walls or the columns and installations.
- Placing of the polystyrene spheres between the meshes according to plans

### 3.2.6 Location of balls

The balls are placed in between the reinforcement instead of concrete. Bottom reinforcement and diagonal girders keep the bubbles in position. Diagonal girders fixed between the top and bottom reinforcement. During the final

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positioning of the slab elements it is checked if the displaying of the spheres is according to the plans. Also, it is checked the reinforcement in the over concreting areas. The transversal reinforcement bars must be embedded in the adjacent slab elements. To maintain the building configuration partially pre-casted elements are made and designed. They are delivered with pieces of polystyrene included that mark the position of the walls or the columns.

### 3.2.7 Mix proportions of conventional and bubble deck slab

Batching operation by weight approaches was adopted in the study. Preliminary mixes of 1:2:4 (cement: fine sand: coarse aggregate) were investigated with water/cement ratio of 0.80, and 0.70 respectively so as to obtained the required w/c ratio for the actual mixes.

### 3.3 Casting and Curing of Conventional and Bubble Deck Slab

#### 3.3.1 Bottom Concrete

Concrete is provided at the bottom of the assembly line. It acts as a bonding material for ball because the ball attached with the concrete. We take waste tiles for casting of slab for better smooth finishing. Then apply oil on it and place steel mesh of conventional slab and bubble deck slab mesh in the two different formwork mould. Concrete provided over the slab by trowel. Concrete is poured in between the ball gaps. Immediately after pouring, the surface of the concrete is cleaned with under pressure water to remove the dust and to moister the surface. Especially in times of high temperatures the surface of the precast element is kept wet to ensure the needed adherence and the connections of the partially prefabricated elements are not rigorously followed according to the design the concreting is adjusted with fluid mortar or with a thin layer of silicon pumped at the bottom part of the connection. In order to adjust the connections, one should never use expanded foams that may lead to reducing the thickness of the concrete layer and therefore to reducing the durability of the reinforcement and the fire resistance. Self-compacting concrete can be poured into forms, flow around congested areas of reinforcement and into tight sections, allow air to escape and resist segregation, without the standard consolidation efforts.

After concreting, vibration is provided for bottom and top concrete setting. Removing air content from the slab. Thin vibrator should be used for compaction as there is less space between the spheres. The surface of the poured concrete is leveled with a metallic profile. Finally, concrete surface finished with finishing tools. There is no further work required, the slab is complete unless requirement for exposed soffit.

Then place it to 24 hr. for final setting. After setting we removed the formwork and place the slabs for curing for 7 days.



Fig.2.3. Casting of Bubble Deck and Conventional Slab

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## IV. CONCLUSION

In the present scenario of the construction industries we need different types of methods which are more economical, easy to construct and environment friendly. The Bubble Deck Slab is one the technology which helps us to achieve the economy, easy to construct and environment friendly. Bubble deck Technology is the innovative system that eliminates Concrete in the mid-section, secondary supporting structure such as beams reinforced concrete columns or structural walls.

As compared to conventional concrete the weight reduction is about 13% (for 1 m<sup>3</sup>) which will help in decreasing dead load and hence ultimately will reduce the moments. This will help in a stable structure which will also reduce the initial constructional cost up to 12 %. (for 1 m<sup>3</sup>).

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