WHAT IS THE PRINCIPLE OF BUBBLE DECK SLAB

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Annotation: A reinforced structure with filled spherical bubbles and possibly thin concrete shells in the form of prefabricated floor slabs is delivered to the construction site.

Keyword: ball, shell, concrete pad.

The principle of the Bubble deck slab is that hollow plastic spheres are incorporated into the floor, clamped in a factory-made reinforced structure. This structure of reinforcement constitutes at the same time the upper and lower reinforcement of the concrete floor.

The reinforcement structure with infill ed bubbles spherical shapes and possibly thin concrete shells as precast slab floors is conveyed to the construction site in factory-made units with a maximum width of 3 meters. They are installed on-site and are assembled by installing the connecting rod and by pouring concrete. After the concrete has set, the floor is ready to be used

The saving oп the weight acquired in this way has the result that a Bubble Deck Slab floor caп provides the required load-bearing capacity at a smaller thickness this leads to a further advantage, resulting in a saving 40 to 50 % of the material consumption in the floor construction

The ratio of the diameter of the plastic sphere to the thickness of the floor is such that a 35% saving is achieved on the material or concrete composition for the floor in collation with a solid concrete floor of the same thickness.

A bubble deck slab is a hollow, flat slab that spans in two directions, in which plastic balls are incorporated to replace, and therefore eliminate the concrete in the middle of a conventional slab which does not contribute to its structural performance.

1: Bubble Deck Slab

Bubble Deck is the invention of Jorgen Bruenig in the 1990s, who developed the first biaxial hollow slab (now known as Bubble Deck) in Denmark. This new prefabricated construction technology using the Bubble Deck slab has recently applied in many industrial projects around the world.

The "bubbles" are sandwiched between the top and bottom meshes create a natural cell-like structure that when concreted. Performs just like a traditional solid reinforced concrete slab. Bubble Deck, however, has all kinds of advantages over the traditional solid slab. The voids in the Bubble Deck slab reduce the dead weights by up to 35%, allowing for a reduction in building structure and foundations, thereby saving materials and costs. Bubble Deck caп span far longer than a solid slab (20 to 40 times the deck thickness) in all directions and without the need for beams! The result? Open floor plates, minimal structure, and flat soffits. It can also achieve astonishing cantilevers up to 10 times the deck thickness. Bubble Deck slabs caп follow any shape, allowing for ultimate design creativity. l t also provides future flexible ty, since adding slab openings is easy and cost-effective. With Bubble Deck, construction time and costs caп be greatly reduced. Lighter-weight materials decrease transportation costs and require less expensive lifting equipment.

Pipes, ductwork, and other penetrations are easily incorporated into the slab. Bubble Deck is also green-friendly and qualifies for LEED points. Made from recycled materials, it uses less material overall. 1 Kilogram of plastic replaces 100 Kilograms of concrete

Basic Principal of Bubble Deck Slab

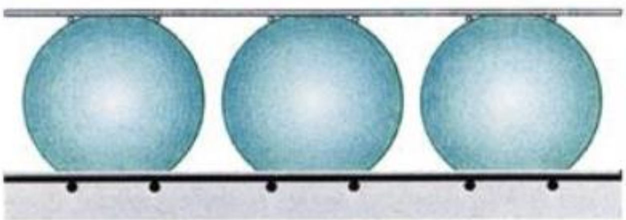
The basic principle characteristic is that hollow plastic spheres are incorporated in the floor, clamped in a factory-made reinforcement structure to virtually eliminate all concrete from the middle of a floor slab not performing any structural function, thereby dramatically reducing structural dead weight.

In this article, we study the types, material specifications, installation, advantages, and applicability of bubble deck slabs.

Types of Bubble Deck Slab

1. Type A – Filigree Elements

Bubble deck Type A is a combination of constructed and unconstructed elements. A 60 mm thick concrete layer and part of the finished depth are precast and brought on-site with the bubbles and steel reinforcement unattached.

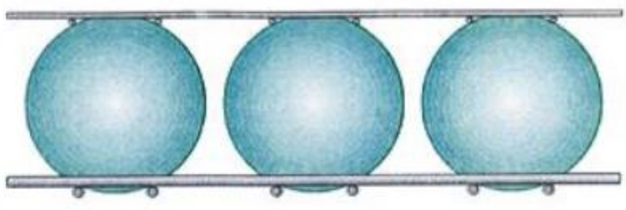


Type A – Filigree Elements

The bubbles are then supported by temporary stands on top of the precast layer and held in place by interconnected steel mesh. This type of bubble deck is optimal for new construction projects where the designer can determine the bubble positions and steel mesh layout.

2. Type B – Reinforcement Modules

The bubble deck Type B is a reinforcement module that consists of pre-assembled steel mesh and plastic bubbles. These components are brought to the site, laid on traditional formwork, connected with any additional reinforcement, and then concreted in place by traditional methods.

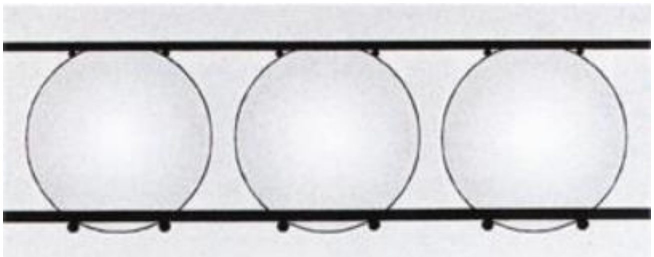


Type B – Reinforcement Modules

This category of Bubble Deck is optimal for construction areas with tight spaces since these modules can be stacked on top of one another for storage until needed.

3. Type C – Finished Planks

The bubble deck Type C is a shop-fabricated module that includes plastic spheres, reinforcement mesh, and concrete in its finished form. The module is manufactured to the final depth in the form of a plank and is delivered on-site.



Type C – Finished Planks

Unlike Type A and B, it is a one-way spanning design that requires the use of support beams or load-bearing walls. This class of Bubble Deck is best for shorter spans and a limited construction schedule.

Material and its Specifications Used in Bubble Deck Slab

1. Concrete

The concrete used for joint filling in the Bubble Deck floor system must be above M20-25 grade. The nominal maximum size of the aggregate is the function of the thickness of the slab.

Usually, self-compacting concrete is used, either for the casting of a prefabricated filigree slab or for the joint filling on the site. Self-compacting concrete can be poured into forms, flow around congested areas of reinforcement, and into tight sections, allowing air to escape and resist segregation.

2. Reinforcement Bars

The reinforcement of the plates is made of two meshes, one at the bottom part and one at the upper part that can be tied or welded. The steel is fabricated in two forms, the meshed layers for lateral support and diagonal girders for vertical support of the bubbles.

The distance between the bars corresponds to the dimensions of the bubbles that are to be used and the quantity of reinforcement from the transverse ribs of the slab. Grade Fe-500 strength or higher is used.

3. Hollow Bubbles

The bubbles are made using high-density polypropylene materials. These are usually made with a non-porous material that does not react chemically with the concrete or reinforcement bars.

Bubbles used in the Bubble Deck slab.

The bubbles have enough strength and stiffness to support between 180mm to 450 mm. Depending on this, the slab depth is 230 mm to 600 mm. The distance between bubbles must be greater than 1/9th of the bubble diameter.

The nominal diameter of the gaps may be 180, 225, 270, 315, or 360 mm. The bubbles may be spherical or ellipsoidal.

Installation of Bubble Deck Slab

The overall floor area is divided into a series of planned individual elements, up to 3 m wide dependent upon site access.

These elements comprise the top and bottom reinforcement mesh, sized to suit the specific project, joined together with vertical lattice girders with the void formers trapped between the top and bottom mesh reinforcement to fix their optimum position which is termed a bubble-reinforcement sandwich.

The bottom layer of 60 mm pre-cast concrete is cast, encasing the bottom mesh reinforcement, to provide permanent formwork within part of the overall finished slab depth.

On-site the individual elements are then ‘stitched’ together with loose reinforcement simply laid centrally across the joints between elements.

After the site is finished, concrete is poured and cured.

This technique provides structural continuity across the entire floor slab – the joints between elements are then redundant without any structural effect, to create a seamless biaxial floor slab.

Advantages of Bubble Deck Slab

1. Superior Statics

Bubble deck slab is a superiority to the conventional slab as it has reduced weight, increased strength, fewer columns, and no beams or ribs under the ceiling.

2. Production and Carrying Out

The production is of higher quality through the automated production of prefabricated units. Minimum work at the site removes the possibility of errors and the lightweight of the slab helps in easier erection with light and cheap lifting equipment.

3. Transportation

The transportation of materials is reduced considerably. Thus, lower costs, and environmental improvement.

4. Economic Savings

The major savings are found in materials (slabs, pillars, fundaments) up to 50 %. Due to its lightweight, transportation costs are heavily reduced.

5. Safety

The bubble deck slab is fireproof and the safety against earthquakes is significantly benefited Fire – Fireproof construction alone from the weight reduction.

6. Environmental Improvement

With the use of the bubble, 1 kg of plastic replaces more than 100 kg of concrete. Energy consumption for production, transport, and carrying out is very low. Thus, less emission of CO_2.

7. Explosions Safe

Bubble Deck's biaxial flat slab system and columns are ideal for structures with high resistance against explosions. To get rid of heavy facades and rigid walls, suppressing air pressure which in the worst case leads to the collapse of the structure.

Functional Applicability

Residential living, offices, utility, and industrial buildings. Used in offices, apartments, villas, hotels, schools, parking, hospitals, laboratories and factories.

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