Experimental Study Of Concrete Using Hollow Plastic Ball

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Abstract- *Void forms in the middle of a flat slab by means of plastic spheres eliminate 35% of a slab's self-weight, removing constraints of high dead loads and short spans. Its flexible layout easily adapts to irregular and curved plan configurations. The system allows for the realization of longer spans, more rapid and less expensive erection, as well as the elimination of down-stand beams. According to the manufacturer, using plastic balls in concrete of slab can reduce total project costs by three percent. Using hollow plastic balls in concrete of slab is a new innovative and sustainable floor system to be used as a self-supporting concrete floor. The application of the concrete slab floor system in the Netherlands is manifested as the world- wide first application. Using hollow balls in concrete slab floor system can be used for story floors, roof floors and ground floor slabs. A such types of slab floor is a flat slab floor, therefore without beams and column heads*

Keywords- plastic balls, concrete, hollow

I. INTRODUCTION

Concrete is a composite material which composed of aggregates, cement and water. Concrete is used more than any other manmade material in the world. In addition, concrete is the 2nd most consumed substance in the world-behind water. About 7.23 billion tons of concrete is produced every year. Annual production represents one ton for every person on the planet. Production of concrete is increasing due to high growth of infrastructure development and construction activities in the world Production of concrete demand its constituents like aggregates, cement, water and admixtures. The large scale production of concrete in construction activities using coarse aggregate, fine aggregates and cement immoderately reduces the natural stone deposits, sand in river, and affecting the environment hence causing ecology imbalance.

The reinforcement structure with spherical shapes and possibly a thin concrete shell as precast slab floor are supplied 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 connecting rods and by pouring concrete. After the concrete has set, the floor is ready to be used. The ratio of the diameter of the plastic spheres to the thickness of the floor is such that a 35 % saving is achieved on the material or concrete consumption for the floor in comparison with a solid concrete floor of the same thickness.
The saving on weight obtained in this way has the result that a Bubble deck slab floor can provide the required load-bearing capacity at a smaller thickness this leads to a further advantage, resulting in a saving of 40 to 50 % of the material consumption in the floor construction. Since the weight of the structure reduced, this type of structure can useful to reduce earthquake damage.

II. STATE OF DEVELOPMENT

Amer M Ibrahim et. al [1]: A study has been conducted in 2012 on the flexural capacities of reinforced two way Bubble deck slabs. A Bubble deck slab has a two dimensional arrangement of voids within the slabs to reduce self-weight. The behavior of Bubble deck slabs is influenced by the ratio of bubble diameter to slab thickness. To verify the flexural behavior of Bubble deck slab such as ultimate load, deflection, concrete compressive strain and crack pattern, two dimensional flexural tests were tested by using special loading frame. Results have shown that the crack pattern and flexural behavior depend on the void diameter to slab thickness ratio. The ultimate load capacities for Bubble deck slabs having bubble diameter to slab thickness of 0.01 to 0.64 were the same of solid slabs, the ultimate capacities were reduced to about 10%.

Arati Shetkar et. al [2]: Presented experimental Study on Bubble Deck Slab System with Elliptical Balls, the behavior of Bubble Deck slabs is influenced by the ratio of bubble diameter to slab thickness, the effectiveness and feasibility of the application of Bubble Deck in the construction. The reinforcements are placed as two meshes one at the bottom part and one at the upper part that can be tied or welded. The distance between the bars are kept corresponding to the dimensions of the bubbles that are to be embodied and the quantity of the reinforcement from the longitudinal and the transversal ribs of the slab.

Bhagyashri Bhade et. al [3]: Weight reduction is 25% compared to solid slab. The bubble deck technology is environmentally green and sustainable; avoiding the cement production allows reducing global CO2 emissions. In comparative of conventional slab the volume of concrete in bubble deck (continuous) are less required, that is 25% approximately. In bubble deck slab volume of concrete is reduced, so that the weight of slab is decrease, comparative to Conventional slab. Cost and time saving by using bubbles in the slab like weight of slab, concrete volume indirectly load on the beam and walls also decrease/ less so that building foundations can be designed for smaller dead loads.

Harishma K R. et. al [4]: 2015, It shows the effectiveness and feasibility of the application of Bubble Deck in the construction. It proves a wide range of cost and construction benefits. It also proves combines the benefits of factory-manufactured elements in controlled conditions along with on-site completion with the final monolith concrete, resulting in a completed floor slab. 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 are corresponding to the dimensions of the bubbles that are to be used and the quantity of reinforcement from transverse ribs of the slab. Grade Fy50 strength or higher is used.

Jorgen Breuning et. al [5]: In the 1990's, invented a way to link the air space and steel within a voided biaxial concrete slab. The Bubble Deck technology uses spheres made of recycled industrial plastic to create air voids while providing strength through arch action. As a result, this allows the hollow slab to act as a normal monolithic two- way spanning concrete slab. These bubbles can decrease the dead weight up to 35% and can increase the capacity by almost 100% with the same thickness. As a result, Bubble Deck slabs can be lighter, stronger, and thinner than regular reinforced concrete slabs.

III. METHODOLOGY

This is a cube with specifications prepared to analyses experimentally with normal concrete of grade M25 by adopting conventional methods.

Step 1- Filling The Cube Moulds And Compacting

The hollow plastic ball was placed inside the cube after first layer. It was put exact centre of cube. After then filled up second layer compacted well with compacting bar. And then added third layer and finishing it

Step 2- Compacting With Compacting Bar

The minimum number of strokes per layer required to produce full compaction will depend upon the workability of the concrete, but at least 35 strokes will be necessary except in the case of very high workability concrete. After the top layer has been compacted, a trowel should be used to finish off the surface level with the top of the mould, and the outside of the mould should be wiped clean

Step 3- Precautions To Take When Making Cubes

Once a specimen has been compacted, it should not be left standing on the same bench as another specimen that is being compacted. If this is done, some vibration will be passed on to the first specimen and it will be more compacted than the other. In extreme cases some re-arranging of the particles may result and segregation will occur

Step 4- Identification Of Cubes

Immediately after making the cubes they should be marked clearly. This can be done by writing the details of the cube in ink on a small piece of paper and placing on top of the concrete until it is remoulded.

Fig.1 Casting of cube

IV. RESULTS AND DISCUSSION

A. Test Result For 14 Days

We tested 12 cubes for 14 days out of which for 9 cubes we used 3 different diameters of plastic ball as 55 mm, 105mm, 135mm with three sets 3 numbers of cubes and 1 set cubes casted without balls and results are as follows

Table 1 Test Result For 14 Days

SR. NO.	DIAMETER OF BUBBLE USED INCUBE	COMPRESSIVESTRENGH [N/mm2]	AVERAGE
1	Without bubble	22.35	22.47
		22.5	
		22.56	
2	55mm	22.43	22.64
	55mm	22.67	
	55mm	22.82	
3	105mm	22.28	22.01
	105mm	21.80	
	105mm	21.96	
4	135mm	17.58	17.74
	135mm	17.76	
	135mm	17.88	

B. Test Result For 21 Days

We tested 12 cubes for 21 days out of which for 9 cubes we used 3 different diameters of plastic ball as 55 mm, 105mm, 135mm with three sets 3 numbers of cubes and 1 set cubes casted without balls and results are as follows

Table 1 Test Result For 21 Days

SR. NO.	DIAMETER OF BUBBLE USED INCUBE	COMPRESSIVESTRENGH [N/mm2]	AVERAGE
1	Without bubble	23.68	23.75
		23.75	
		23.84	
2	55mm	23.53	23.66
	55mm	23.62	
	55mm	23.84	
3	105mm	22.98	23.13
	105mm	23.10	
	105mm	23.32	
4	135mm	19.11	19.24
	135mm	19.25	
	135mm	19.38	

C. Test Result For 28 Days

We tested 12 cubes for 28 days out of which for 9 cubes we used 3 different diameters of plastic ball as 55 mm, 105mm, 135mm with three sets 3 numbers of cubes and 1 set cubes casted without balls and results are as follows

Table 1 Test Result For 28 Days

SR. NO.	DIAMETER OF BUBBLE USED INCUBE	COMPRESSIVESTRENGH [N/mm2]	AVERAGE
1	Without bubble	25.10	24.97
		24.88	
		24.94	
2	55mm	24.72	24.80
	55mm	24.80	
	55mm	24.88	
3	105mm	24.82	24.74
	105mm	24.63	
	105mm	24.76	
4	135mm	21.13	21.32
	135mm	21.32	
	135mm	21.53	

V. CONCLUSION

We had conducted test on different cubes having different diameter of ball, such 55mm, 105mm and 135mm.We conducted test on 14,21 and 28 days and the result are as follows:

1. we can see that 55mm ball used in cube, i.e., ball cubes casted for 14,21 and 28 days which does not give much difference of compressive strength as compare to conventional cube.
2. we can see that 105mm ball used in cube, i.e., ball cubes casted for 14,21 and 28 days which does not give much difference of compressive strength as compare to conventional cube.
3. By using the ball of size 105mm in the design of concrete is maintain the compressive strength good enough. Thus we can use 105 mm bubble in the construction work which is capable of achieving economy and reduction in volume of concrete and time of construction work.
4. As the 135mm ball is used in cube, the compressive strength is decreases. The compressive strength of without ball of concrete cube is higher than with ball 135mm. The use of 135mm ball in the construction work not efficient.
5. Weight reduction is 35% compared to solid cube.
6. By using hollow plastic Ball in concrete, we can reduce the volume of concrete, we can also reduce production of cement, which help in reduction of CO_2 emission.

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