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Comparative Study between Conventional R.C.C Slab and 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 are reduced 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 gapes 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 to introduce about the various properties of bubble deck slab based on various studies done in in the comparison with the conventional slab. Using bubble deck means floor cycle up to 20% faster than traditional construction method. Using of recycled material, lower energy consumption and reduced CO₂ 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. (Generally, we used HDPE 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.

1. INTRODUCTION

1.1 General

RCC stands for Reinforced Cement Concrete, which is when plain cement concrete (mixture of cement, fine aggregate and coarse aggregate) is reinforced with steel bars. An RCC building means the main structural members of the building, viz, slabs, beams, columns and foundations are made up of reinforced cement concrete.

1.1.2 RCC Structure

Concrete Frame Structures. Its full name is reinforced cement concrete, or RCC. RCC is concrete that contains steel bars, called reinforcement bars, or rebars. This combination works very well, as concrete is very strong in compression, easy to produce at site, and inexpensive, and steel is very strong in tension.

1.2 Slab

Slabs are constructed to provide flat surfaces, usually horizontal in building floors, roofs, bridges, and other types of structures. The slab may be supported by walls or by reinforced concrete beams usually cast monolithically with the slab or by structural steel beams or by columns, or by the ground.

1.2.1 Type of slab

A. Flat Slab

The flat slab is a reinforced concrete slab supported directly by concrete columns or caps. Flat slab doesn't have beams so it is also called as beam-less slab. They are supported on columns itself. Loads are directly transferred to columns. In this type of construction, a plain ceiling is obtained thus giving attractive appearance from an architectural point of view. The plain ceiling diffuses the light better and is considered less vulnerable in the case of fire than the traditional beam slab construction. The flat slab is easier to construct and requires less formwork. This is one of the types of concrete slabs.

Application of flat slab

1. To provide plain ceiling surface giving better diffusion of light
2. Easy constructability with the economy in the formwork
3. Larger headroom or shorter story height & pleasing appearance.

4. This kind of slabs are provided in parking
5. Flat slabs are generally used in parking decks, commercial buildings, hotels or places where beam projections are not desired.



Figure 1.1. Flat Slab

B. Conventional Slab

The slab which is supported on Beams and columns is called conventional slab. In this kind, the thickness of slab is small whereas depth of the beam is large and load is transferred to beams and then to columns. It requires more formwork when compared with the flat slab. In conventional type of slab there is no need of providing column caps. The thickness of conventional slab is 100mm or 10cm. 127 to 150mm is recommended if the concrete will receive occasional heavy loads, such as motor homes or garbage trucks.

Conventional concrete slabs are square in shape and has a length of 4m. Reinforcement is provided in conventional slab and the bars which are set in horizontal are called Main Reinforcement Bars and bars which are set in vertical are called Distribution bars.

Based on length and breadth of Conventional Slab is classified into two types:

1. One-Way Slab
2. Two-Way Slab

1. One Way Slab

One-way slab is supported by beams on the two opposite sides to carry the load along one direction. The ratio of longer span (l) to shorter span (b) is equal or greater than 2, considered as One-way slab. In this type slab will bend in one direction i.e. in the direction along its shorter span. However minimum reinforcement known as distribution steel is provided along the longer span above the main reinforcement to distribute the load uniformly and to resist temperature and shrinkage stresses.

$$\frac{\text{Longer Span}}{\text{Shorter Span}} = \frac{l}{b} \geq 2$$

In general length of the slab is 4m. But in one-way slab one side length is 4m and another side length is more than 4m. So, it satisfies the above equation. Main reinforcement is provided in shorter span and distribution reinforcement is provided in longer span. Distribution bars are cranked to resist the formation of stresses.

Example: Generally, all the Cantilever slabs are one Way slab. Chajjas and verandas are a practical example of one-way slab.



Figure 1.2. One-Way Slab

2. Two Way Slab

Two-way slab is supported by beams on all the four sides and the loads are carried by the supports along both directions, it is known as two-way slab. In two-way slab, the ratio of longer span (l) to shorter span (b) is less than 2. The slabs are likely to bend along both the directions to the four supporting edges and hence distribution reinforcement is provided in both the directions.

$$\frac{\text{Longer Span}}{\text{Short Span}} < 2$$

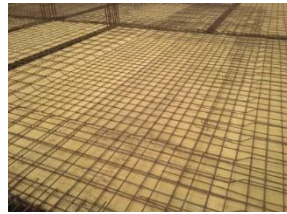


Figure 1.3. Two-Way Slab

C. Bubble deck slab

It is constructed by placing plastic bubbles which are prefabricated and the reinforcement is then placed between and over plastic bubbles and finally, fresh concrete is poured. The plastic bubbles replace the ineffective concrete at the centre of the slab.

Bubble Deck slabs reduce weight, increase strength, larger spans can be provided, fewer columns needed, no beams or ribs under the ceiling are required. Consequently, not only does it decline the total cost of construction but is also environmentally friendly since it reduces amount of concrete.

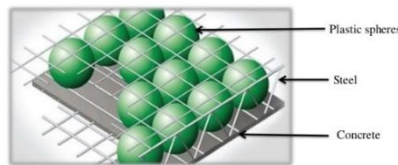


Figure 1.4. Bubble Deck Slab

1.3 Importance of Study of Bubble Deck Slab

1.3.1 Concept Bubble Deck Slab

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, 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/center of the slab by using or inserting (HDPE) recycled balls in it. High density polyethylene (HDPE)hollow spheres/balls insert or place in-effective concrete in the middle portion or center 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/center 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 center of the slab, thus decreasing the dead weight and increasing the efficiency of the floor.

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. In the former work, flat slab condition is used which results increase in the depth of the slab that is more than 230mm. High density polyethylene hollow plastic spheres were used in the earlier research.

1.3.2 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. Figure shows the cross-section of a typical filigree element.

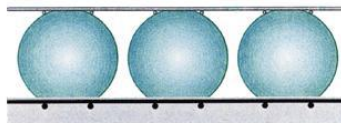


Figure 1.5. Filigree elements Bubble deck Type A

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. Figure shows the cross-section of a typical reinforcement module.

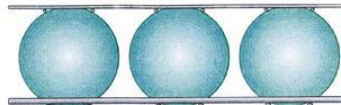


Figure 1.6. Reinforcement modules Bubble Deck Type B

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. Figure shows the cross-section of finished planks.



Figure 1.7. Finished planks Bubble Deck Type C

1.3.4 Materials Used in Bubble Deck Slab

A. Steel reinforcement

(HYSD) High grade steel of Fe 415, Fe 500 or Fe 550 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.

B. Concrete

Concrete is a composite mixture which consists of Cement, Sand and Aggregate. Concrete mix design is the procedure for finding the right quantities of these materials to achieve the desired strength. Accurate concrete mix design makes concrete construction economical. Large constructions such as Bridges, dams require huge amount of concrete, using the right quantity of constituents make the structure economical. In order to calculate or find the right amount of cement, sand and aggregate required in 1m³ of concrete; you need to know about different grades of concrete.

As per IS456:2000, Different grades of concrete are classified into M5, M7.5, M10, M15 etc., whereas M stands for Mix and the number behind M stands for Characteristic Compressive strength(f_{ck}) of the concrete in N/mm² @28 days when checked with 15cm×15cm×15cm cube in direct compression test.

C. 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.



Figure 1.8. Diagonal Girder

D. 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.1.12.

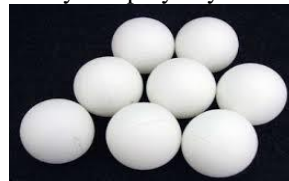


Figure 1.9. Recycled Polyethylene Hollow Spheres

II. METHODOLOGY

2.1. Introduction

A slab is a structural element, made of concrete, that is used to create flat horizontal surfaces such as floors, roofdecks and ceilings. A slab is generally several inches thick and supported by beams, columns, walls, or the ground.

2.2. Conventional slab

This type of slab is supported with beams and columns, with the load transferred to those elements. A conventional slab is classified as either: One-way: Supported by beams on two opposite sides, carrying the load along one direction

2.2.1 Concrete Mix Design of Conventional slab (M25)

The conventional concrete, i.e. M25 grade concrete is having a mixed design according to the IS 456:2000 & IS10262:2009 is explained in this section.

2.2.2 Construction Procedure

1) Selection of Materials and testing on material

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. Ordinary clean tap water free for drinking was used for the experiment. We used steel having 8mm diameter for the project.

2) Making of reinforcement steel

We took 8 mm diameter bar of grade Fe 415 and cut it in to 570mm for placement along longer span and 200mm bent up bar along shorter span each strip. In that system bent-up bar is required in a main steel. The main and distribution steel is place @100mm c/c.

3)Casting of conventional slab

We prepared a slab formwork of 230x600 mm size with respect to the depth of 125mm for conventional slab.

Before laying of mesh and casting of concrete we applied oil to the formwork for increasing its efficiency for removing.

We took concrete of ratio 1:1.31:2.37. We take water cement ratio of 0.45 as per our concrete mix design. we take cement of 13.07 kg cement, 17.13 kg fine aggregate and 30.99 kg coarse aggregate. We used the manual mixing type for preparing concrete mix. Then we pour the concrete into the formwork and compact it by tamping rod and by table vibrator.



Figure 2.2. Mixing of concrete and casting of slab

After compaction we kept it for final setting time for 24hrs. We placed the slab for curing for 28days. We used the gunny bag curing method.

After the curing of slab, we removed formwork and performed various test on it such as Flexural test, hardness test by using rebound hammer method and compressive test.

2.3. Bubble deck Slab

Bubble deck slab is a method of virtually eliminating all concrete from the middle of a floor slab, which is not performing any structural function, thereby dramatically reducing structural dead weight.

2.3.1 Concrete Mix Design of Conventional slab (M25)

The bubble deck slab concrete, i.e. M25 grade concrete is having a mixed design according to the IS 456:2000 & IS10262:2009 is explained in this section.

2.3.2 Selection of Materials and testing on material

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1. Testing on (HDPE balls)

We have tested the bubble which is required for the bubble deck slab for this compression test we have taken a bubble of diameter 65 mm and tested it on the UTM (Universal testing machine) the maximum load taken by the bubble was 14.850 KN.

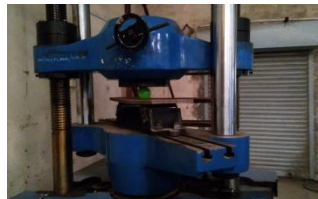


Figure 2.3. Compression test on hard plastic ball

2.3.3 Making steel mesh for Bubble Deck slab

We took 6 mm diameter bar of grade Fe 415 and cut it in to 570mm for placement along longer span and 200mm along shorter span each strip. In that system no bent-up bar is required in a main steel, only straight bar mesh is provided in bottom and top of the bubbles. The main and distribution steel is place @70mm c/c. And in these two meshes we have fixed the Bubble (HDPE) in proper manner.



Figure 2.4. Making of steel mesh

2.3.4 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.

2.3.5 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 of the HDPE spheres between the meshes according to plans.

2.3.6 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 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.



Figure 2.5. Bubble deck slab mesh

2.3.7 Casting the bubble deck slab with hollow strong plastic balls i.e. HDPE (High density polyethylene balls)

Preparation of form work

We prepared a slab formwork of 230x600 mm size with respect to the depth of 125mm for both conventional and bubble deck slab.

Before laying of mesh and casting of concrete we applied oil to the formwork for increasing its efficiency for removing.



Figure 2.6. Preparation of formwork

We took concrete of ratio 1:1.31:2.37. We take water cement ratio of 0.45 as per our concrete mix design. we take cement of 13.07 kg cement, 17.13 kg fine aggregate and 30.99 kg coarse aggregate. We used the manual mixing type for preparing concrete mix. Then we pour the concrete into the formwork and compact it by tamping rod and by table vibrator.



Figure 2.7. Preparation of concrete

After compaction we kept it for final setting time for 24hrs. We placed the slab for curing for 28days. We used the gunny bag curing method.

After the curing of slab, we removed formwork and performed various test on it such as Flexural test, hardness or compressive test by using rebound hammer method.



Figure 2.8. Curing of concrete Slab

After the curing of slab, we removed formwork and performed various test on it such as Flexural test, hardness or compressive test by using rebound hammer method.

III. PERFORMANCE ANALYSIS

3.1 General

We have performed various tests on our bubble deck slab as well as on the conventional slab during the process of the project we have performed Flexure, rebound hammer test on our slabs (Both Bubble deck and conventional slab) from the tests we have obtained the following results

3.2 Flexural test

3.2.1 For Flexure Test on Conventional Slab the Following Results Are Obtained

Sample 1

Table no. 3.1. Testing result of conventional slab.

Load at Failure	57.3 KN
$M = WL/4$ $= 57.3 \times 10^3 \times 400/4$	$5.73 \times 10^6 \text{ N.mm}$

$I = \frac{bd^3}{12}$ $= \frac{230 \times 125^3}{12}$	$37.43 \times 10^6 \text{ mm}^4$
$\sigma = \frac{M \times Y}{I}$ $\frac{5.73 \times 10^6 \times (125/2)}{37.43 \times 10^6}$	9.56 N/mm^2

Table no. 3.2. Testing result of conventional slab. (Sample 2-3)

Load at Failure	55 KN	Load at Failure	59.32 KN
M	$5.5 \times 10^6 \text{ N.mm}$	M	$5.93 \times 10^6 \text{ N.mm}$
I	$37.43 \times 10^6 \text{ mm}^4$	I	$37.43 \times 10^6 \text{ mm}^4$
σ	9.18 N/mm^2	σ	9.90 N/mm^2

Average $\sigma = \frac{9.56 + 9.18 + 9.90}{3}$	9.55 N/mm^2
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Figure 3.1. Flexural test on conventional slab

3.2.2 For Flexure Test on bubble deck slab the Following Results are Obtained

Sample 1

Table no. 3.3. Testing result of Bubble deck slab.

Load at Failure	65.7 KN
$M = \frac{WL}{4}$ $= \frac{65.7 \times 10^3 \times 400}{4}$	$6.57 \times 10^6 \text{ N.mm}$
$I = \frac{bd^3}{12}$ $= \frac{230 \times 125^3}{12}$	$37.43 \times 10^6 \text{ mm}^4$
$\sigma = \frac{M \times Y}{I}$ $\frac{6.57 \times 10^6 \times (125/2)}{37.43 \times 10^6}$	10.97 N/mm^2



Figure 3.2. Flexural test on Bubble deck slab

Table no. 3.4. Testing result of Bubble deck slab. (Sample 2-3)

Load at Failure	64.4 KN	Load at Failure	67.72 KN
M	$6.44 \times 10^6 \text{ N.mm}^4$	M	$6.77 \times 10^6 \text{ N.mm}^4$
I	$37.43 \times 10^6 \text{ mm}^4$	I	$37.43 \times 10^6 \text{ mm}^4$
σ	10.75 N/mm^2	σ	11.30 N/mm^2

Average $\sigma=10.97+10.75+11.30/3$	11.00 N/mm ²
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3.3 Rebound Hammer Test

3.3.1 Rebound Hammer Test on Bubble Deck and Conventional Slab

- Bubble Deck slab (BDS)
 BDS compressive strength (Horizontal)= 30 N/mm²
 BDS Compressive strength (Vertical Downward) = 49.25 N/mm²
- conventional slab
 Conventional Slab compressive Strength (Horizontal) = 29 N/mm²
 Conventional slab compressive strength (Vertical Downward) = 41.75 N/mm²

Table no. 3.5. Rebound hammer test results

Average Rebound hammer: -

Name of structural element	Position of hammer	Rebound number					
		1	2	3	4	5	6
Bubble deck slab	Horizontal (0°)	34	38	34	44	33	34
Bubble deck slab	Vertical downward (90°)	35	41	42	38	40	34
Conventional slab	Horizontal (0°)	34	36	34	38	36	34
Conventional slab	Vertical downward (90°)	35	38	36	41	35	36

- For Bubble deck slab (horizontal position) = 34+38+34+44+33+34/6
 217/6 = 36.16
- For bubble deck slab (vertical downward position) = 35+41+42+38+40+34
 230/6 = 38.88
- For conventional slab (horizontal position) = 34+36+34+38+36+34
 212/6 = 35.33
- For conventional slab (vertical downward position) = 35+38+36+41+35+36
 221/6 = 36.83

Therefore, after correlation rebound number graph the following results are obtained

- bubble deck slab compressive strength = 30 N/mm².... (Position of rebound hammer horizontal)
- Bubble deck slab compressive strength = 49.25 N/mm² (Position of rebound hammer vertical downward)
- Conventional slab compressive strength =29n/mm².... (Position of rebound hammer horizontal)
- Conventional slab compressive strength=41.75N/33²..... (Position of rebound hammer vertical downward).



Figure 4.3. Test Performance of rebound hammer

a. Estimate of Conventional and Bubble Deck Slab

3.3.1 Measurement sheet

Description of work	No	Length(L)	Width (H)	Depth (T)	Quantity	Total quantity
Conventional slab	1	0.23	0.6	0.125	0.01725	0.01725
Bubble deck slab	1	0.23	0.6	0.125	0.01725	0.01725
Deduction of bubble	27	$\pi/4 \times 0.65^2$ 0.0033 m ²		0.065	0.00579	0.01725-0.00579 =0.01146 m ³



Concrete Reduction = 33.5%
 $33.5/100 \times 0.01725 = 0.00577$
 $= 0.00579$

Quantity	Description of item	Unit	Rate	Per	Amount
0.01725	Conventional slab	m ³	12037.00	m ³	207.67
0.01146	Bubble deck slab	m ³	12037.00	m ³	137.944

Total Cost of Conventional Slab = 207.67 (Excluding Beam cost)

Total cost of Bubble Deck slab = 137.944 (Excluding Bubble cost)

= 137.94 + (27 x 8) = Rs 354 /- (Including Bubble Cost)

Note – 1. Rate for particular item of work is taken from the SSR 2019-20 respectively. 2. Bubble Rate (as per market rate)

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.

In that experiment found that the bubble deck has brought down the concrete volume so that slab of weight ultimately decreases. Simultaneously the load along the bubble deck slab has also a 13.18 % increase as compared to conventional slab. Simultaneously, a slab of bubble deck has improved the elasticity property of the slab, such as conventional slab is 6% less deflect than bubble deck, and quantity of bubbles in slab also an effect on this elasticity property. Weight reduction is the important ingredient is found in a slab of bubble deck. Conventional slab weight is 13 more than the bubble deck slab.

As compared to conventional concrete the weight reduction is about 13% (for 1 m³) 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 m³).

REFERENCES

- 1) M. Surendar, M. Ranjitham (2016). Numerical and Experimental Study on Bubble Deck Slab Research Article Volume 6 Issue No. 2016 IJESC.
- 2) Tina Lai “Structural behavior of bubble deck slab and their applications to lightweight bridge decks” M-Tech thesis, MIT, 2009.
- 3) Bubble deck design and detailing, Bubble Deck Voided Flat Slab Solutions- Technical Manual and Documents (2007).
- 4) Prabhu Teja and P Vijay Kumar International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 5 Issue X, October 2017.
- 5) (IRJET) Volume: 05 Issue -02, Feb-2018 N. LakshmiPriya, M. Karthik Pandi, UG students, Dept. of Civil Engineering, Dr. Mahalingam College of Engineering and Technology, Pollachi, Tamil Nadu.
- 6) Bubble Deck Engineering Design & Properties" Overview." Bubble Deck Voided Flat Slab Solutions- Technical Manual and Documents (2007).
- 7) Bubble Deck Slab properties “Bubble Deck Voided Flat Slab Solutions- Technical Manual and Documents (2006).
- 8) Comparative Study of Bubble Deck Slab and Solid Deck Slab – A Review Raj. R. Vakil1, Dr.Mangulkar Madhuri Nilesh2 1 Department of Civil Engineering, Jawaharlal Nehru Engineering College, Aurangabad, (India) Vol.no.6 Issu.no. 10 October 2017.
 Study And Model Making Of Slab Using Bubble Deck Technology, N. LakshmiPriya, M. Karthik Pandi1, 2 UG Students, Dept. Of Civil Engineering, Dr. Mahalingam College of Engineering and Technology, Pollachi, Tamil Nadu. Volume: 05 Issues - 02 Feb-2018.



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