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Investigation of slab for analytical method

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ABSTRACT

A new solution has been introduced to reduce the weight of the concrete in the structures and to reduce the span of the concrete slab. This system was developed during the early 1990's inn Germany and it gained its acceptance throughout the world. This method develops many benefits throughout the world and it was accepted by the engineers. In this thesis work our main focus on the reduction of concrete of bridge deck.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Newer Trends and Innovation in Mechanical Engineering: Materials Science.

1. Introduction

In any structure, slab has most important role. Slabs that primarily deflect in one direction is referred as one way slab. Two way slab is also called as slab spanning in two directions because bending takes place in both directions. Many things have consisted among the blocks of a light weight material like polystyrene. The bubble deck slab reduces up to 34.5% of the structural concrete in the slab and up to 18.9% reduction in the structural members due to this. This study was first invented by Jorgen Bruenig during the early 90 period (see Fig. 1.1).

1.1. Flat slab

It is a two way reinforced concrete slab which does not has neither beam nor a column the column forced to punch through the flat slab [1]. It can be generally treated by three methods, Drop panel and column capital in slab Drop panel without using a column capital in slab Column capital without using drop a panel in slab (see Table 3.1).

1.2. Bubble deck slab

It is a Slab with cavity which is filled with the recycled plastic balls and elements. This directly reduced the self-weight of slab and they saves the volume of concrete which is to be used for a normal slab and that makes structure economically and the surrounding greener bubble deck technology was invited during early 1990 in Netherland In this technology it locks sphere between the top and bottom reinforcement meshes, there by creating a natural cell structure, acting like a solid slab (see Fig. 1.2).

2. Materials used

2.1. Cement

It acts as the binder material on concrete. This binder often called as the gel. It governs in large part most of the properties. Ordinary Portland cement of grade 43 is confirming to IS 8112-1989 is being used in this structures.

2.2. Fine aggregate

They are obtained from River sand sizing 4.75 mm and below confirming to the zone 3 of IS 383-1970 is being used as the fine aggregate.

2.3. Coarse aggregate

They were obtained from the natural crushed stones with size 20 mm is being used as the coarse aggregate.

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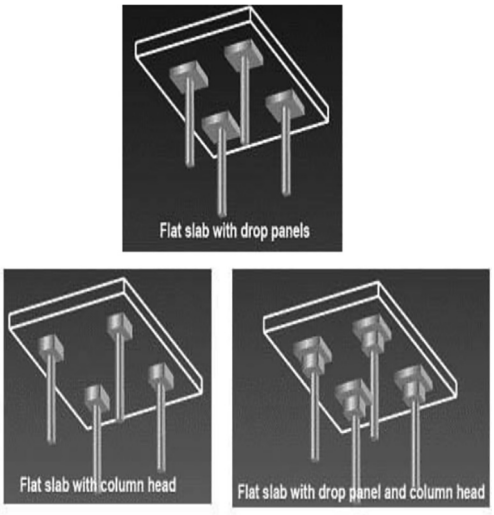

Fig. 1.1. 3D Diagram For Flat Slab.

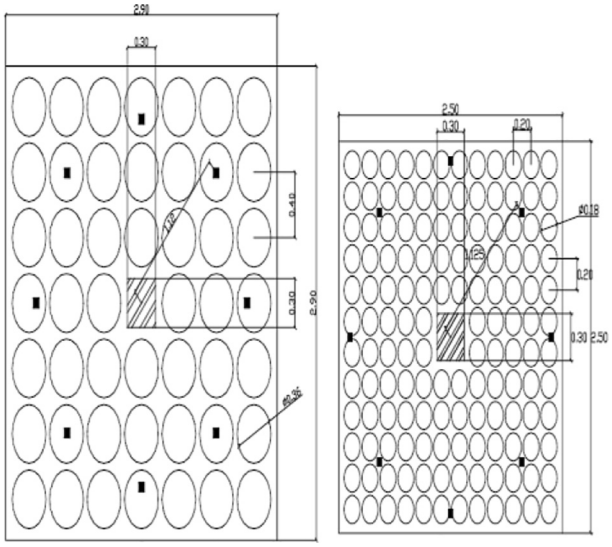

Fig. 1.3. CAD Structure.

Table 3.1

Specimen	Length	Width	Thickness	Diameter
Solid slab	1500 mm	1500 mm	230 mm	_
Void slab-1	1500 mm	1500 mm	230 mm	180 mm
Void slab-2	1500 mm	1500 mm	230 mm	180 mm

Fig. 1.2. Used In Construction.

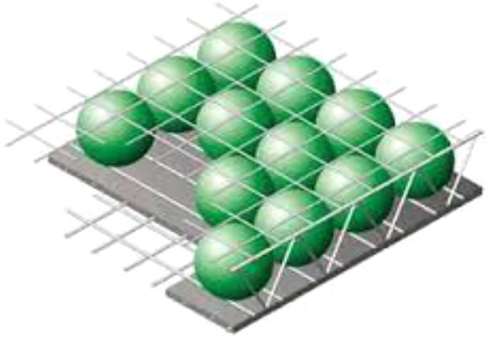

Fig. 1.4. 3D Pattern.

2.4. Plastic hollow spheres (Recycled plastic balls)

The plastic hollow spheres used in this project are manufactured from recycled plastic with diameter of (90 mm and 120 mm) [2]. Since using the recycled resources the burden on the environment reduces and the risks to human health is partially reduced.

2.5. Steel reinforcement

This uses high grade steel of Fe500. This steel is used in both the top and bottom as steel reinforcement [3]. Here 8 mm diameter steel bar is used as main reinforcement and distributor reinforcement. Reinforcement provided in both transverse and longitudinal direction.

2.6. Water

Potable water was being used for the construction. The reinforcement module and the balls are vibrated into the concrete and they produce the uniformity in distribution. The amount of water in the concrete is important for more constructability and the service life of the construction (see Fig. 1.3).

2.7. Structural properties

2.7.1. Compressive strength and flexural capacities

It is exclude a significant volume of concrete as compared to a flat slab in the central area where the slab is chiefly un-stressed in a flexure. The concrete between the ball and the surface is no reasonable difference. The behavior of a Bubble Deck and solid slab remains unchanged. The only work is the steel on the tension side and the outer of the 'shell' of concrete on the compression side. In terms of flexural strength is the moments of the resistance where the same solid slab remain unchanged (see Fig. 1.4).

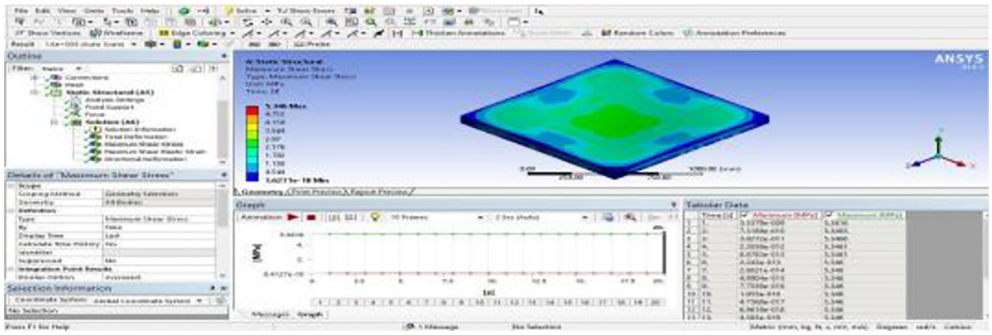

Fig. 4.1. Normal Slab Numerical Analysis.

Table 4.1
Curved modelling.

Slab	Ball dia.	c/c Dis.	Clear spacing	Dis,from edge	Dis, from edge to ball center	Ball center from bottom
V-160	160 mm	160 mm	20 mm	20 mm	90 mm	90 mm

Table 4.2
Surface modelling.

Slab	Thickness	Reinforcement	c/c dis.	Clear cover
Ns	200 mm	10–10 mm	200 mm	25 mm
V-160	180 mm	10–10 mm	180 mm	20 mm

2.7.2. Durability

The durability of the deck slab is not essentially varies from the ordinary solid slabs. This is mainly due to the fusion of the relevant to the durability of the structure (see Fig. 4.1).

2.8. Benefits of bubble deck slabs

The deck slabs are benifitable in various structures and to the construction companies in many kinds. The transportation cost is reduced [4]. The construction time is speeded. The buildings are easily installed (see Table 4.1).

2.8.1. Structural benefits

Increased in the strength There is no need of beams The choice of the shape is free Foundation depth is reduced.

The energy and the material consumption is very less. The components used in here are recyclable The co_2 emission is reduced as lesser than 40% [5].

Savings in the materials is increased.

Which results in profitable to the construction company.

3. Experimental programme

The design of the deck slab in the lab consist many various procedures. The deck slab is the combination of reinforced concrete and the PVC balls. The sand and the mixed aggregates on the basis of INDIAN STANDARAD CODES (concrete mix proportioning) IS 10262:2009 basis (see Table 4.2).

Step 1: Dimension of mould of the deck slab – 0.65m × 0.35 × 0.15 m

Volume of mould of the deck slab is = 0.0275 m^3

Step 2: Dimension of PVC balls (dia) = 0.062 m

Radius = 0.035 m

Then the volume of the sphere is = 4/3xπxr3

Volume of the sphere of 24 (pvc) ball is = 0.035 m3

To determine the volume of the design for mix proportioning is = 0.2775–0.035

= 0.0245 m3

The concrete required for mix proportion is M25

3.1. Slump testing

Slump difference = height of slum apparatus - height of fresh concrete

= 27.5–18 cm

= 9.5

The result shows the medium of work is fresh concrete.

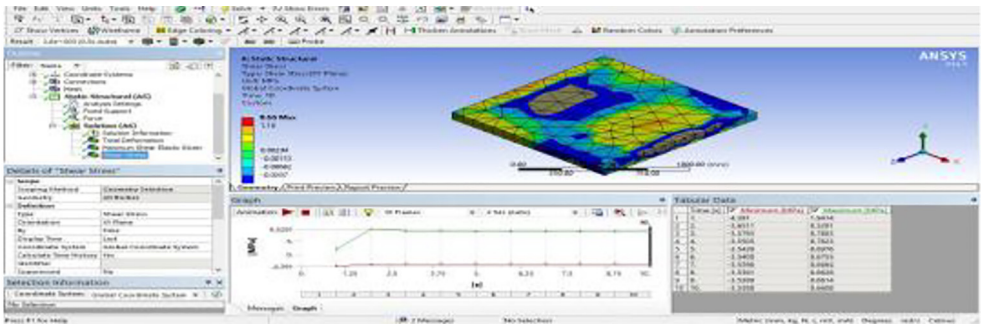

Fig. 4.2. Deck Slab Numerical Analysis.

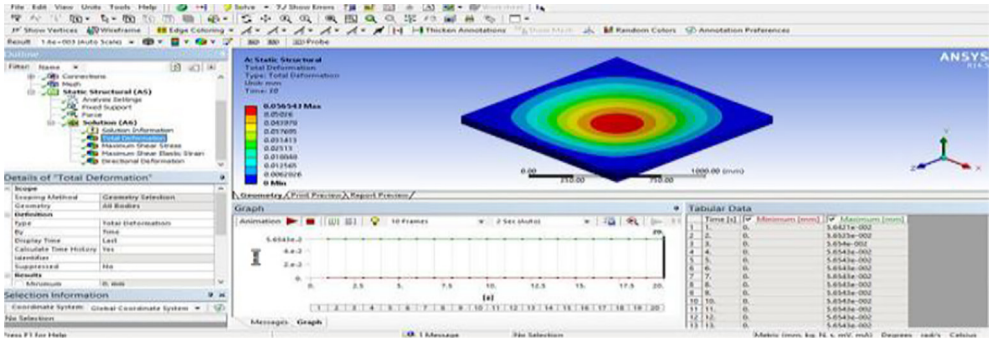

Fig. 4.3. Normal Slab deformation Analysis.

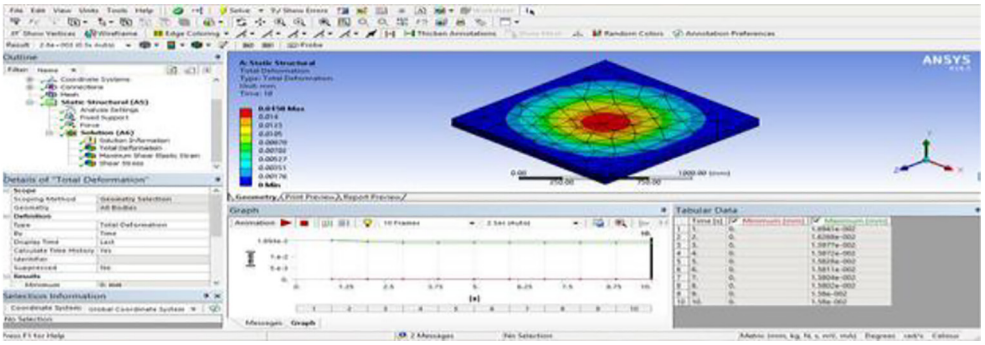

Fig. 4.4. Deck Slab deformation analysis.

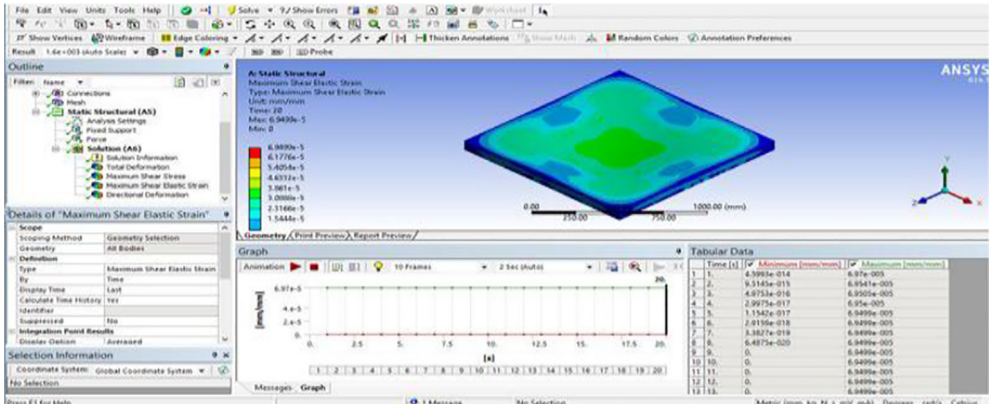

Fig. 4.5. Normal Slab Strain Analysis.

3.2. Flat slab

It is a two-way reinforced concrete flat slab that commonly do not have a beam and girder, and the loads are directly transferred to the supporting concrete in the structure.

In our project there will be a normal slab and two voided slabs and will be analyzed in AMSYS 15.0 the dimension of the specimen is the length = 1500 mm, width = 1500 mm and thickness = 230 mm. The void will be used in the project having dimension which is equal to L = 1500 mm, B = 1500 mm, H = 230 mm and ball diameter is 180 mm, and 200 mm (Fig. 4.2.).

4. Results and discussion

4.1. Numerical analysis

The study of the quantitative approximations which are to be the solution of the mathematical problems which includes the consideration of the land bounds to the error that involves. Elastic body which regains its original shape due to the internal restoring forces (see Fig. 4.3).

4.2. Deformation analysis

when a sufficient load is applied to the structural material or metal, where it will cause the material to change its shape. This change in the shape is known as deformation (see Fig. 4.4).

4.3. Strain analysis

It is define as the geological deformation that represents the relative displacement between the particles that present in a structure (see Fig. 4.5).

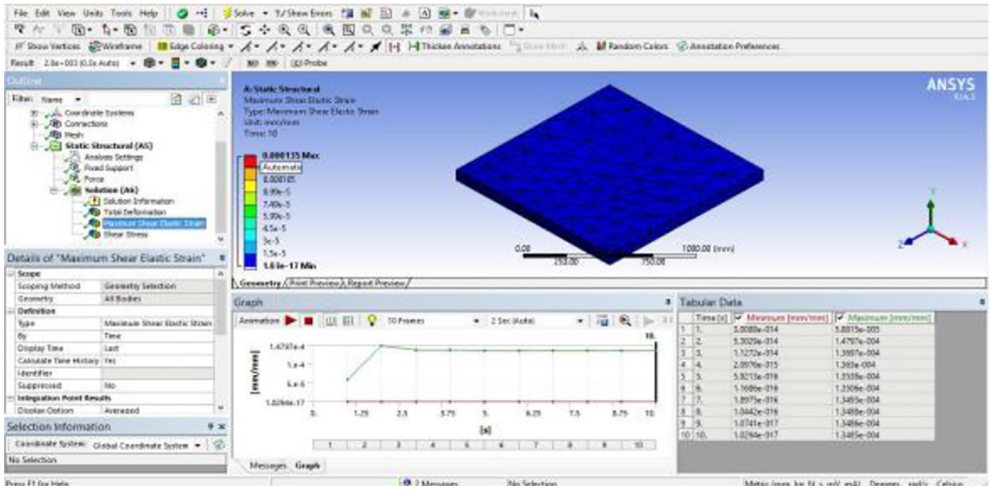

Fig. 4.6. Deck Slab Strain Analysis.

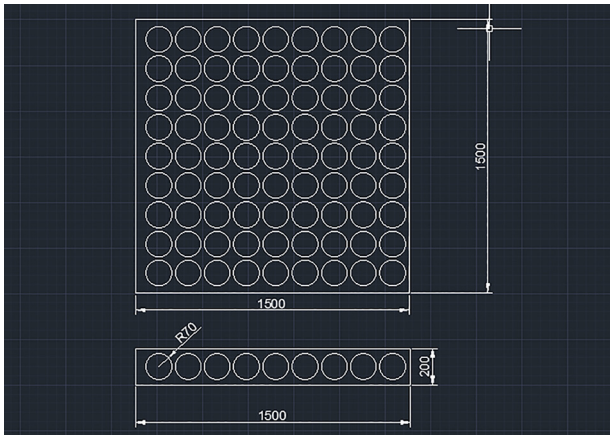

Fig. 4.7. Geometry model design in AUTOCAD.

4.4. Geometry design

It deals with the construction and the representation of the free-form curves, surfaces, volumes and they are closely related to the geometric modeling [4]. Core problems are curved and the surface modeling and the representation (see Fig. 4.6 and Fig. 4.7).

5. Conclusion

The use of plastic spheres(bubble deck slab) in reinforced concrete slabs can be improved and used in all structures. The deflections which are under the service load of voided specimens are little higher than those of an equivalent solid flat slab [6]. This concrete shows the strain of voided specimens are greater than that of an equivalent specimens. And it Saves the concrete volume i.e., used in the construction. Hence the bubble deck slabs can be used in future constructions.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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