IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Comparative Stress Analysis of Void Slab and Conventional Slab

Amulya G.Joshi[1*]
[1*]M.E Student, Department Of Civil Engineering[2*]
D.Y.Patil SOET,Lohegaon,Pune, Maharashtra, India

Vishwajeet A.Kadlag[2*]
[2*]Associate Professor ,Department Of Civil Engineering
D.Y.Patil SOET,Lohegaon,Pune, Maharashtra, India

Abstract: - The use of plastic is increasing day by day some action were taken to reduce its consumption. This creates more number of garbage everyday which is not good for environment. Therefore Re-use of plastic may of provide to some advantage to environment. Disposal of huge quantity of plastic may lead to land, water & air pollution etc. Plastic waste and its low recycling rate leads to positive contribution towards environment. So the step taken is to use the recycle plastic in concrete. This paper investigates the reuse of waste plastic in the construction sector so as to make the structure more lighter and to reduce dead load of the structure. In this study hollow shell is made by recycled plastic and is placed in the slab and it is compared with the conventional slab by following points i.e. stresses at the centre and end of slab, strains in slab & deformation of slab etc. This all analysis is done on Ansys Workbench software. At the last comparison of void slab is done with conventional slab.

Keyword: - Reuse of plastic, Use of plastic in construction sector, Environmental friendly, Void slab.

1 Introduction

India being a developing country, as there is increase in infrastructure day by day there is need for invent something new technology in the construction field. The main problem in this field is shortage of material and manpower. All main factor is money it matters a lot in the construction along with equipments, machinery etc. Therefore to satisfy with such results voided slab is the most effective technology in construction sector. Void slab Technology is based on generating specific hollows inside a reinforced concrete slab. This method which replaces the concrete by recycled balls with less amount of concrete is known as void slab Technology. Concrete plays significant role in construction field. The use of concrete is more in the construction. Now take an example of slab, it transfers its load on the beam and beam transfer towards column after that column transfers its load to footing so their is no much need of concrete in the slab it is used to achieve the required depth. Also concrete is weak in tension zone. So as to reduce the use of concrete from the tension zone of slab recycle pp bubble is is best suitable to replace the concrete from weak zone and making slab more lighter and efficient.

2 Data collection and analysis

This is the new bubble shape which to be used for designing the voided slab as per Indian slab conditions the shape is made up of recycled pp. As this shape of module have been chosen for the depth of slab upto 150mm thickness. There is difference between the other bubbles and new deigned bubble i.e they have made those bubbles of upto depth of 12” to 14” in size but in India we may go for maximum of 5” to 7” in size so that we have gone through this shape.

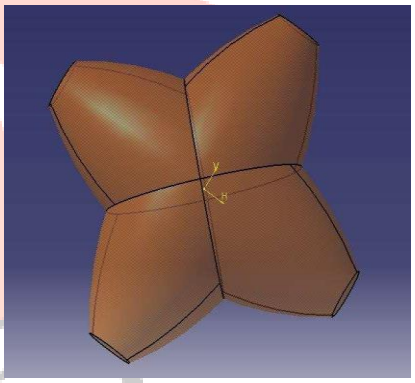

Fig. 1 New shape Bubble

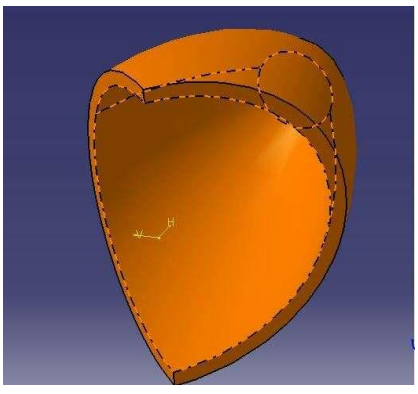

Fig. 2 Inside view of Bubble

First of all we have tried this bubble kept in a cage of steel and it is placed in the slab at 170mm c/c distance. After that various end conditions of slab such as all ends are fixed, Both opposite ends are fixed and One end is fixed is applied and analysis is being done in Ansys Workbench software.

2.1 Material Properties

Name of Material	Material Properties	Value
Steel	Modulus Of Elasticity (E)	500000 Mpa
	Density	7850 Kg/m^3
	Specific Gravity	7.7
	Poisson's Ratio	0.3
Concrete	Modulus Of Elasticity (E)	25000 Mpa
	Density	2460 Kg/m^3
	Specific Gravity	9.81
	Poisson's Ratio	0.18
Recycled PP & HDPE	Modulus Of Elasticity (E)	1035 Mpa
	Density	970 Kg/m^3
	Specific Gravity	0.91
	Poisson's Ratio	0.4

3 Analysis and Results

3.1 Slab no. 1 : All ends are Fixed

- Size of Slab : 1.5m x 1.5m
- Spacing of bars in ‘x’ direction : 170mm c/c
- Spacing of bars in ‘Y’ direction : 170mm c/c
- Volume of concrete in Slab : (1.5x1.5x0.15) = 0.3375m^3
- Volume of 1 Bubble module : 0.00341m^3
- Number of Bubbles used in the slab : 64
- Total volume of bubbles in slab : 0.21 m^3
- Grade of Concrete : M25 (1:1.75:3.5), Fe 500

I. Results of Conventional slab on Software:

a) Total Deformation –

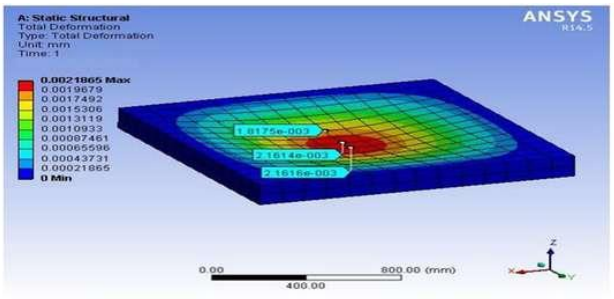

Fig. 3 Deformation of conventional slab 1

b) Total Strain –

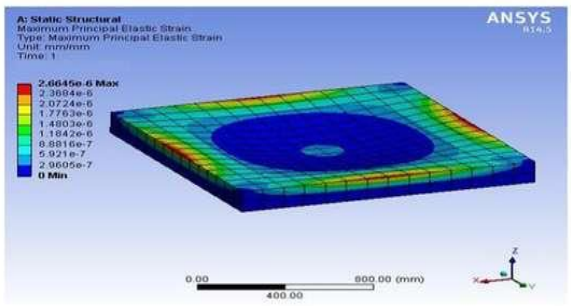

Fig. 4 Strain of conventional slab 1

c) Total Stresses –

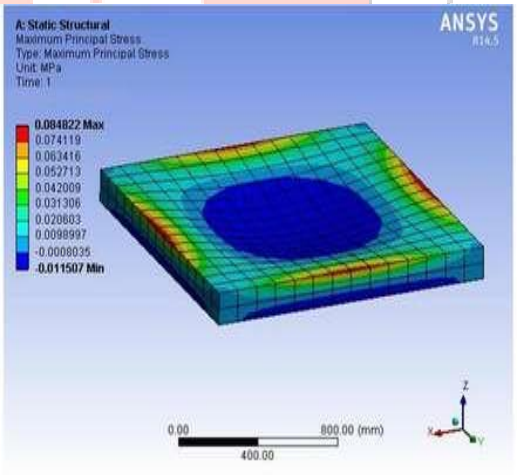

Fig. 5 Stresses of conventional slab 1

II. Results of Voided slab on Software:

a) Total Deformation –

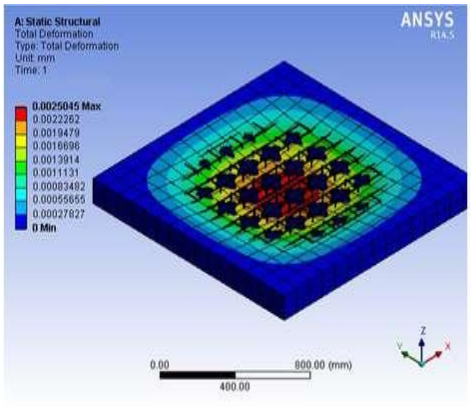

Fig. 6 Deformation of void slab 1

b) Total Strain –

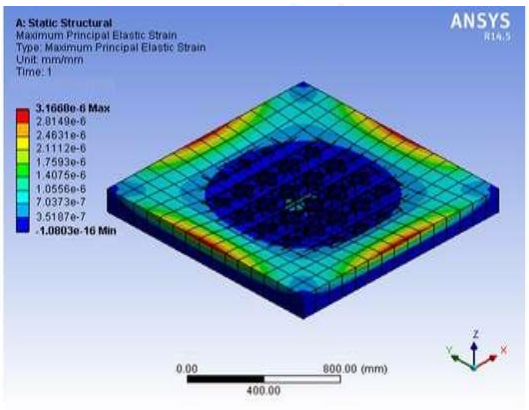

Fig. 7 Strain of void slab 1

c) Total stresses –

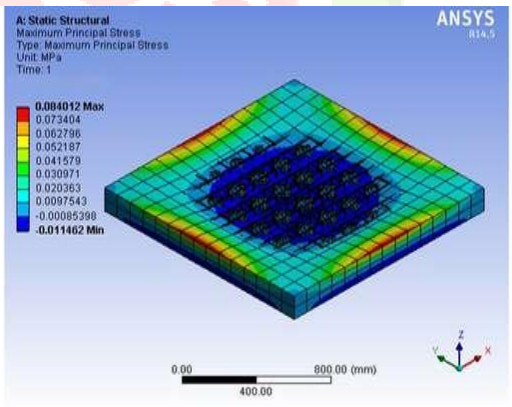

Fig. 8 Stress of void slab 1

A. Comparison of Conventional Slab with Voided Slab:

Sr.no	Description	Conventional Slab	Voided Slab
1	Deformation	0.002186 mm	0.0025 mm
2	Stresses	0.08482 N/mm^2	0.0840 N/mm^2
3	Strain	2.664	3.1668

B. Comparison of Conventional Slab with Voided Slab in the form of Graph:

a) Deformation –

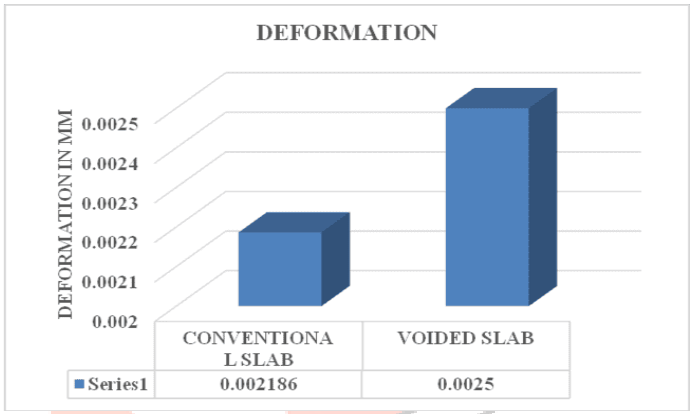

Fig. 9 Comparision of Deformation of slab 1

b) Strain –

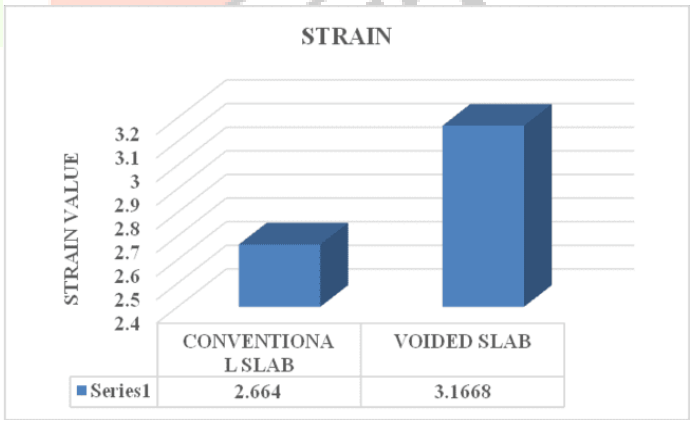

Fig. 10 Comparision Strain of slab 1

c) **Stresses –**

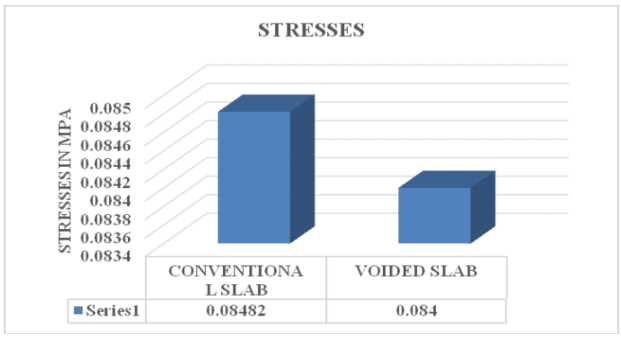

Fig. 11 Comparision Stresses of slab 1

3.2 Slab no. 2 : Both opposite ends are Fixed

- Size of Slab : 1.5m x 1.5m
- Spacing of bars in 'x' direction : 200mm c/c
- Spacing of bars in 'Y' direction : 200mm c/c
- Volume of concrete in Slab : (1.5x1.5x0.15) = 0.3375m^3
- Volume of 1 Bubble module : 0.000341m^3
- Number of Bubbles used in the slab : 64
- Total volume of bubbles in slab : 0.21 m^3
- Grade of Concrete : M25 (1:1.75:3.5), Fe 500

I. **Results of Conventional slab on Software:**

a. **Total Deformation –**

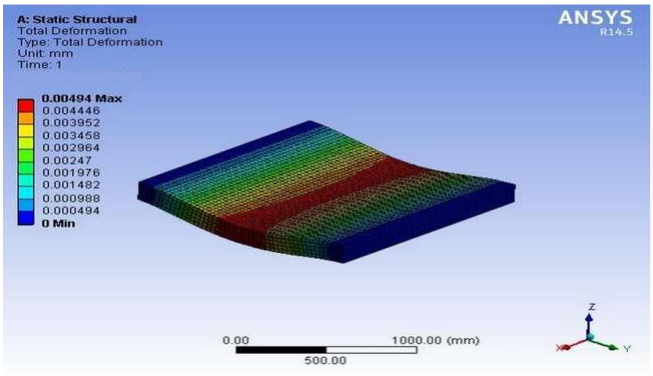

Fig. 12 Deformation of conventional slab 2

b. **Total Strain –**

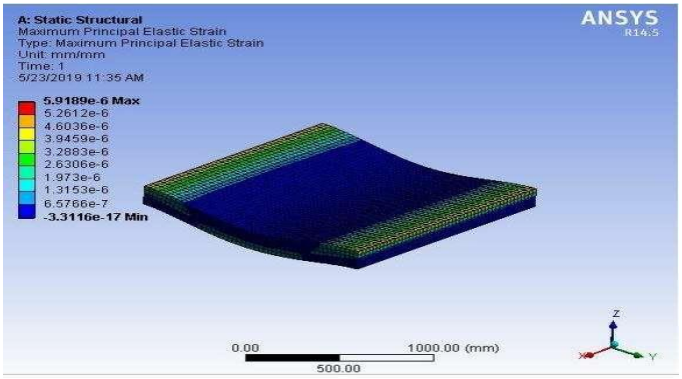

Fig. 13 Strain of conventional slab 2

c. **Total Stresses –**

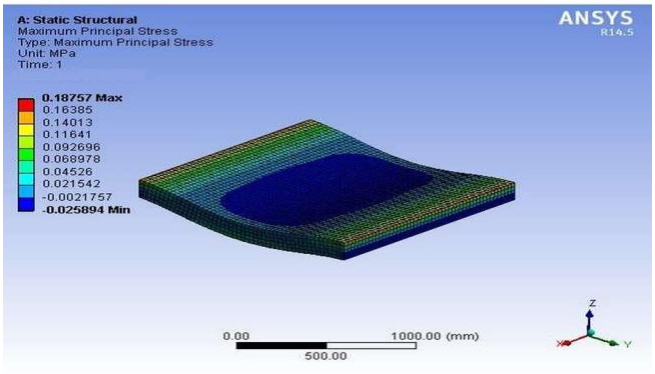

Fig. 14 Stresses of conventional slab 2

II. **Results of Voided slab on Software:**

a. **Total Deformation –**

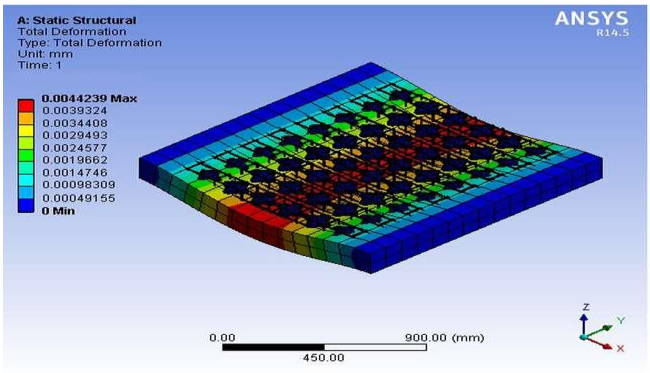

Fig. 15 Deformation of void slab 2

b. **Total Strain –**

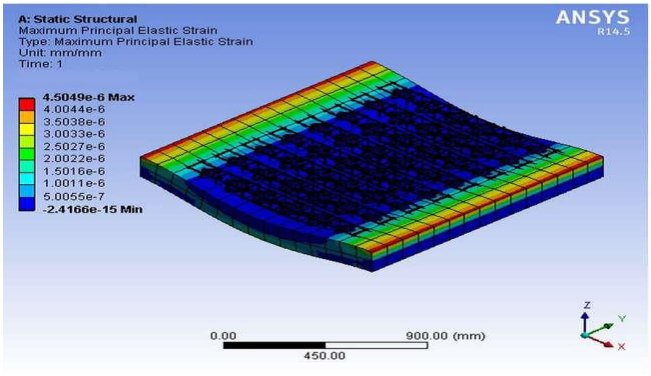

Fig. 16 Strain of void slab 2

c. **Total Stresses –**

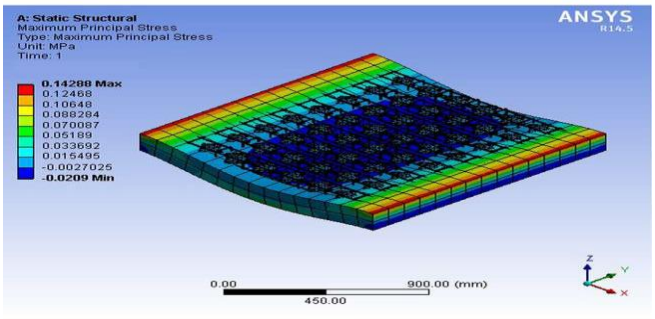

Fig. 17 Stresses of void slab 2

A. **Comparison of Conventional Slab with Voided Slab:**

Sr.no	Description	Conventional Slab	Voided Slab
1	Deformation	0.0049 mm	0.0044 mm
2	Stresses	0.1875 N/mm2	0.142 N/mm2
3	Strain	5.91	4.5

B. **Comparison of Conventional Slab with Voided Slab in the form of Graph:**

a. **Deformation:**

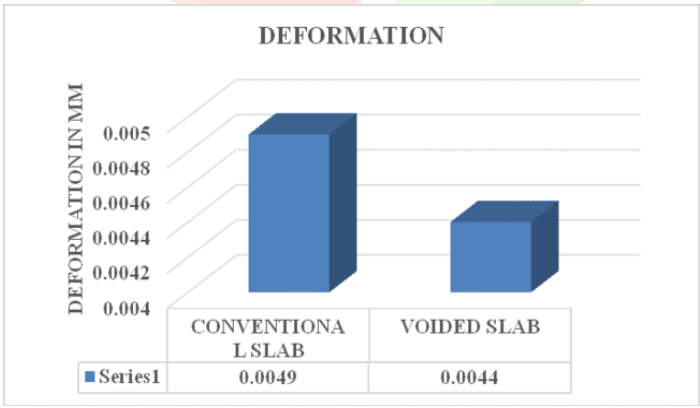

Fig. 18 Comparision of Deformation of slab 2

b. **Strain:**

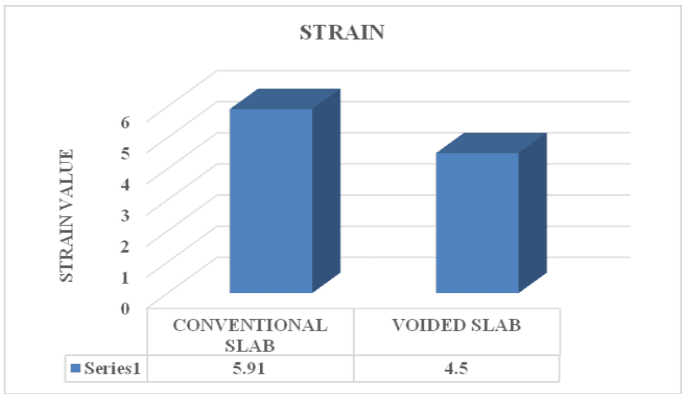

Fig. 19 Comparision of Strain of slab 2

c. **Stresses:**

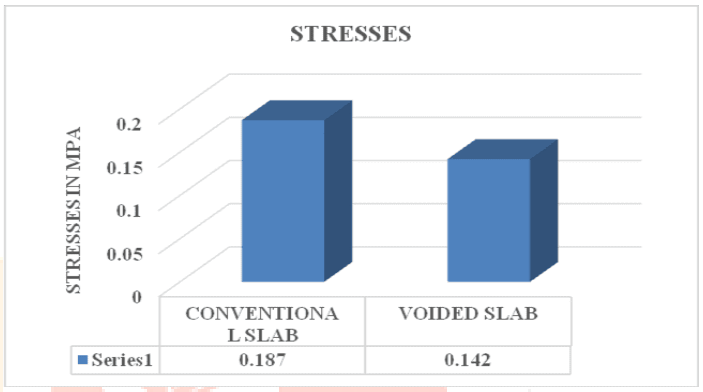

Fig. 20 Comparision of Stresses of slab 2

3.3 One end is Fixed

- Size of Slab : 1.5m x 1.5m
- Spacing of bars in 'x' direction : 225mm c/c
- Spacing of bars in 'Y' direction : 225mm c/c
- Volume of concrete in Slab : (1.5x1.5x0.15) = 0.3375m^3
- Volume of 1 Bubble module : 0.000341m^3
- Number of Bubbles used in the slab : 64
- Total volume of bubbles in slab : 0.21 m^3
- Grade of Concrete : M25 (1:1.75:3.5), Fe 50**0**

I. Results of Conventional slab on Software:

a. Total Deformation:

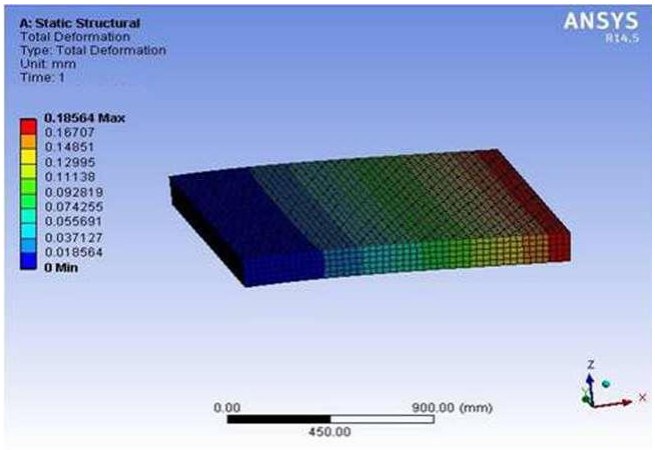

Fig. 13 Deformation of conventional slab 3

b. Total Strain:

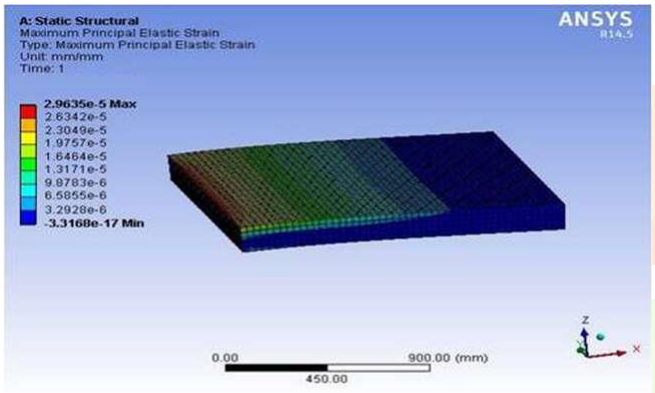

Fig. 14 Strain of conventional slab 3

c. Total Stresses:

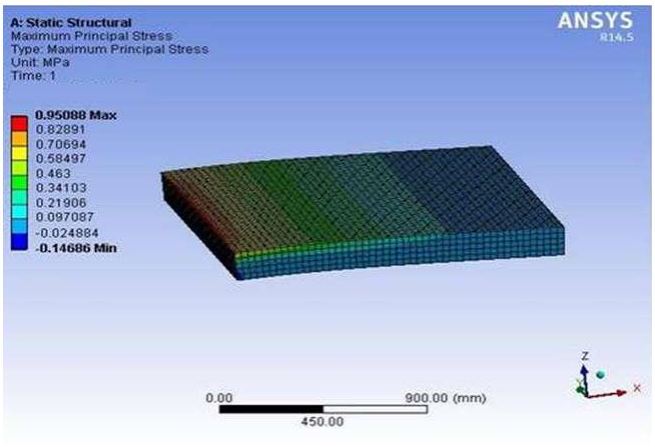

Fig. 16 Stresses of conventional slab 3

II. Results of Voided slab on Software:

a. Total Deformation –

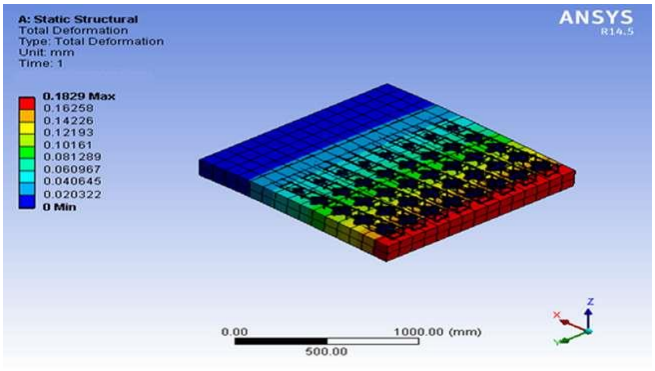

Fig. 16 Deformation of void slab 3

b. Total Strain –

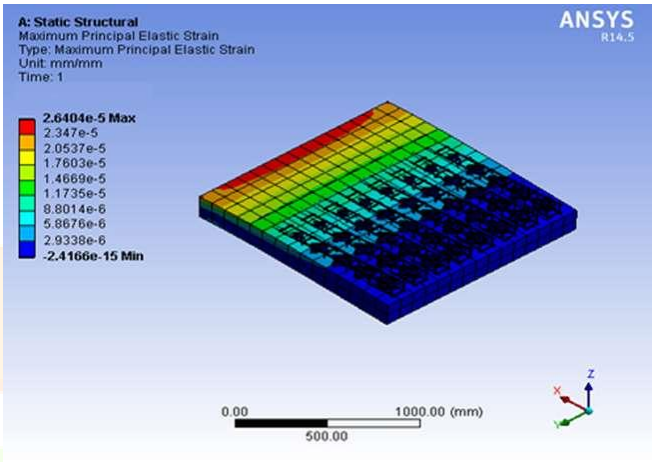

Fig. 17 Strain of void slab 3

c. Total Stresses –

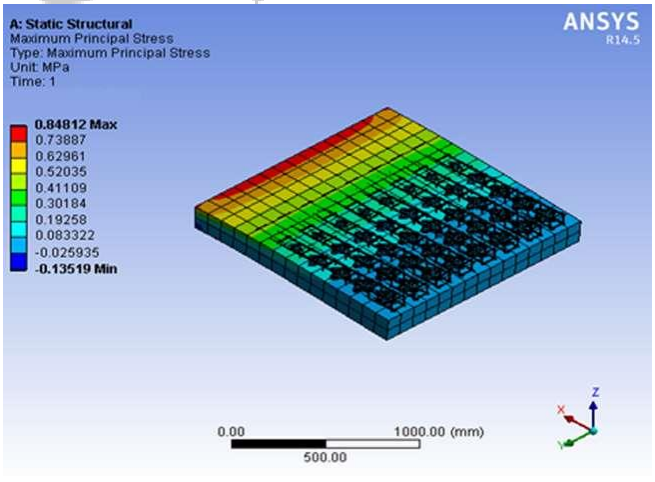

Fig. 18 Stresses of void slab 3

A. **Comparison of Conventional Slab with Voided Slab:**

Sr.no	Description	Conventional Slab	Voided Slab
1	Deformation	0.185 mm	0.182 mm
2	Stresses	0.95 N/mm2	0.84 N/mm2
3	Strain	2.96	2.6

B. Comparison of Conventional Slab with Voided Slab in the form of Graph:Deformation:

a. **Deformation:**

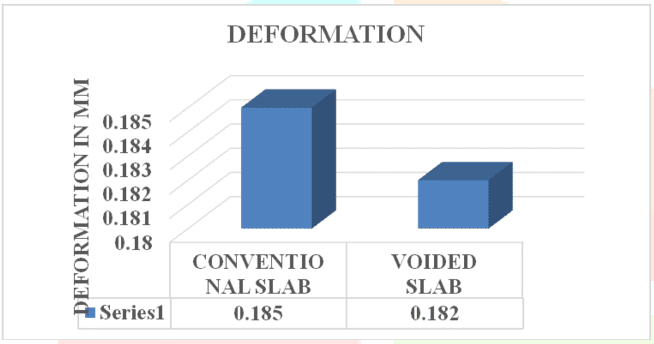

Fig. 19 Comparision of Deformation of slab 3

b. **Strain:**

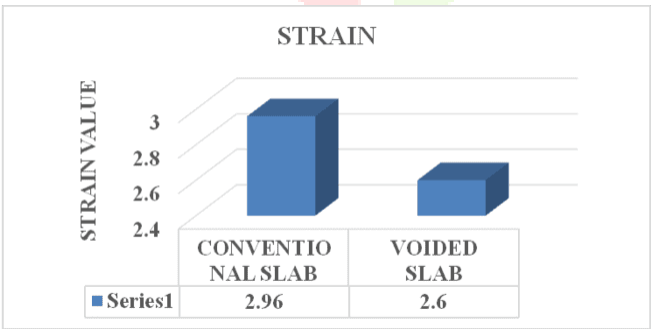

Fig. 20 Comparision of Strain of slab 3

c. Stresses:

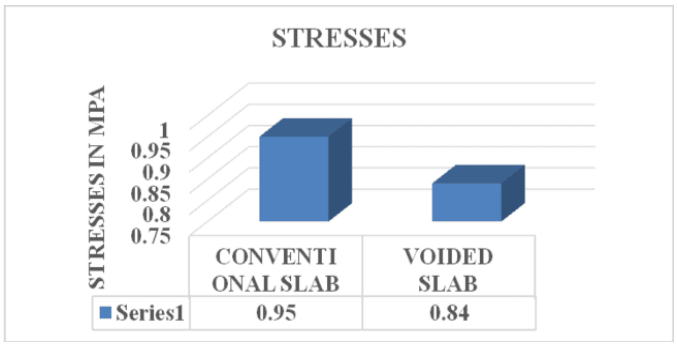

Fig. 21 Comparision of Stresses of slab 3

4 Bubble Analysis :

Here the analysis of single bubble at a load of 6kn and found out deformation, stresses and strain.

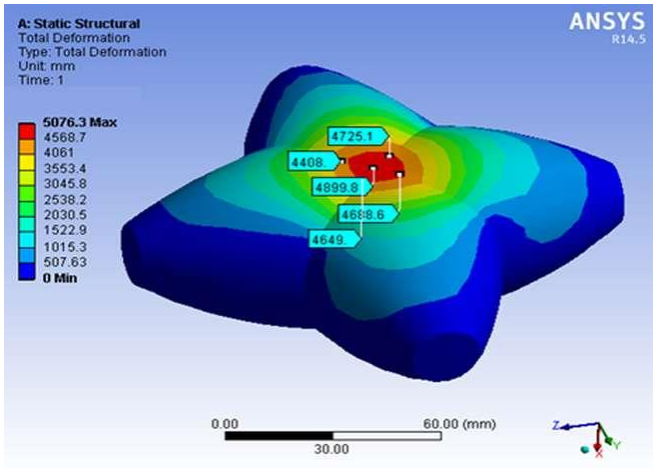

Fig. 22 Deformation of Bubble

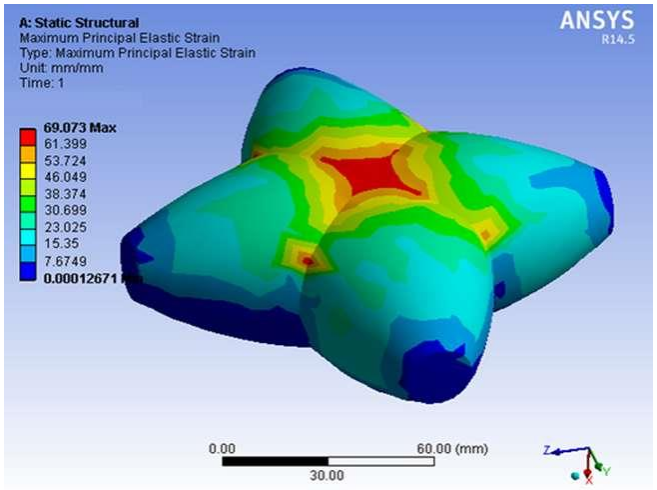

Fig.23 Strain of Bubble

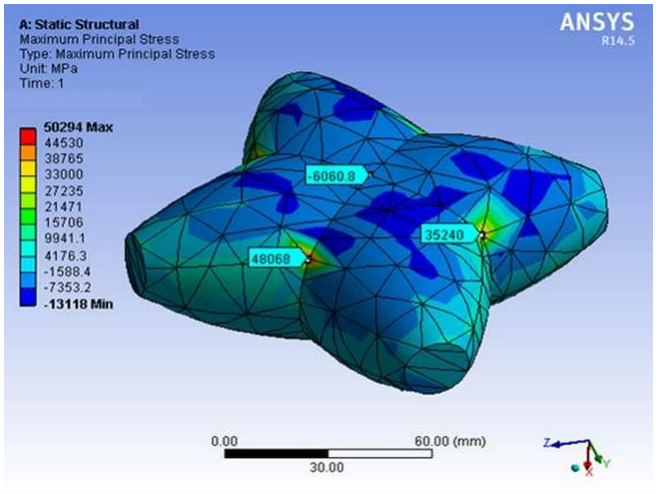

Fig.24 Stress of Bubble

4. Conclusions & Future Scope

It is the big step initiated by using waste plastic in the construction sector. By using this technology there is reduction in the dead load of slab. Increase in rigidity. Re-use of plastic waste in construction sector. Eco-friendly material.

Future scope

- Used for constructing all types of buildings.
- Best for large span halls like Theatre, Auditoriums etc.
- Use in parking areas as less number of columns required.

5. Acknowledgment

I would like to express my sincere gratitude to Prof. Vishwajeet A.Kadlag for his excellent guidance and continuous encouragement during course of my work. I truly appreciate for his vast knowledge and delight supervision and advice. My special thanks to Prof. Dr. Nagesh Shelke Head of Civil Engineering Department, for his constant inspiration and all the facilities provided to successfully complete this work. I would also like to thank the Institute who has provided me this opportunity to present this paper. I would also like to thank to all the faculty members of the department for their valuable guidance and support during the course of my work. Also I would like to thank all my friends who have directly or indirectly helped me in my project work throughout the course. Finally, I would like to thank my parents, from whom I learnt the value of hard work and its fruitful results

6. References

Bunker, J., Parajuli, and Ashis. (2006). "Examining lateral positions of cars and heavy vehicles on a two lane, two way motorway." *Transport Engineering in Australia*, 10(2), 129–139.

Highway {C}apacity {M}anual. (2012). .

Kaur, S. (2015). "Use of Vissim in Heterogeneous Traffic Modelling-A Review Lecturer in Civil Engineering , Government Polytechnic , Ah- medabad." (May), 453–454.

Lennie, S., and Bunker, J. (2004). "Using lateral position information as a measure of driver behaviour around MCVs." 1–19.

Mahapatra, G., and Maurya, A. K. (2013a). "Study of Vehicles Lateral Movement in Non-lane Discipline Traffic Stream on a Straight Road." *Procedia - Social and Behavioral Sciences*, Elsevier B.V., 104, 352–359.

Mahapatra, G., and Maurya, A. K. (2013b). "Study of Vehicles Lateral Movement in Non-lane Discipline Traffic Stream on a Straight Road." *Procedia - Social and Behavioral Sciences*, Elsevier B.V., 104(December), 352–359.

Manjunatha, P., Vortisch, P., and Mathew, T. (2013). "Methodology for the Calibration of VISSIM in Mixed Traffic." *Transportation Research Board 92nd Annual Meeting*, 11.

Pal, D., and Mallikarjuna, C. (2016). "Analysis of the effect of variable lateral gap maintaining behavior of vehicles on traffic flow modeling." *Procedia Engineering*, Elsevier B.V., 142, 197–203.