iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** VI **Month of publication:** June 2022

DOI: https://doi.org/10.22214/ijraset.2022.43726

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VI June 2022- Available at www.ijraset.com

Analysis and Comparative Study of Conventional Slab with Voided Slab

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Abstract— As the infrastructure is developing there is need for some changes in the construction field, as one cannot rely on the same method for a long time as it can have different consequences. The main consequence is the shortage of material and manpower. Also, money matters a lot in construction department along with it the machines, equipment and technology in some region is not at a level, which we want. Hence in order to satisfy these results Bubble deck slab is one of the most effective slab techniques to replace conventional slab in terms of money and materials.
In this study a hollow shell is made by recycled plastic and is kept in the slab and comparison is to be done between voided slab and conventional slab regarding further points such as stresses at the centre and end of the slab, steel and concrete quantity is to be calculated and cost analysis is also done of both slabs by software such as Ansys or ETABS and cost analysis is done is done by hand. After that comparison of both void slab and conventional slab is shown.
Keywords— Reuse of plastic, Use of plastic in construction sector, Environmental friendly, Void slab

I. INTRODUCTION

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. This technology is used where the bending moment is minimum. This technology is mainly used in tension zone as concrete is weak in tension. Concrete plays a major role in the construction field. The usage of concrete is high in slab construction. It leads to loss of concrete because the load transfers from the structure only on the column portion not throughout the slabs. So reduce the concrete from the tension zone and minimum bending moment is available. High density polyethylene hollow plastic replace the in effective concrete from the slab, thus decreasing the dead weight and increasing the efficiency of the floor.
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II. DATA COLLECTION AND ANALYSIS

A concrete slab is a common structural element of modern buildings. Horizontal slabs of steel reinforced concrete, typically between 4 and 20 inches (100 and 500 millimeters) thick, are most often used to construct floors and ceilings, while thinner slabs are also used for exterior paving. Sometimes these thinner slabs, ranging from 2 inches (51 mm) to 6 inches (150 mm) thick, are called mud slabs, particularly when used under the main floor slabs or in crawl spaces. In many domestic and industrial buildings a thick concrete slab, supported on foundations or directly on the subsoil, is used to construct the ground floor of a building. These can either be "ground-bearing" or "suspended" slabs. Void forms in the middle of a conventional slab by means of plastic spheres eliminate 30% – 50% of a slab self-weight removing constraints of high 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. The void slab system can be used for storey floors, roof floors and ground floor slabs. Since the weight of the structure reduced, this type of structure can be useful to reduce earthquake damage. The void slab system is composed of three main materials they are Concrete, Steel and Recycled Plastic.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 for 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.

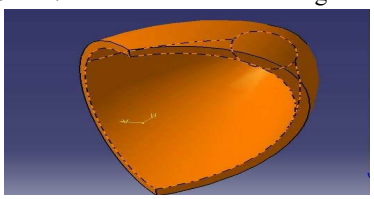


Fig.A

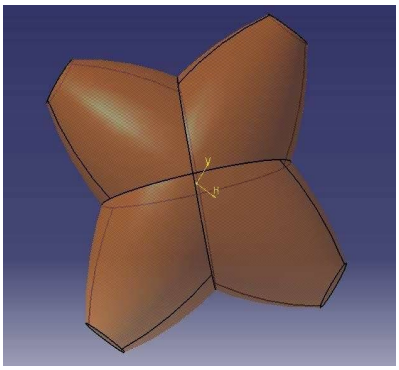


Fig.B

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.

III. 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

IV. RESULTS

Slab no. 1: All ends are Fixed

A. Results of Conventional slab on Software

1) Total Deformation :

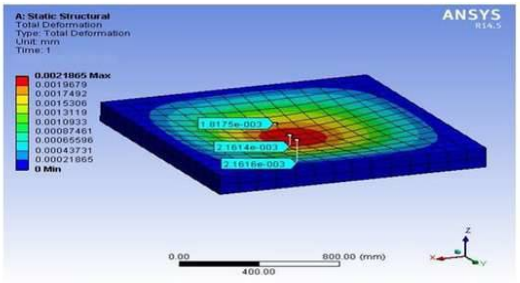


Fig.C

2) Total Strain :

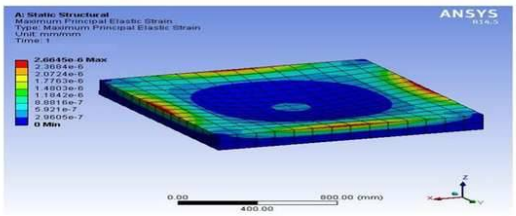


Fig.D

3) Total Stresses:

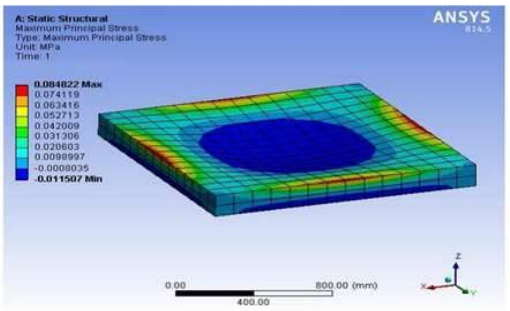


Fig.E

B. Results of Voided slab on Software

1) Total Deformation:

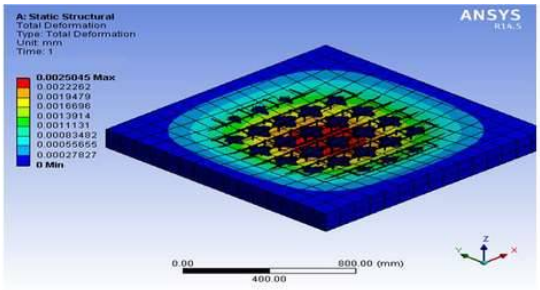


Fig.F

2) Total Strain:

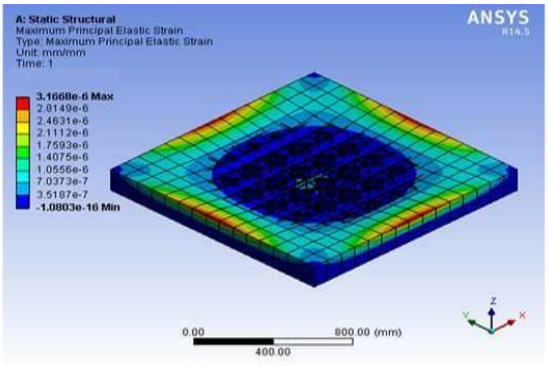


Fig.G

3) Total Stresses:

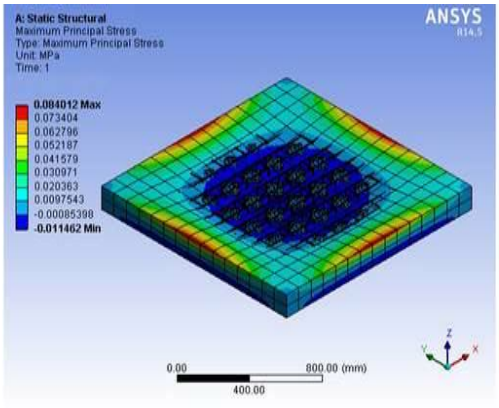
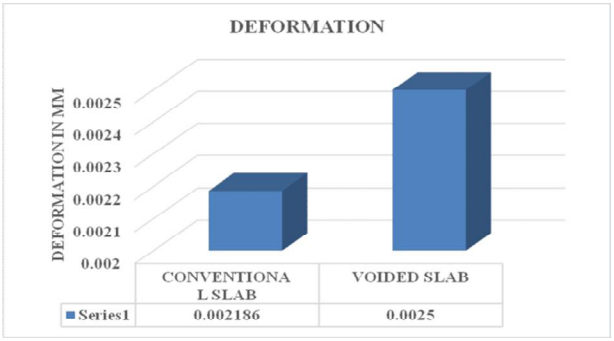


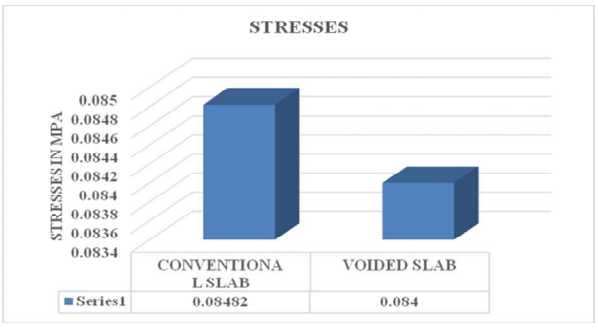
Fig.H

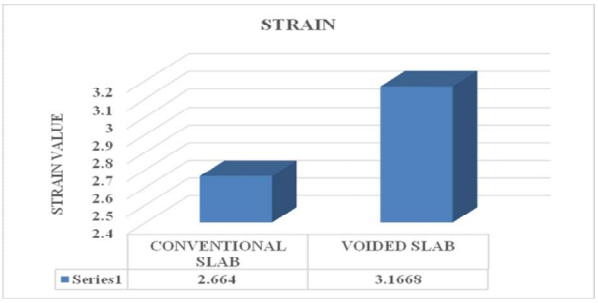
C. Comparison of Conventional Slab with Voided Slab

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

D. Graphs







Slab no. 2 : Both opposite ends are Fixed

E. Results of Conventional slab on Software

1) Total Deformation :

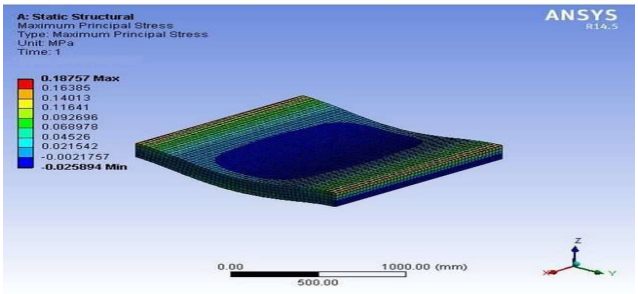


Fig.I

2) Total Strain:

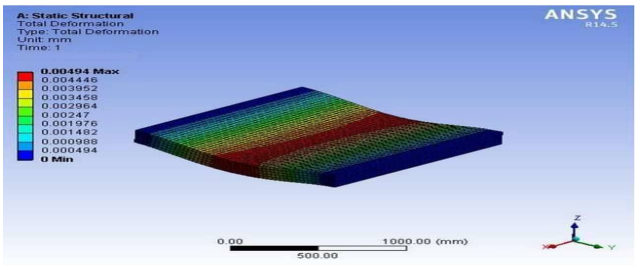


Fig.J

3) Total Stresses:

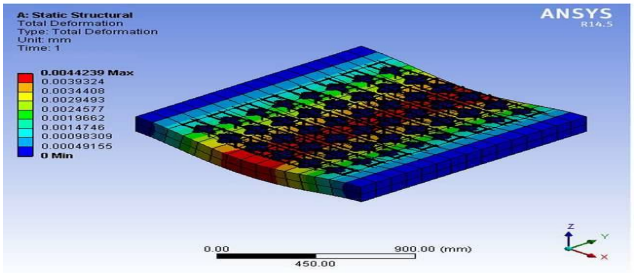


Fig.K

F. Results of Voided slab on Software

1) Total Deformation :

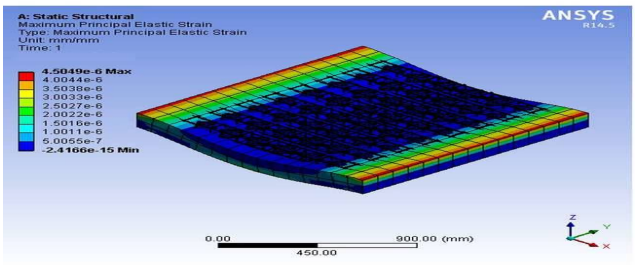


Fig.L

2) Total Strain:

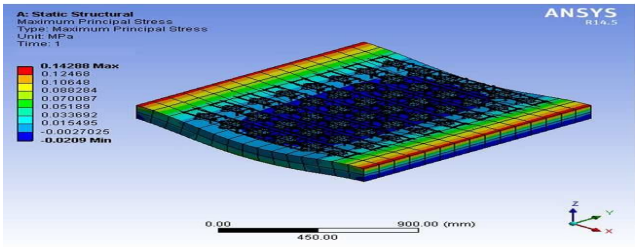


Fig.M

3) Total Stresses:

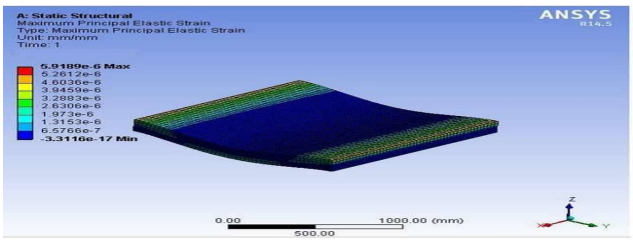
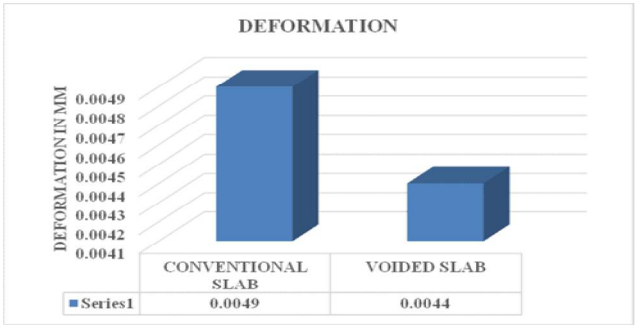


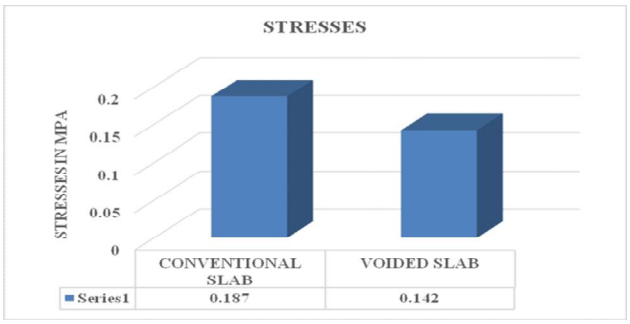
Fig.N

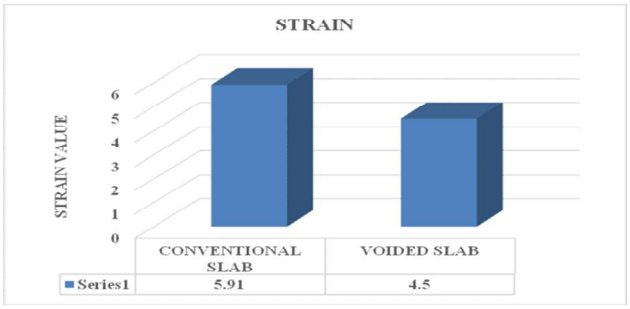
G. Comparison of Conventional Slab with Voided Slab:

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

H. Graphs







V. ADVANTAGES

A. Efficient and Light weight.
B. Significant material savings
C. Up to 25% lighter than solid slabs.
D. Lower priced than conventional slabs.
E. Simple installation without extra work.
F. Compatible with any building type.
G. Reduced damage potential.
H. Made from 100% recycled plastic material.
I. Outstanding lifecycle assessment.

VI. CONCLUSION

A. By using this technology there is reduction in the dead load of slab.
B. Increase in rigidity.
C. Re-use of plastic waste in construction sector.
D. Eco-friendly material.

VII. FUTURE SCOPE

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

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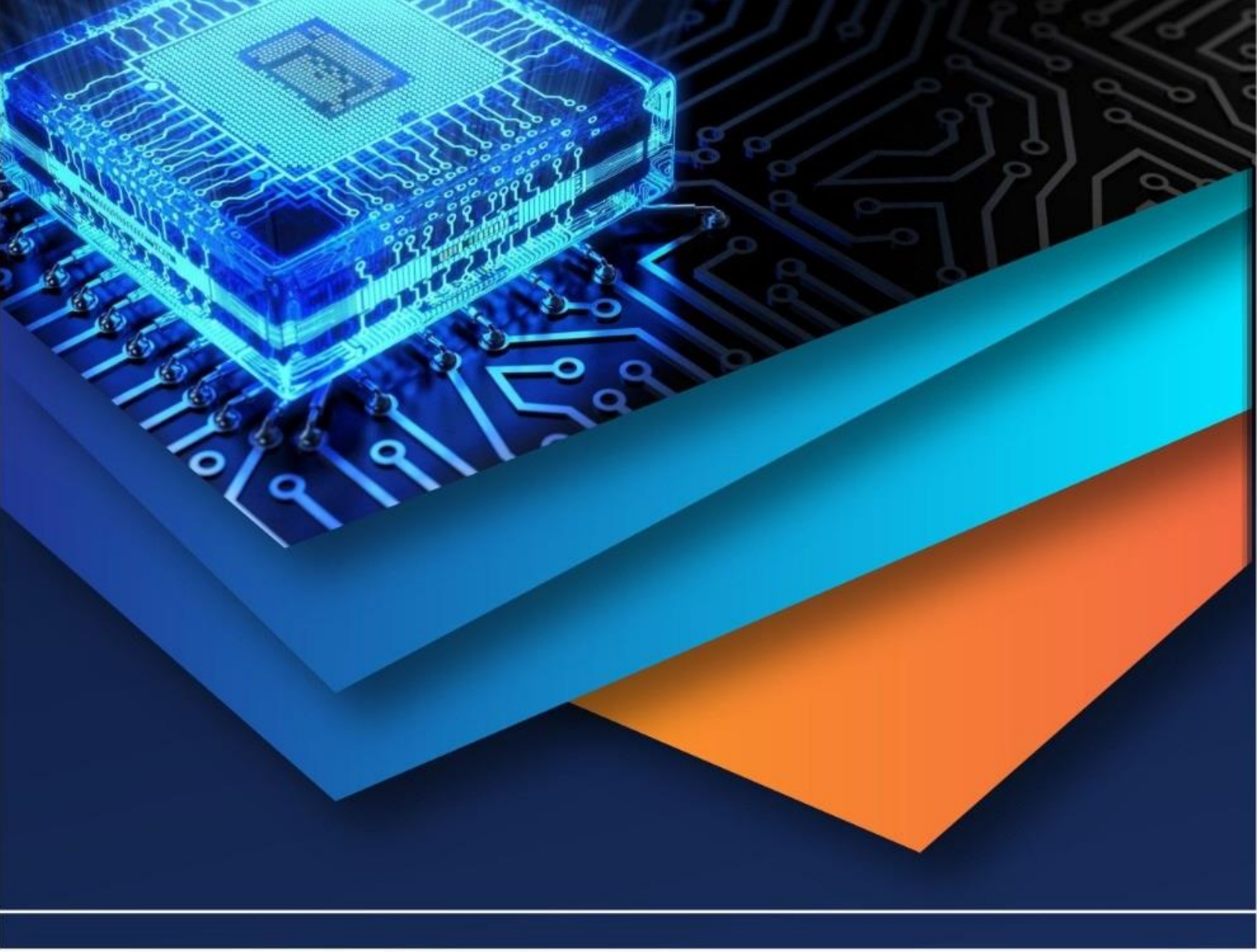

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