International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 05 | May 2019 www.irjet.net p-ISSN: 2395-0072

Analysis Of Beam, Column, Slab Using Steel Fiber Reinforced Ultra-Light Weight Cement Composite With Different Densities

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Abstract - *This paper examines the analysis of column, beam and slab with different densities using Ultra-Light Weight Cement Composites (ULCC).First four like beam, column, one way slab, and two way slab then each of the section is taken and the analysis is carried out. In this analysis mainly taken densities are 1250, 1350, 1450, 1550 and the conventional concrete density of 2400 kg/m3 has to been proposed. On the basis of each densities one by one models are developed on beam, column, slab to been carried out. So that there must be a model of about 16 without conventional and with adding this conventional of 4 models there are total 20 models. Twenty models are analysed in finite element analysis software ANSYS Workbench 16.1. This project mainly carried out the deformation and loading condition of varying densities are adopted and which ever has the maximum load and the deflection carrying capacity is carried out that and maximum strength attain member also can be catchable by the analysis of these three members, also the detailed analysis is carried out in this.*

Key Words: Ultra-light weight of varying densities, Beam, Column, One way slab, two way slab, Ansys 16.1, Finite element model

1. INTRODUCTION

Ultra-Light weight cement composite of varying densities such as mainly carried out by 1250, 1350, 1450, 1550, and conventional has to been done on column, beam, one way slab and two way slab. In the previous study it is all based on mainly of about the test of compression and tension directly. In this analysis is mainly carried out by Ansys 6.1. Mainly this is implemented due to economic cost. The cost must be minimized in the project mainly by adopting this light weight cement concrete with varying densities. In every big project in construction that must be not cost effective, the cost of the overall project budget should be greater this can be minimized by mainly adopted by this lightweight with varying densities effective member should be considered.

By due to the earthquake and the seismic damages on the building construction can be minimized by adopting this method such as light weight with varying densities. By this light weight and vibration can be minimize the seismic damage. In this mainly these are adopted in column, beam, and slab. In each of these members different densities are adopted maximum and the minimum load carrying capacity can be carried out and the same way the maximum and the minimum deformation also done in this method. In which member can be carried more ductile all the characters can be easily attach by this.

As the analysis is carried out and get a result of maximum load carrying capacity goes to one way slab of ultra-light weight density of 1550 has 45.44% and also column has also the maximum load carrying capacity is same of about 45.27% for ULCC of 1550, without the consideration of conventional. By considering the conventional the load carrying capacity is increased in one way slab of ULCC 1550 of 30.97%, in two way slab of ULCC 1550 of 20.83%, in column case it is compared to conventional the ULCC 1550 has 13.12%, in the case of beam in ULCC 1550 of 13.56%.

1.1 Objectives

The project focused on the basis of maximum load carrying capacity member analysis is done in column, beam, and slab. By these analysis is done one way slab and column has the maximum load carrying capacity by the detailed analysis is done in Ansys. The maximum load carrying capacity, strength and deformation characteristics are known by this analysis.

2. MODELLING AND ANALYSIS

The general layout and dimensions of elements are given below fig.3.1 and fig.3.2. The dimensions are carried out from the base journals of Slab K.S. Chia, M.H. Zhang, J.Y.R. [1], Beam N.Z. Hassan, A.G. Sherif, A.H. Zamarawy [8], column [12].In this the varying densities of 1250,1350,1450,1550 and the conventional type densities are adopted the other parameters are same to the ordinary composition. The finite element model of section size are taken from the above journals of slab, beam and column. The finite element model is created in ANSYS using different element Types, Real Constants and Material Models and is assigned to respective elements of the model. The loads and boundary conditions are then applied. Next, the material properties are defined. The materials properties such as varying densities is the important factor and poisson ratio young's modulus are also given the constant value appropriately, their engineering data are assigned. Table 1 shows the material property of connection elements.

Table -1: Material property of connection elements

Material	Modulus of elasticity (GPa)	Poisson's ratio	Yielding stress (MPa)	Ultimate stress (MPa)
Structural Steel	200	0.3	250	550

2.1 Boundary Condition, Different Members and Loading

The beam, column, one way slab and the two way slab analysis are carried out and the boundary conditions such as the varying densities of 1250,1350,1450,1550 kg/m3 are applied with different loading conditions. In the software as well, they are connected to each member and the conventional type too the modelling of each section is done based on this. Mainly based on each densities each model is developed and the analysis is carried out.

2.2 Selected Parameters

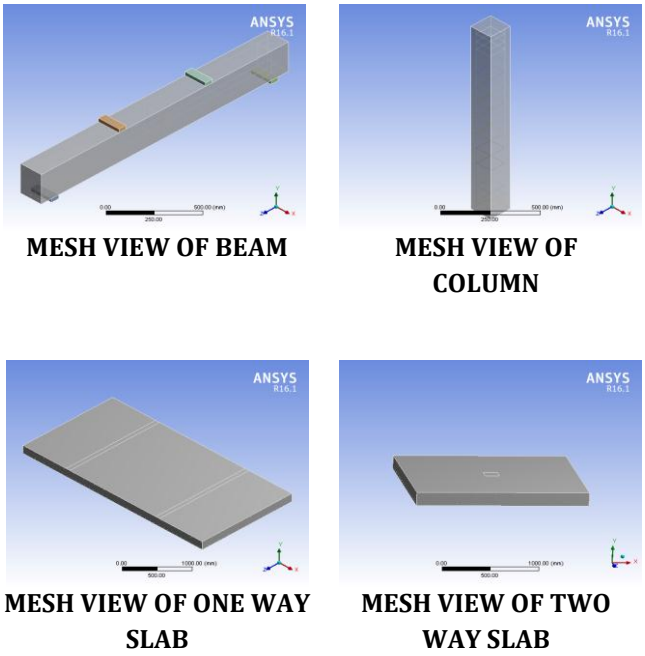
In the column, beam, one way slab and the two way slab analysis is carried The first parametric study was done based on each element such as consideration of a beam first as the base model and the varying densities are adopted as the second parameter.

The secondly the consideration of a second member as that column is considered as the base model and the each has a varying density of 1250,1350,1450,1550on this density bases each model is developed secondly.

Third member such as one way slab are provided as the base model and with varying of different densities are also implemented in this. The varying densities are adopted.

The fourth member is that the two way slab is considered as the base model and the varying densities are adopted and the varying densities of each models are implemented on this with of each density.

Finally the comparison of the load carrying capacity of the member with each of the varying densities also adopted in this the maximum percentage of the load carrying can be easily analyzed by this were selected for the performance evaluation like strength behavior, ductility behavior and stress distribution of different column models. The analysis was done in ANSYS software.



MESH VIEW OF BEAM | **MESH VIEW OF COLUMN**

MESH VIEW OF ONE WAY SLAB | **MESH VIEW OF TWO WAY SLAB**

Fig -1: Mesh view of members

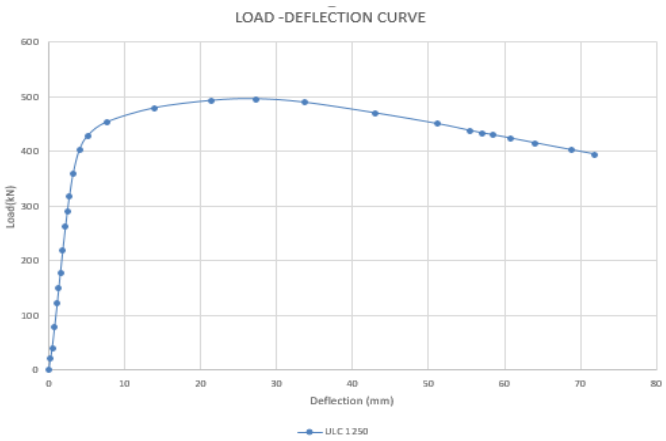


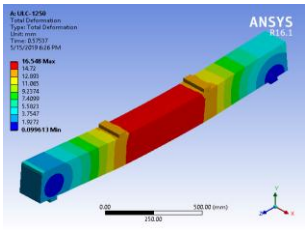
Chart -1: Load deflection curve

In the finite element software, loading was applied statically which a displacement control loading in the different varying densities in the different members. Fig 1 shows the beam, column, slab members shows the curve of the load at the bolted flanged column. Then analyse the model in ANSYS Workbench 16.1.

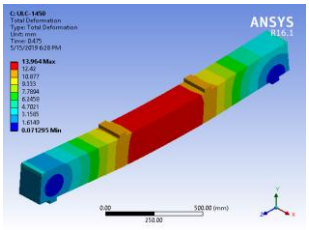
3. RESULTS AND DISCUSSION

3.1 Varying Densities of Member Such As Beams

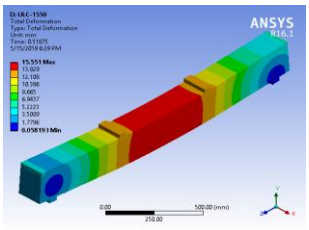
In this study, the beam analysis is carried out and with varying densities and conventional beam is also conceded so that there is about five models. In each model other factors are same. The models are different just in the varying of density.



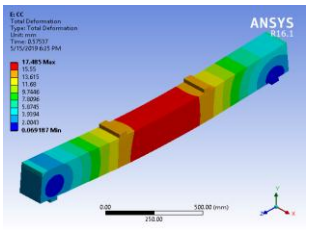
ULCC 1250



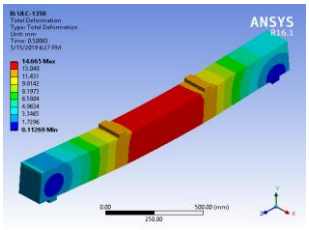
ULCC 1450



ULCC 1550



ULCC CC



ULCC 1350

Fig -2: Analysis Of Beam

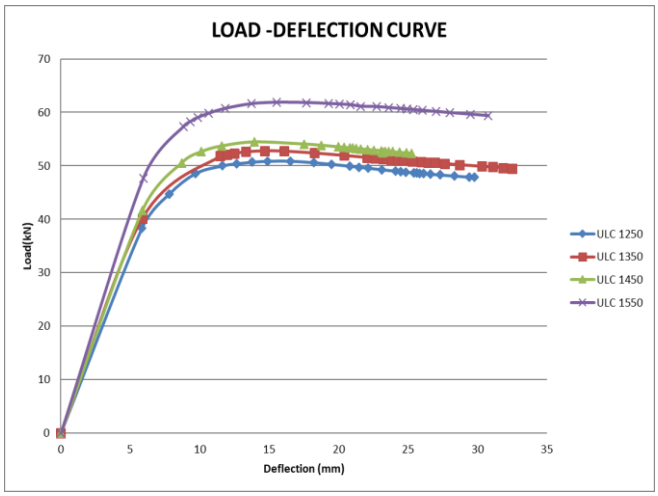
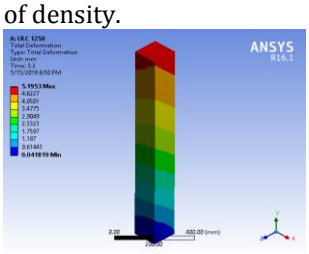


Chart -2: Load deflection curve

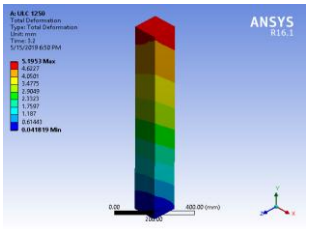
Chart. 2 and figure 2 shows the load-deflection graph of the each member of varying density has to been considered such as 1250,1350,1450,1550 kg/m3 are taken. In each of the member each loading conditions are too been applied and the load deflection curves are changes based on these varying density deflection and the load changes accordingly. In 1250 has 1%, 1350 has 3.80%, 1450 has 7.05% and 1550 has 21.57%is done in beam.

3.2 Varying Densities of Member Such As Column

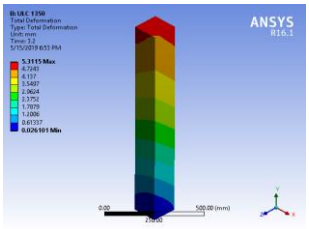
In this study, the column analysis is carried out and with varying densities and conventional column is also conceded so that there is about five models. In each model other factors are same. The models are different just in the varying of density.



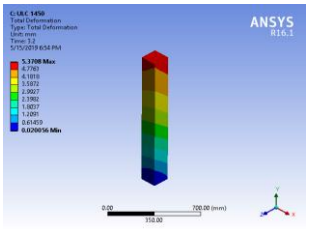
ULCC CC



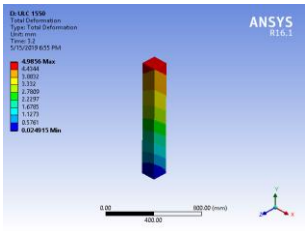
ULCC 1250



ULCC 1350



ULCC 1450



ULCC 1550

Fig -3: Analysis Of Column

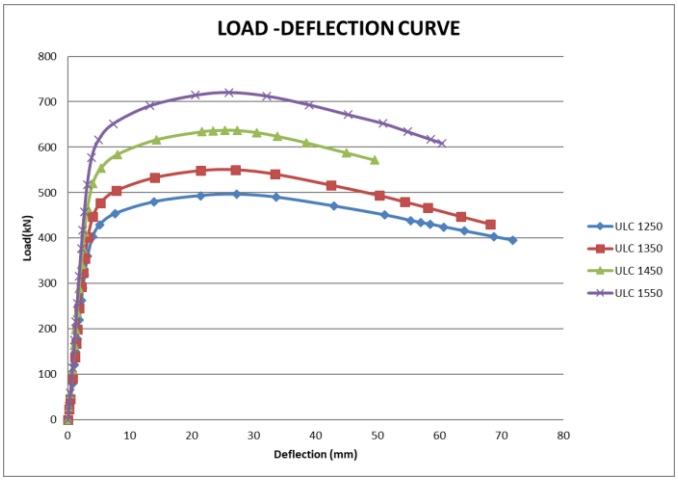
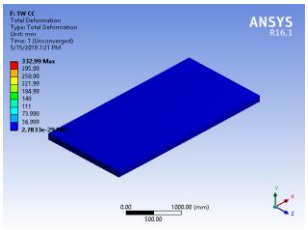


Chart -3: Load deflection curve

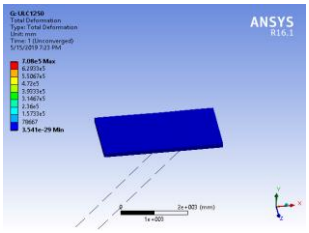
Chart. 3 and figure3 shows the load-deflection graph of the each member of varying density has to been considered such as 1250,1350,1450,1550 kg/m3 are taken. In each of the member each loading conditions are too been applied and the load deflection curves are changes based on these varying density deflection and the load changes accordingly. In 1250 has 1%, 1350 has 10.90%, 1450 has 28.43% and 1550 has 45.27% it is done in column.

3.3 Varying Densities of Member Such As One Way Slab

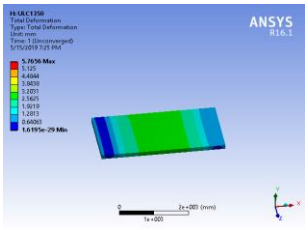
In this study, the one way slab analysis is carried out and with varying densities and conventional slab is also conceded so that there is about five models. In each model other factors are same. The models are different just in the varying of density.



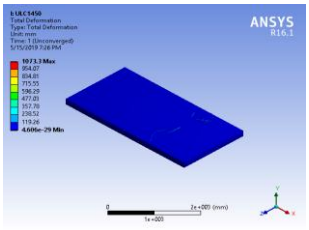
ULCC CC



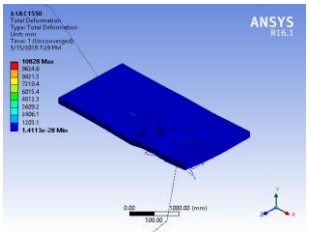
ULCC 1250



ULCC 1350



ULCC 1450



ULCC 1550

Fig -4: Analysis Of One Way Slab

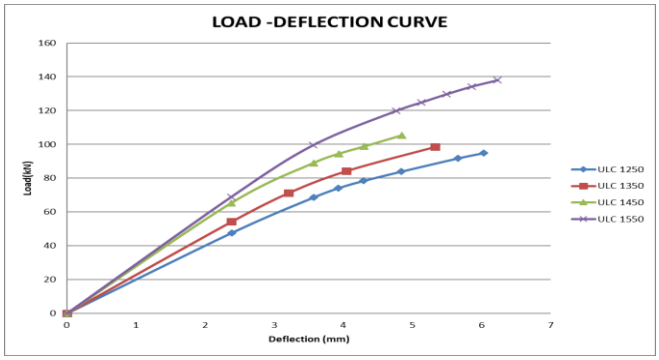
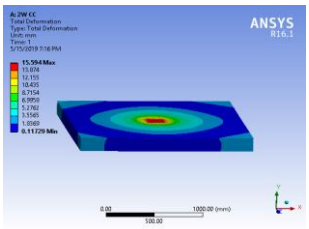


Chart -4: Load deflection curve

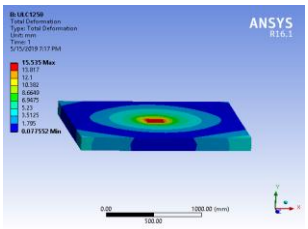
Chart. 4 and figure 4 shows the load-deflection graph of the each member of varying density has to been considered such as 1250,1350,1450,1550 kg/m3 are taken. In each of the member each loading conditions are too been applied and the load deflection curves are changes based on these varying density deflection and the load changes accordingly. In 1250 has 1%, 1350 has 3.86%, 1450 has 11.04% and 1550 has 45.44% it is done in one way slab.

3.4 Varying Densities of Member Such As Two Way Slab

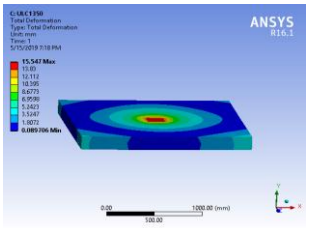
In this study, the two way slab analysis is carried out and with varying densities and conventional slab is also conceded so that there is about five models. In each model other factors are same. The models are different just in the varying of density.



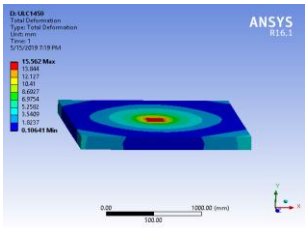
ULCC CC



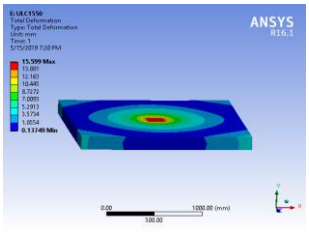
ULCC 1250



ULCC 1350



ULCC 1450



ULCC 1550

Fig -5: Analysis Of Two Way Slab

Chart. 5 and figure 5 shows the load-deflection graph of the each member of varying density has to been considered such as 1250,1350,1450,1550 kg/m3 are taken. In each of the member each loading conditions are too been applied and the load deflection curves are changes based on these varying density deflection and the load changes accordingly. In 1250 has 1%, 1350 has 6.90%, 1450 has 12.53% and 1550 has 35.96% it is done in two way slab.

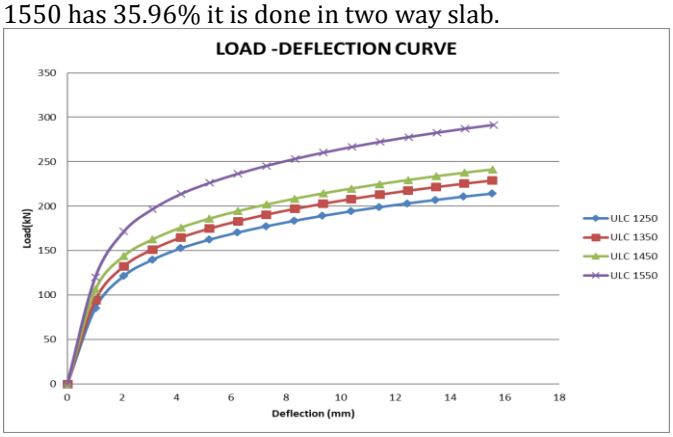


Chart -5: Load deflection curve

4. COMPARISON OF RESULTS

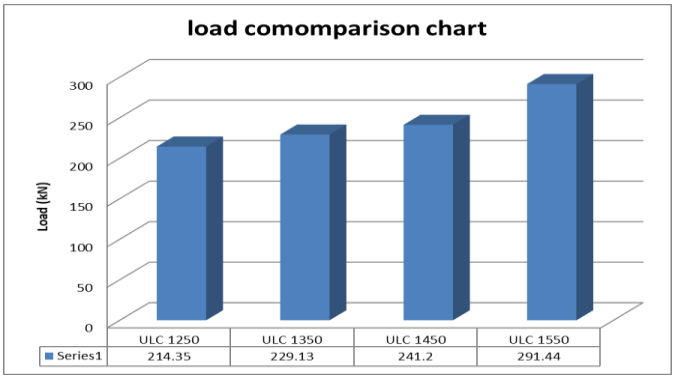
In this paper mainly comparison is done by two methods. Firstly it is compared with conventional density 2400 kg/m3 and secondly when it is compared with the base element with a density of 1250 kg/m3 has considered one and finding the other values with the percentage of load increasing can be calculated in column, beam, one way slab, and two way slab. Based on that there are 4 models and with varying densities the comparison and the analysis is carried out.

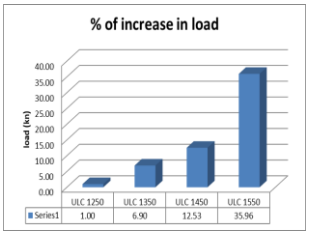
4.1 The Column Is Compared With Conventional and Other Varying Density

Based on column one base model and others have a varying density and conventional type of 5 models are developed and the load carrying capacity of the each member like column.

Firstly consider 1250 density column member has the percentage of loading is considered it to be as 1%, based on this percentage of increase of load of other varying load of column member has carried in this such as 1350 has 10.90%, 1450 has 28.43% and 1550 has 45.27% based on this test result done by analysis of this member the percentage of loading is increased by 45.27% with density of 1550. So the maximum load carrying capacity member is that 1550kg/m3 density column.

Secondly it is compared with the conventional density of 2400 kg/m3, it is only compared with the densities of 1450 and 1550 kg/m3. The percentage of increase in load of 1450 has 15.81% and 1550 has 29.53% respectively. For each percentage of member is carried out in this analysis.





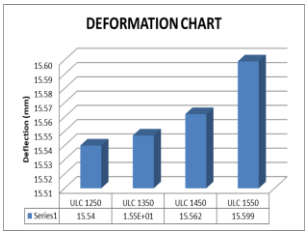


Chart -6: Comparison of load with varying density and maximum load carrying and the deformation -COLUMN

Chart-6 shows the comparison of varying density and the different load carrying capacity and the deformation chat also based on conventional type and the 1250 kg/m3 density deflection in each member is analysis is done and find out the maximum load carrying capacity to which member.

4.2 The Beam Is Compared With Conventional and Other Varying Density

Based on beam one base model and others have a varying density and conventional type of 5 models are developed and the load carrying capacity of the each member like beam analysis.

Firstly consider 1250 density beam member has the percentage of loading is considered it to be as 1%, based on this percentage of increase of load of other varying load of beam member has carried in this such as 1350 has 3.80%, 1450 has 7.05% and 1550 has 21.57% based on this test. Result done by analysis of this member the percentage of loading is increased by 21.57% with density of 1550. So the maximum load carrying capacity member is that 1550kg/m3 density beam.

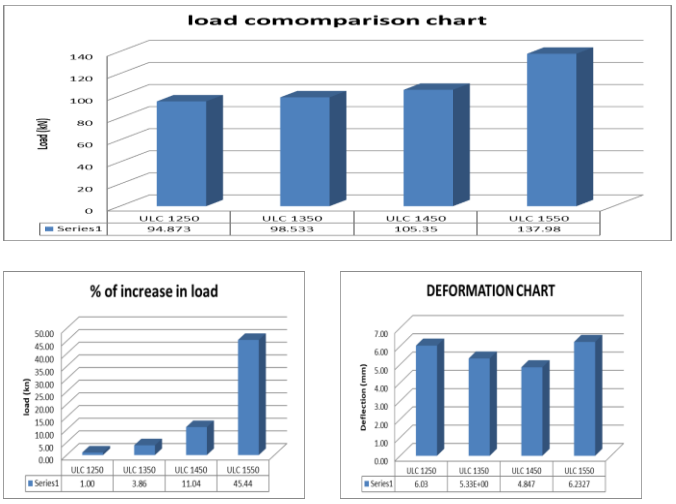


Chart -7: Comparison of load with varying density and maximum load carrying and the deformation –BEAM

Secondly it is compared with the conventional density of 2400 kg/m3, it is only compared with the densities of 1450 and 1550 kg/m3. The percentage of increase in load of 1450 has 3.13% and 1550 has 13.56% respectively. For each percentage of member is carried out in this analysis.

Chart-7 shows the comparison of varying density and the different load carrying capacity and the deformation chat also based on conventional type and the 1250 kg/m3 density deflection in each member is analysis is done and find out the maximum load carrying capacity to which member.

4.3 The 1-Way Slab Is Compared With Conventional and Other Varying Density

Based on one way slab one base model and others have a varying density and conventional type of 5 models are developed and the load carrying capacity of the each member like one way slab analysis.
Firstly consider 1250 density one way slab member has the percentage of loading is considered it to be as 1%, based on this percentage of increase of load of other varying load of one way slab member has carried in this such as 1350 has 3.86%, 1450 has 11.04% and 1550 has 45.44% based on this test result done by analysis of this member the percentage of loading is increased by 45.44% with density of 1550. So the maximum load carrying capacity member is that 1550kg/m3 density one way slab.

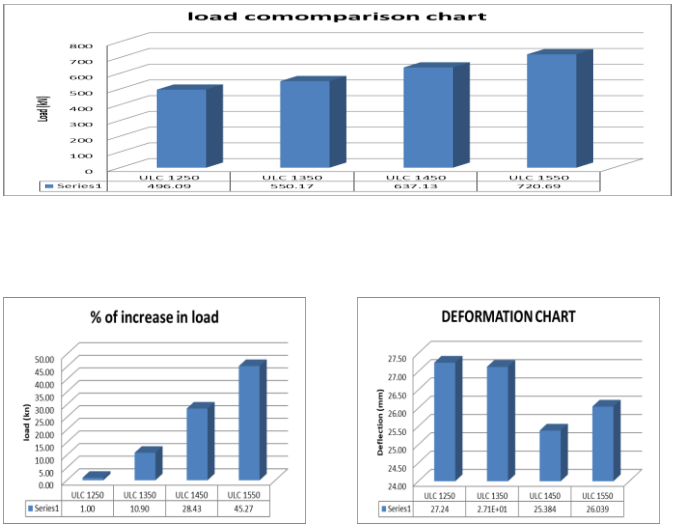


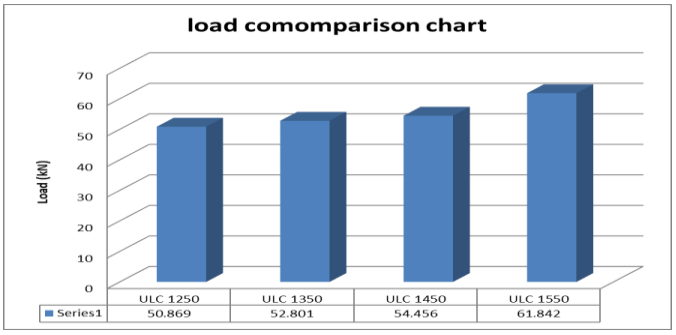
Chart -8: Comparison of load with varying density and maximum load carrying and the deformation –ONE WAY SLAB

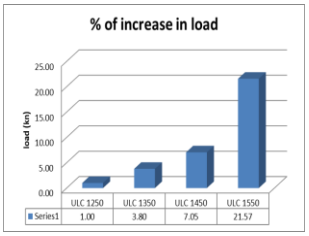
Secondly it is compared with the conventional density of 2400 kg/m3, it is only compared with the densities of 1450 and 1550 kg/m3. The percentage of increase in load of 1450 has 6.92% and 1550 has 30.97% respectively. For each percentage of member is carried out in this analysis.

Chart-8 shows the comparison of varying density and the different load carrying capacity and the deformation chat also based on conventional type and the 1250 kg/m3 density deflection in each member is analysis is done and find out the maximum load carrying capacity to which member.

4.4 The 2-Way Slab Is Compared With Conventional and Other Varying Density

Based on two way slab one base model and others have a varying density and conventional type of 5 models are developed and the load carrying capacity of the each member like two way slab analysis.
Firstly consider 1250 density two way slab member has the percentage of loading is considered it to be as 1%, based on this percentage of increase of load of other varying load of two way slab member has carried in this such as 1350 has 6.90%, 1450 has 12.53% and 1550 has 35.96% based on this test result done by analysis of this member the percentage of loading is increased by 35.96% with density of 1550. So the maximum load carrying capacity member is that 1550kg/m3 density two way slab.





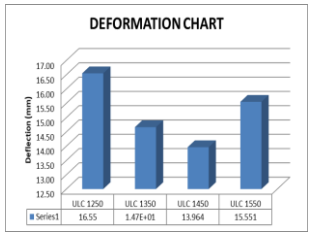


Chart -9: Comparison of load with varying density and maximum load carrying and the deformation –TWO WAY SLAB

Secondly it is compared with the conventional density of 2400 kg/m3, it is only compared with the densities of 1450 and 1550 kg/m3. The percentage of increase in load of 1450 has 5.27% and 1550 has 20.83% respectively. For each percentage of member is carried out in this analysis.

Chart-9 shows the comparison of varying density and the different load carrying capacity and the deformation chat also based on conventional type and the 1250 kg/m3 density deflection in each member is analysis is done and find out the maximum load carrying capacity to which member

5. CONCLUSIONS

The following conclusions may be drawn from the Finite Element Analysis (FEA) performed on four members using finite element analysis software ANSYS Workbench 16.1.
In the case of beam and slab it has the maximum deformation and the maximum loading condition. If the load increases the strength also increases. Also in the case of slab deflection increase the ductility also increase. In the case of beam displacement decrease the stiffness increase in this analysis.

•In the case of beam the maximum load carrying capacity to with varying density that 1550 has 21.57, 1450 has 7.05and 1350 has 3.80 percentage.
•In the case of column the maximum load carrying capacity to with varying density that 1550 has 45.27, 1450 has 28.43and 1350 has 10.90 percentage.
•In the case of one way slab the maximum load carrying capacity to with varying density that 1550 has 45.44, 1450 has 11.04and 1350 has 3.86 percentage.
•In the case of two way slab the maximum load carrying capacity to with varying density that 1550 has 35.96, 1450 has 12.53and 1350 has 6.90 percentage.
•In the case of conventional beam the maximum load carrying capacity to with varying density that 1550 has 13.56, 1450 has 3.13 percentage.
•In the case of conventional column the maximum load carrying capacity to with varying density that 1550 has 29.53, 1450 has 15.81 percentage.

•In the case of conventional one way slab the maximum load carrying capacity to with varying density that 1550 has 30.97, 1450 has 6.92 percentage.
• In the case of conventional two way slab the maximum load carrying capacity to with varying density that 1550 has 20.83, 1450 has 5.27 percentage.

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