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Comparative Analysis of Frame of MSRTC Bus using Material Mild steel, S-Glass Epoxy and E-Glass Epoxy

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Abstract*:* Comparative analysis of frame of MSRTC bus is taken for the stress analysis and displacement analysis of frame at different materials and this paper provide effects of materials mild steel, S-glass epoxy and E-glass epoxy on the bus frame. This is done by using CAD modeling and it's stress and displacement analysis on analysis on ANSYS

Keywords*:* CAD, ANSYS,stress and displacement analysis,mild steel, s-glass epoxy.

I. INTRODUCTION

In this project we are reducing the impact by changing the existing design materials. Data is collected from the Body construction work shape in MSRTC Workshop , Dapodi.. Presently steel is used for chassis construction. The aim of the project is to analyze the frameless chassis with presently used material steel and replacing with composite materials like S- Glass epoxy, E-glass epoxy. Impact analysis is conducted on chassis for different speeds by varying the materials. We are conducting above analysis for the existing design and for the modified design. Best of the result we will consider for the chassis design. Also we are going to reduce weight of the chassis by using composite materials replacing with steel.

II. ANALYSIS OF FRAME

It includes
1) modelling
2) Analysis in ANSYS

1) Modelling of frame

Modelling of frame is done using CATIA V5 R21 software based on 2D designs.

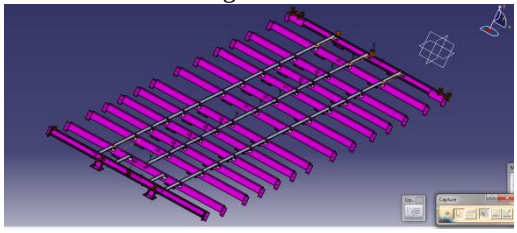

Fig.1: 3D model of frame using CATIA V5

2) Analysis in ANSYS

It includes
1. Import file
2. Define Material s
3. Meshing
4. Loading
5. Solving

1.Import File

Start with a simple file in a CAD system, export a Stp file, and then import the STEP file into the ANSYS Workbench platform. Within ANSYS Workbench, assign a unique color to each face of the model. Return to the CAD system and change the geometry slightly. Export this new model as a Stp. file and replace the original model in ANSYS Workbench, reusing the existing setup.

2. Define material

Material is defined using material data
1) Young's modulus
2) Poisson 's ratio
3) Density

3.Meshing

The accuracy of results depends upon the accuracy of CAD geometry and quality of meshing.
Hexagonal meshing is done using mid –side node kept. Mesh size is taken as 120 mm.

4.Loading

- Total load on frame 72500 N
- For loading , we consider uniform pressure is distributed on frame area which is subjected to loading
- Total area on frame which is subjected to loading = 2962300 mm^2
- Pressure on frame = 0.0245MPa

5. Solution

Solution is done is using ANSYS for different materials is as follows:

1) Material selection : Mild steel

Material Properties
1) Young's modulus = 200 GPa
2) Poisson 's ratio =.295
3) Density =7700 kg/m^3

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A) Stress analysis

The stress analysis of frame using mild steel is as shown in fig. It shows that

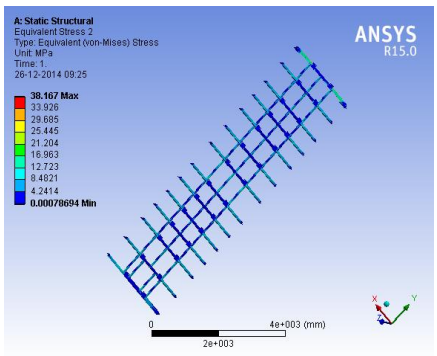

Fig. 2: Stress analysis of frame using Mild Steel

➢ Maximum stress region

Figure shows maximum stress region this stress is on the last channel of frame. This are compressive stresses and it's value is 38.187MPa.

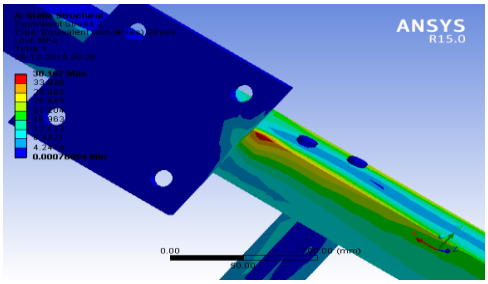

Fig. 3: Maximum stress region on frame of Mild steel

A) Equivalent deformation of frame

Figure shows the deformation of frame, the deformation is at both end is more because of away from supports. There is no deformation at middle of channel.

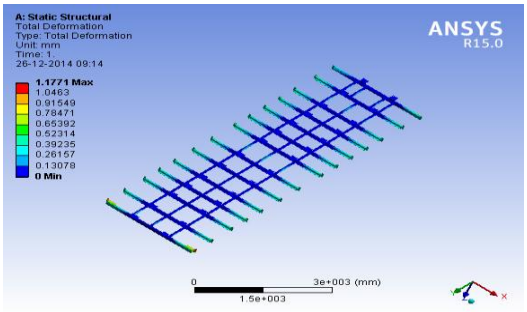

Fig. 4: Equivalent deformation of frame of Mild steel

➢ Maximum deformation on the frame

The maximum deformation is at last channel on it's both ends is 1.1771mm . This is as shown in fig.

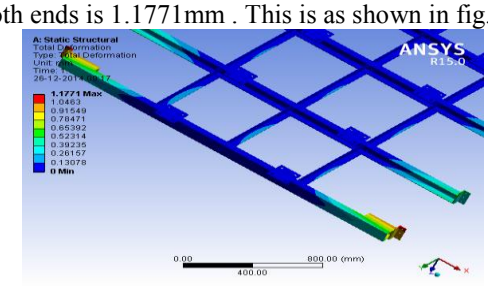

Fig.5:Maximum deformation on the frame of Mild steel

3) Material selection : S-glass Epoxy

Material Properties

1)Young's modulus = 87 GPa
2)Poisson 's ratio =.23
3)Density = 2.48kg/m^3

A) Stress analysis

The stress analysis of frame using S-glass Epoxy is as shown in fig.

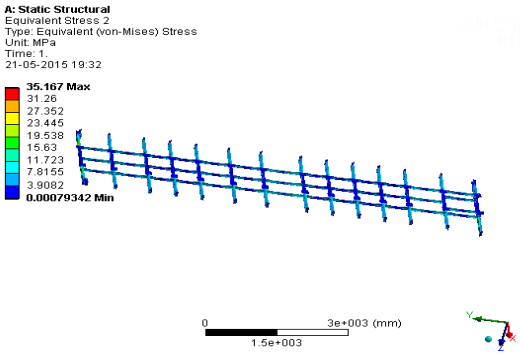

Fig. 6: Stress analysis of frame using S-glass Epoxy

➢ Maximum stress region

Figure shows maximum stress region this stress is on the last channel of frame. This are compressive stresses and it's value is 35.187MPa

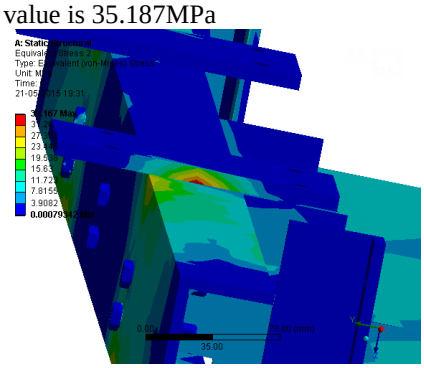

Fig. 7: Maximum stress region on frame of S-glass epoxy

B) Equivalent deformation of frame

Figure shows the deformation of frame, the deformation is at both end is more because of away from supports. Here deformation is more than mild steel.

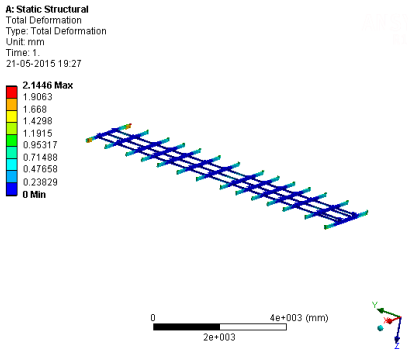

Fig. 8: Equivalent deformation of frame of S-glass epoxy

➢ Maximum deformation on the frame

The maximum deformation is at last channel on it's both ends is 2.1406 mm .

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This is as shown in fig.

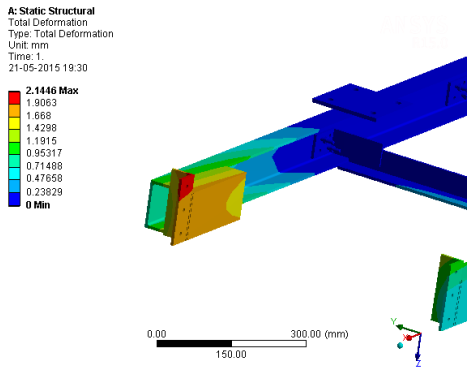

Fig.9:Maximum deformation on the frame of S-glass epoxy

3)Material selection : E-glass Epoxy

➢ Material Properties

1) Young's modulus = 72 GPa
2)Poisson 's ratio =.21
3)Density = 2.48kg/m^3

A) Stress analysis

The stress analysis of frame using E-glass epoxy is as shown in fig.

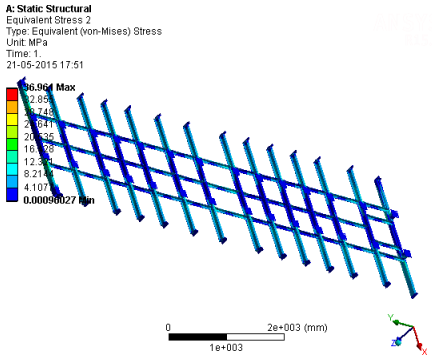

Fig. 10: Stress analysis of frame using E-glass Epoxy

➢ Maximum stress region

Figure shows maximum stress region this stress is on the last channel of frame. This are compressive stresses and it's value is 36.961 MPa

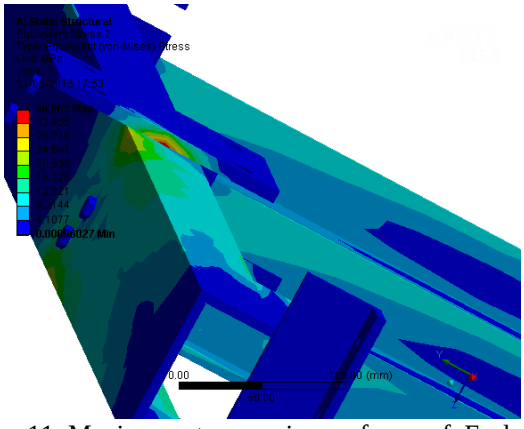

Fig. 11: Maximum stress region on frame of E-glass epoxy

B) Equivalent deformation of frame

Figure shows the deformation of frame, the deformation is at both end is more because of away from supports. Here deformation is more than mild steel.

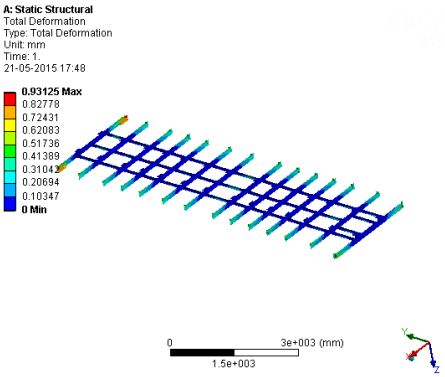

Fig. 12: Equivalent deformation of frame of E-glass epoxy

➢ Maximum deformation on the frame

The maximum deformation is at last channel on it's both ends is 0.93125 mm . This is as shown in fig.

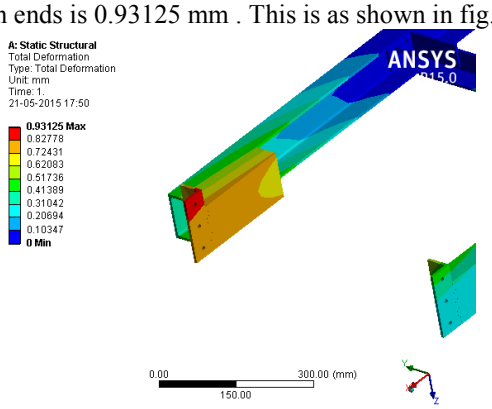

Fig.13:Maximum deformation on the frame of E-glass epoxy

RESULTS

Material	Maximum Stress(MPa)	Maximum Deformation (mm)	Strain
Mild Steel	38.187	1.1771	0.000191
S-glass Epoxy	35.187	2.1406	0.0004
E-glass Epoxy	36.961	0.93125	0.00051

Table 1: Results of Analysis of frame

III. CONCLUSION

In this analysis, we conclude that E-glass Epoxy and S-glass Epoxy are better than mild steel in the sense that they give approximately same result with very low density as compared to mild steel. It helps to reduce weight of the vehicle which is useful for better engine performance.

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