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Material Optimization of Tata ACE Chassis

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Abstract – Tata Ace is a fast moving and cost efficient commercial vehicle. The load carrying capacity of the chassis seems to be low. Here we improve this by optimizing the base material with composite fibers. By this we can improve the chassis failures and also the kerb weight can be reduced.

***Key Words*:** FEA, Solid Works, ANSYS, Structural analysis…

1.INTRODUCTION

Reliability is the most important quality that is expected by the customers. So all the industries work to achieve the requirement. The Tata manufactures India's most economic vehicles. Ace is a highly sold economic vehicle for its cost and efficiency. The chassis is the backbone for a vehicle, which carries each and every part together. All the weight including kerb weight and pay load have an impact on the chassis. So chassis's quality is very most important factor to be considered. Improving the quality of chassis improves the quality of the vehicle.

2. MODELLING

2.1 REVERSE ENGINEERING

Instead of designing a new component of same specification and to reduce time, this process is used. Here, the piston of the pulsar piston is brought out from market and its dimension and geometries are remodeled by 3D software and is subjected to FEA analysis.

2.2 CHASSIS DESIGN

The Chassis design is modelled exactly in SolidWorks with basic tools. The measurements are obtained manually with basic measuring tools. The chassis design is shown in the fig.1.

2. INPUTS

The 3D model is converted to IGES format. The file in imported in Ansys workbench and meshing is done with medium relevance center. By which the nodes and elements achieved are 100192 and 44851 respectively. The weight of the chassis with steel is 387 Kg. Initially, steel is assigned and the properties of the same are assigned to the model. The boundary conditions are applied as in the table 1.

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Table -1: Input Parameters

BOUNDARY CONDITIONS			
Analysis type	Static structural	weight	387 kg
mesh	Tetrahedrons	Force applied	10000 N
Nodes	100192	Elements	44851

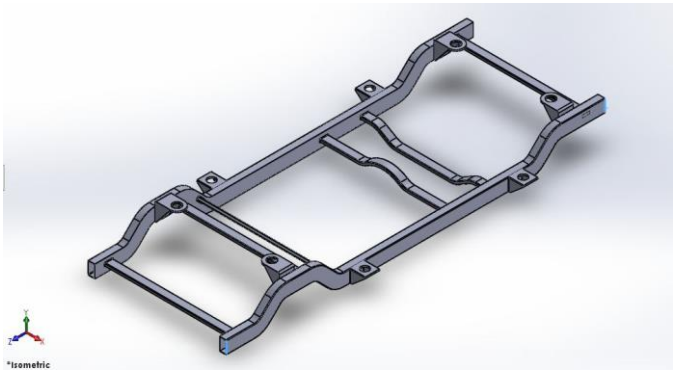

Fig -1: chassis

Table -2: Material Properties of Steel, carbon epoxy & s glass epoxy

Density	7.85e-006 kg mm^-3	1.6e-006 kg mm^-3	2.5e-006 kg mm^-3
Young's modulus	2.e+005MPa	1.7e+005MPa	93000 MPa
Poisson's ratio			

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	0.3	0.3	0.22

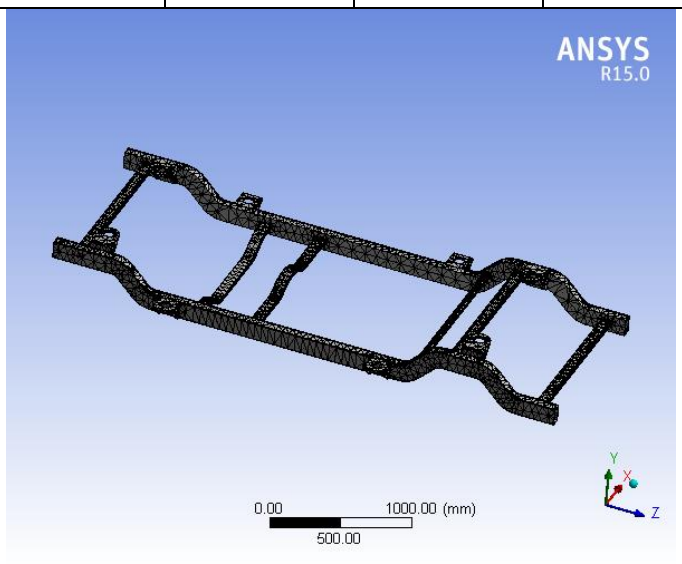

Fig -2: Mesh of chassis

Meshed model of the piston is shown in fig 2. The results of the steel after importing the boundary conditions are obtained. The deformation, stress and strain, are tabulated below.

Deformation	0.0538 mm
Stress	13.772 MPa
Strain	9.3 e-9 mm/mm

Table -3: Results of Steel.

3. RESULTS:

Results of Steel:

The total deformation in piston with steel is obtained due to the input loading condition. The maximum value of 0.0538mm is the mid of the chassis. The result images are shown below,.

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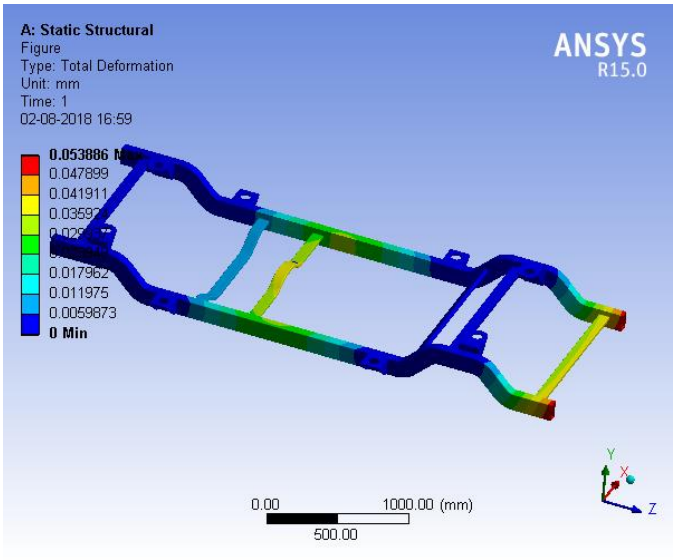

Fig-3 – Deformation of steel

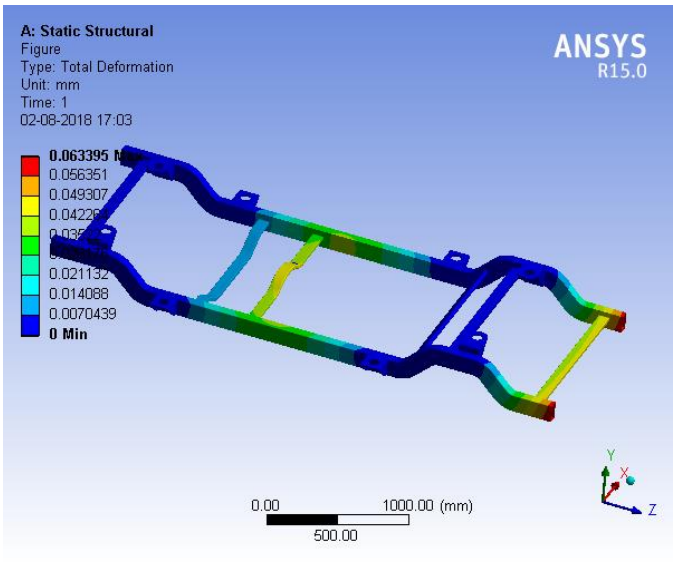

Fig-4 – Deformation of carbon epoxy

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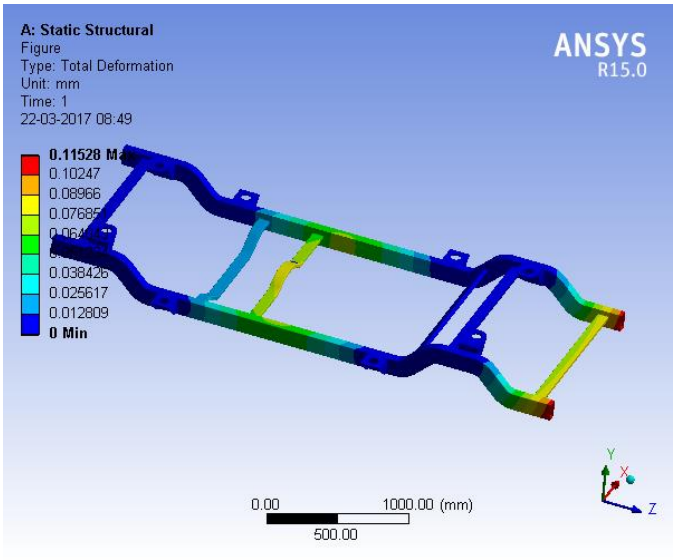

Fig- 5 – Deformation of s glass epoxy

Table -4: Results of Carbon epoxy and S Glass epoxy

Deformation	0.0633 mm	0.11582 mm
Stress	13.772 MPa	14.773 MPa
Strain	0.0001095 mm/mm	0.0002153 mm/mm

From the analysis by assigning carbon epoxy material to the model, the results are obtained. The result seems to be better than that of steel.

4. CONCLUSIONS

The analysis carried out on Tata Ace chassis revealed the effects of forces acting on it. Also material optimization was carried out so that better material found to show better resistance to force. Here the Carbon epoxy has low values of deformation and the weight of silumin is 80 Kg less than steel. So carbon epoxy can be used instead of steel.

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