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Analysis and Optimization of Tractor Trolley Chassis

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***Abstract* - Tractor trolley are basically meant for transporting food product unlike sugarcane, jawar, wheat and agro based fertilizers, so during transportation the tractor trolley are subjected to a heavy loads up to 4 tons (worst case) so it becomes very important to study the trolley chassis cross section which are subjected to a torsion load, axial load, bending load the focus here in my project is to check deflection and stress occurring in the trolley chassis under the above loads (axial, bending, torsion) and to optimize the structure without compromising the factor of safety.**

Keywords
sleevering;SOLIDEDGE;ABAQUS;HYPERMESH;solver deck.

I.INTRODUCTION

There are so many industrial sectors using tractor for their transportation such as logistics, agriculture products for one place to other place. The mainly different types of trailers those are mainly based on the wheels of trailer has and types of classification are based on the specification function of the trailer. trailer plays a important role in India because of India is mainly based on the agriculture. Chassis is the structural unit and it is the one of the main part of tractor trolley. It is the most decisive element that gives stability and strength under different load conditions of the vehicle. Many things are considered while designing a chassis such as weight, material selection, strength of the material, and other material properties. It is the main mounting part for all the components including the body so it is also called the carrying unit.

In my present study analysis of tractor trolley chassis is done for different loading conditions such as when tractor trolley is travelling on road brakes, while parking the trolley i.e. braking load condition and while taking left or right turn of trolley i.e. transverse loading condition.

II.LITERATURE REVIEW

This paper analyses the failure of the tractor trolley chassis an approach using the finite element method(FEM). The Ms. Kshitija A Bhat and Prof Harish v katore, authors in their paper The maximum stress in the chassis 75MPa. If sudden load effects are considered then the stress may rise to twice of that the static stress of 75MPa. This maximum stress will be nearer to 150MPa. And the factor of safety is 1.66. they observed that due to self weight failure may occur. So they reduce self weight of existing chassis to 751.82Kg[1].

Authors Vinayak R.Tayade, Prof. A. V. Patil, aims to redesign a modified chassis for the tractor trolley. In their research paper the manufacturing of the tractor trolley in the industries may have failures, to overcome the failure the authors used 'I' cross section instead of 'c' cross section trolley chassis is not safe stress are above ultimate stress. In this paper redesign the trolley chassis of existing one by keeping material and dimensions same and replaced 'I' instead of 'C' which results in more safe stress than existing one.[2]

III.METHODOLOGY

First step is to collect the dimensional details of the chassis and by taking these dimensions to create the model of tractor trolley chassis using the solid edge software and that model can be imported into the hyper mesh for the meshing purpose. the analysis is done by using Abacus software for the different chassis thickness i.e. 6 and 5mm. the chassis weight can be reduced as the thickness reduced. Then we obtained the various stresses and deformations.

IV.BOUNDARY CONDITIONS

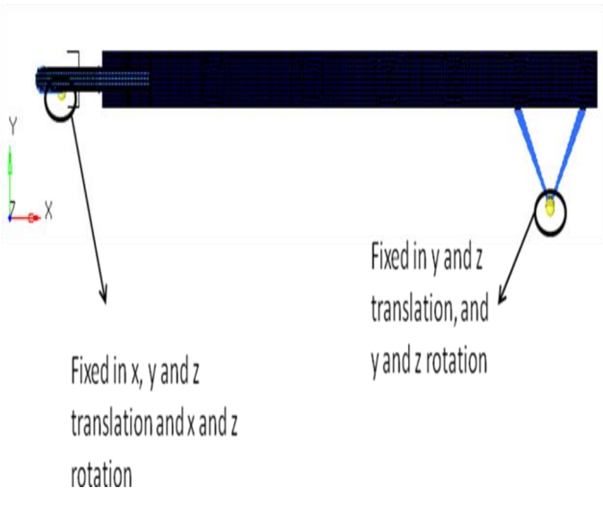

Fig.1 Boundary condition

V.RESULTS AND CONCLUSION

The analysis can be done by the various thicknesses of the trolley chassis for 6mm and 5mm and results are obtained. The below figures shows the results of von misses stresses, maximum and minimum principle stresses and deflection for the 6mm and 5mm thickness for the trolley chassis.

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A: Results of 6mm thickness of chassis and 6mm tube

1. Load of 3G with 2.5 tons acting vertically downward direction

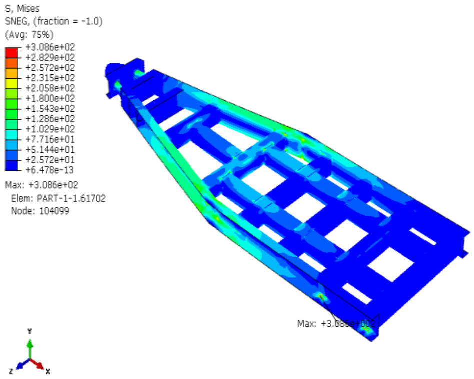

Fig 2: Von misses stress

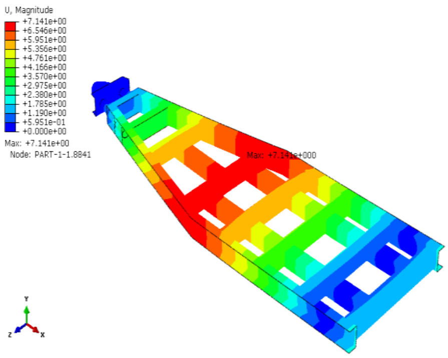

Fig3: deflection in Y direction

2. Load of 3G with 2.5 tons acting in the axial direction during braking.

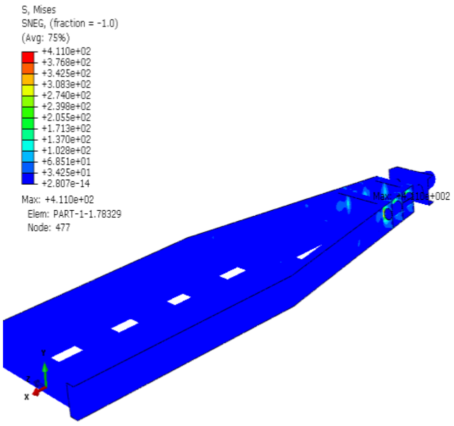

Fig 4: Von misses stress

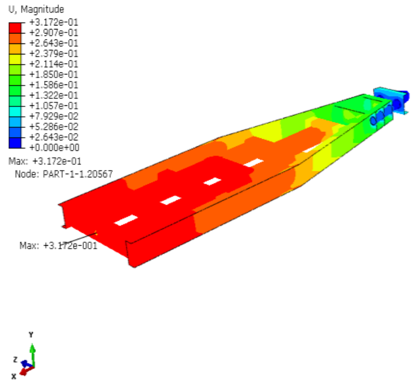

Fig 5: deflection in X direction

3. Load of 3G with 2.5 tons acting in the transverse direction while taking turn.

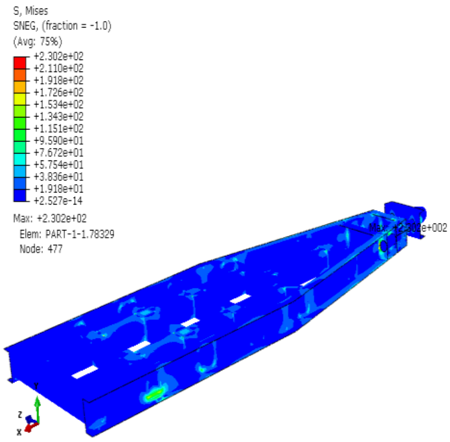

Fig 6: Von misses stress

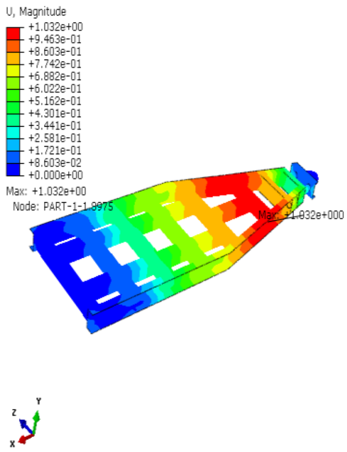

Fig 7: deflection in Y direction

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B: Results of 6mm thickness of chassis and 5mm tube.

1. Load of 3G with 2.5 tons acting vertically downward direction

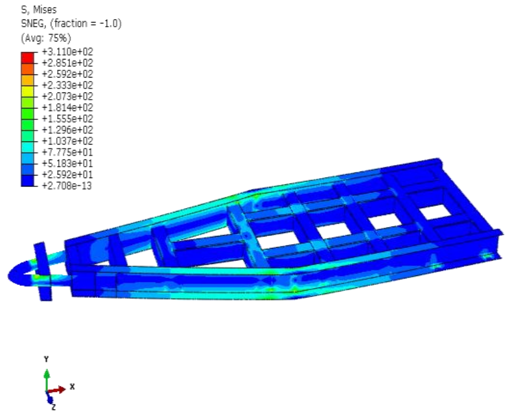

Fig 8: von misses stress

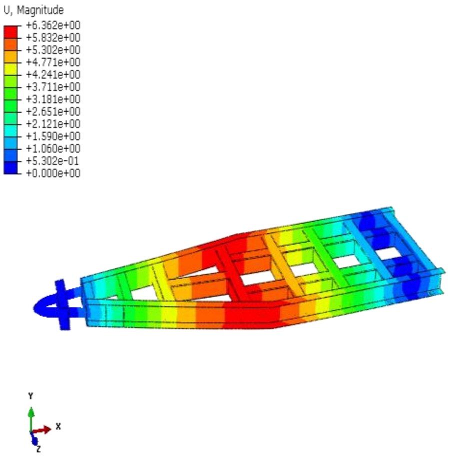

Fig 9: deflection in Y direction

2. Load of 3G with 2.5 tons acting in the axial direction during braking.

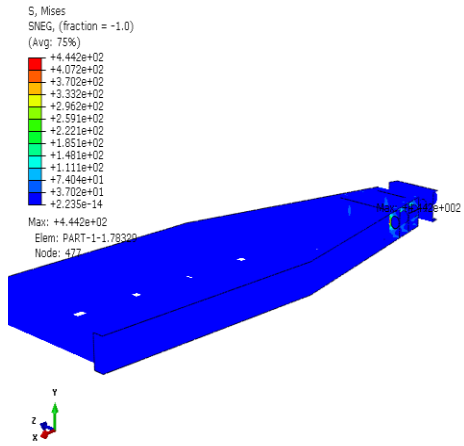

Fig 10: Von misses stress

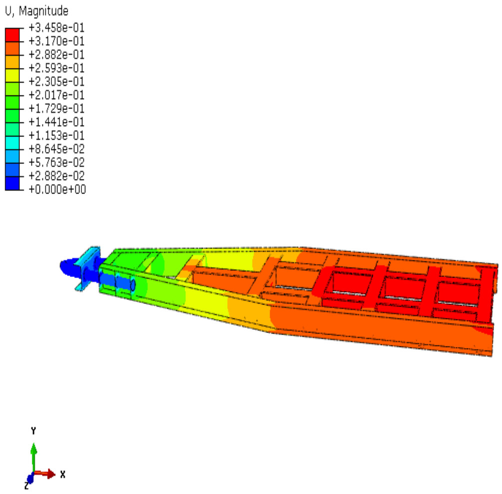

Fig 11: deflection in Y direction

3. Load of 3G with 2.5 tons acting in the transverse direction while taking turn.

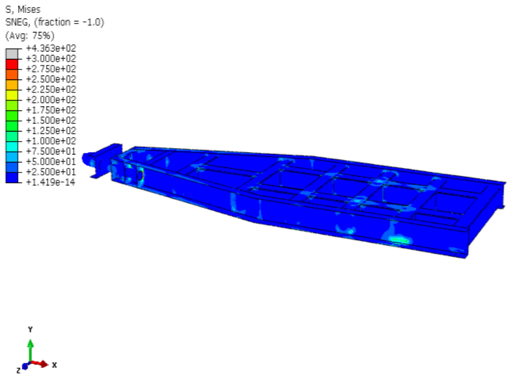

Fig 12: Von misses stress

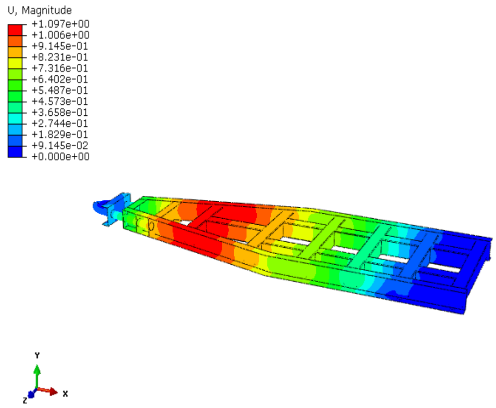

Fig 13: deflection in Z direction

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C: Results for 5mm thickness chassis and 5mm tube

1. Load of 3G with 2.5 tons acting vertically downward direction

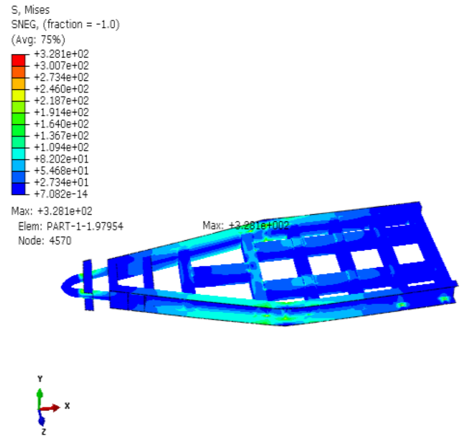

Fig 14: von misses stress

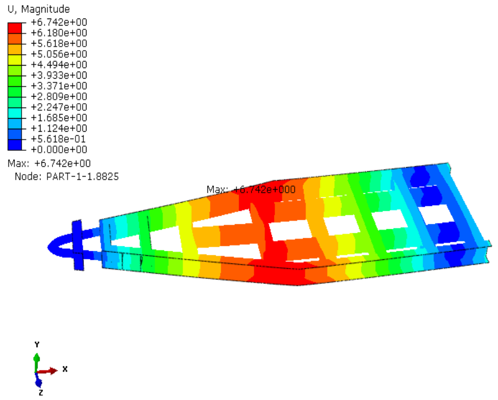

Fig 15: deflection in Y direction

2. Load of 3G with 2.5 tons acting in the axial direction during braking.

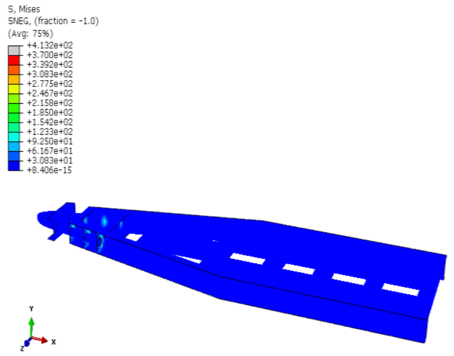

Fig 16: Von misses stress

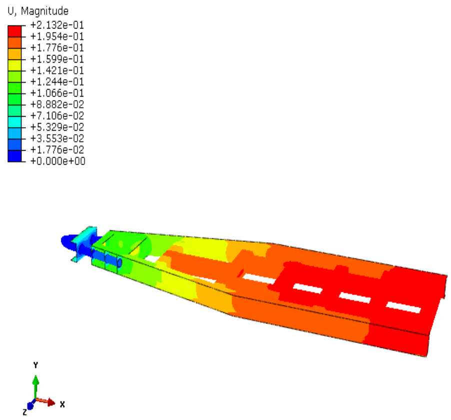

Fig 17: deflection in Y direction

3. Load of 3G with 2.5 tons acting in the transverse direction while taking turn.

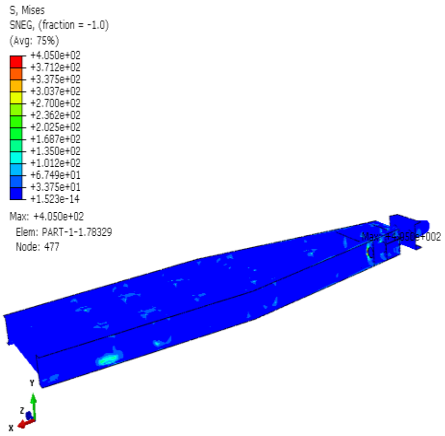

Fig 18: Von misses stress

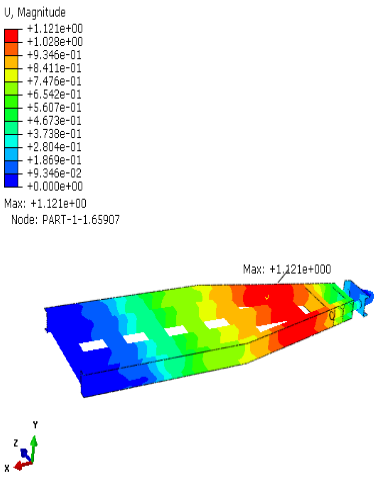

Fig 19: deflection in Z direction

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SL.NO	Thickness(mm)		Mass of the chassis(Kg)	Stress(N/mm)			Yield stress	FOS	Reduction of mass(Kg)
	C-channel	Tube		LC1	LC2	LC3			
1	6	6	284	308	411	230	450	1.09	0
2	6	5	231	231	444	436	450	1.01	19%
3	5	5	215	328	413	405	450	1.08	24%

Table 1: summary of weight reduction by varying thickness of Tractor trolley chassis

The above table shows that the stresses and deflection of the trolley chassis for different load condition and the percentage of weight reduction obtained by changing the thickness of the chassis.

CONCLUSION

From the 2.5 tons load on chassis in different conditions like a breaking, road humps and while turning, the results summary table it is evident at the stress are within the yield strength of 350mpa for different thickness of the c-channel and tube of the chassis. So the structure is safe for the worst loading conditions [for 3g load].

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