

FINITE ELEMENT ANALYSIS OF TRACTOR TROLLEY CHASSIS

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Abstract

This paper aims to redesign a modified chassis for tractor trolley. Tractor Trolleys are very popular and cheaper modes of goods transport in rural as well as urban area. But these trolleys are manufactured in small scale to moderate scale industry, due to which design of chassis is at primary level. As design is not properly done according to the stress analysis, so if any type of failure occurs then we can't afford the replacement of the chassis. As the chassis design is not proper and excess material is used to overcome the failure, the self weights of the chassis get increases and capacity of the trolley get decreases. The existing trolley chassis designed by industry uses 'C' Cross section and the material used is mild steel. By keeping the material and dimension similar and using 'I' cross section area instead of 'C' resulted in more safer stresses than 'C' and reduction in weight.

Keyword- tractor trolley chassis, cad model, finite element analysis, stress analysis.

I. INTRODUCTION

A chassis is one of the key components of the trolley. The Chassis is used to support the container on which the load is to be carried out. It is a dead vehicle which is connected to the tractor to carry the load. It serves as a frame work for supporting the body. It should be rigid enough to withstand the shock, twist, and other stresses & its principle function is to carry the maximum load for static and dynamic condition safely. An important consideration in chassis design is to have adequate bending stiffness along with strength for better handling characteristics. [1]The trolley chassis main frame is supported at two points over the axle. In the present market scenario, cost reduction technique is playing signified role to meet the competition in the market. Weight reduction and simplicity in design are application of industrial engineering etc, the sources of the technique which are used. [2]

Various products used in rural areas are mostly manufactured in small scale industries such as tractor trolleys. It has been observed that these rural products are not properly designed. These products are manufactured as per need, by trial and error methods of manufacturing. Big industrial sectors have not yet entered in manufacturing of these products; hence no significant development in design of rural product has been done so far. [2,3] Thus most of rural products are manufactured without availability of design. Though tractor trolleys are manufactured in various capacities by various industries, three dimensional finite element analyses of the chassis consist of a computer model or design that is stressed and analyzed for specific results. A company that is able to verify a proposed design will be able to perform to the clients specifications prior to manufacturing or construction. The general purpose finite element analysis software ANSYS is used for present study. The variation of bending stress and displacement values are predicted. [4]

II. FINITE ELEMENT ANALYSIS OF CHASSIS

A. General Procedure for Finite Element Analysis

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Certain steps in formulating a finite element analysis of a physical problem are common to all such analyses, whether structural, heat transfer, fluid flow, or some other problem. These steps are embodied in commercial finite element software packages (some are mentioned in the following paragraphs) and are implicitly incorporated in this text, although we do not necessarily refer to the steps explicitly.

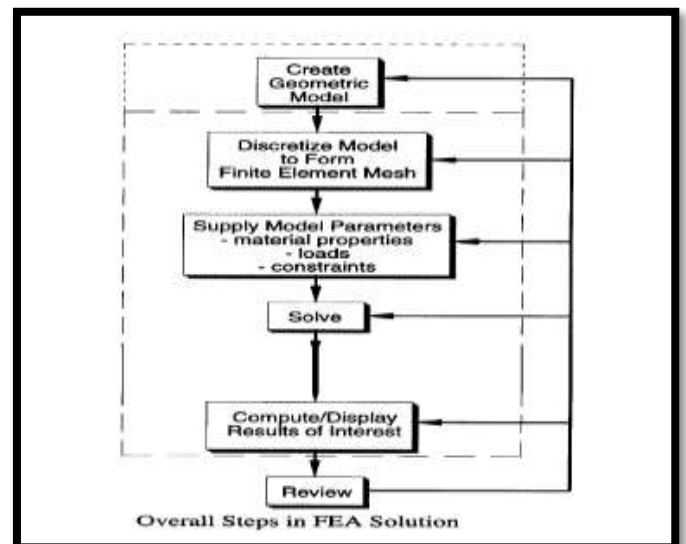


Fig. 6 Overall Steps in FEA Solution

B. ANALYSIS OF EXISTING 'C' CROSS SECTION CHASSIS USING ANSYS TOOL

The existing chassis geometry is generated in ANSYS workbench 11 by selecting toolbox where various commands like draw, dimensioning, constraints, extrude, generate, rotate etc. are used. Then mesh is generated on the model and after that load points are defined and load values are given. Then the results are generated automatically for stresses and deformation in solution phase. Figure shows the ANSYS results for Mesh Generated, Total Deformation,

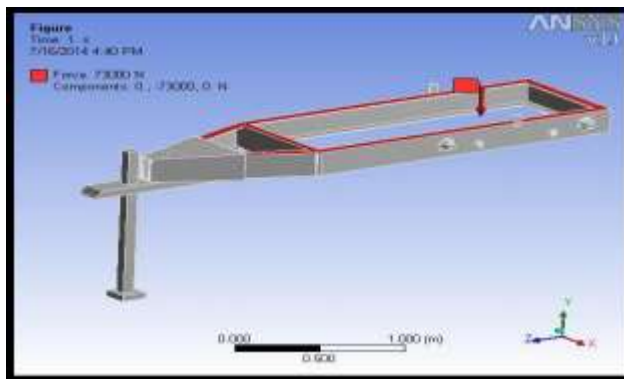


Fig. 7 Force Diagram

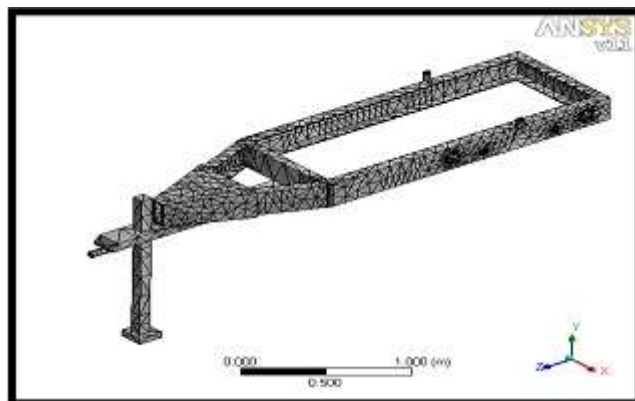


Fig. 8 Mesh Generated

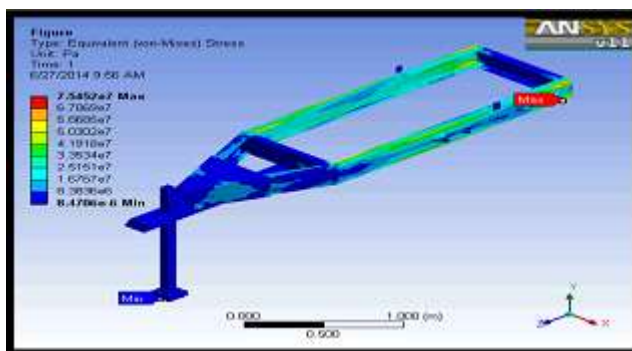


Fig.9 Von-Mises Stress

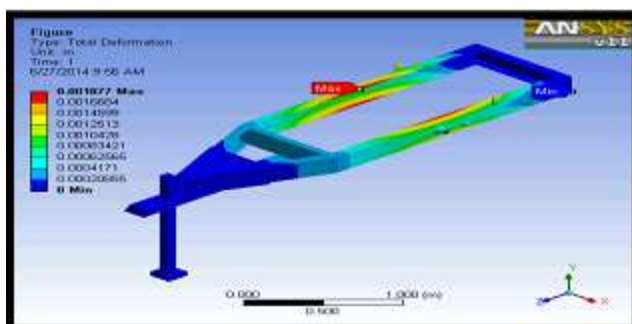


Fig.10 Total Deformations

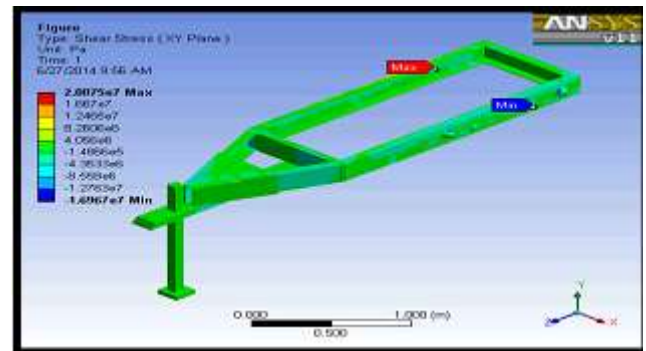


Fig. 11 Shear Stress

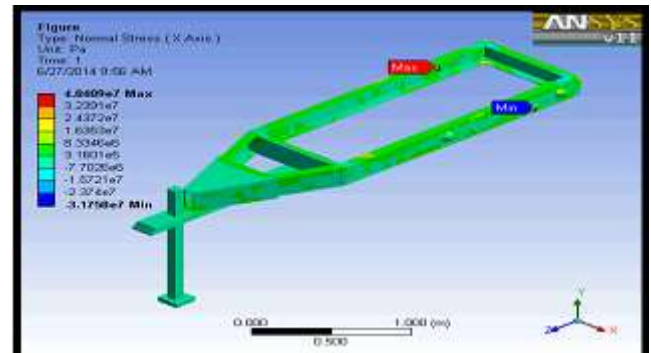


Fig. 12 Normal Stress

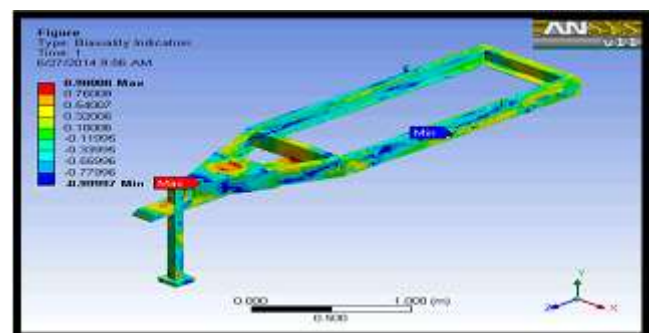


Fig. 13 Biaxiality Indication

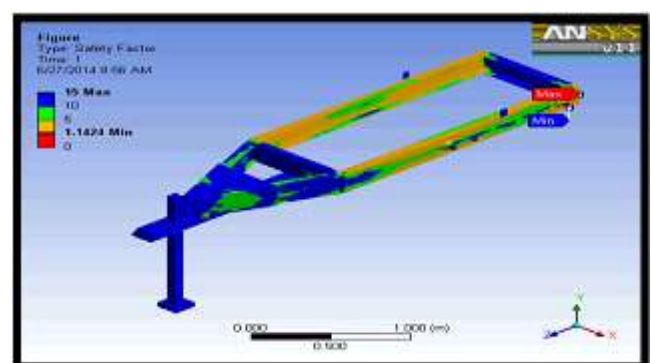


Fig. 14 Factor of Safety

C. ANALYSIS OF MODIFIED 'I' CROSS SECTION CHASSIS USING ANSYS TOOL

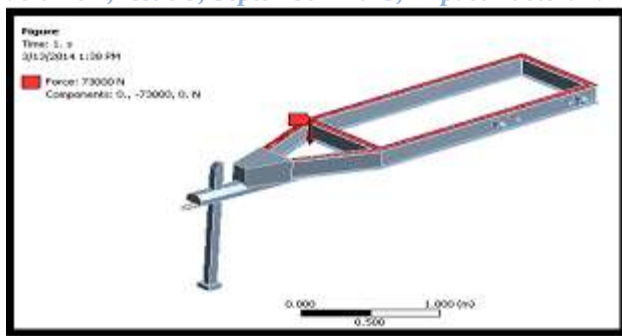


Fig. 15 Force Diagram

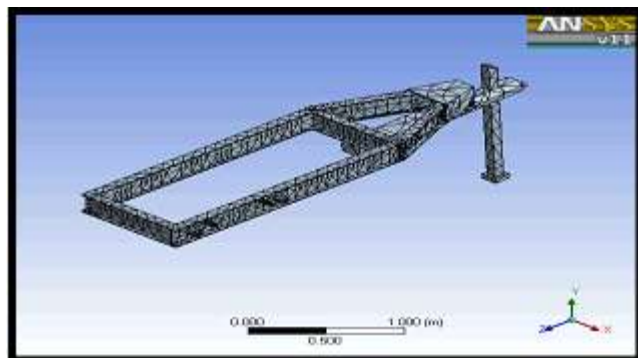


Fig. 16 Mesh Generated

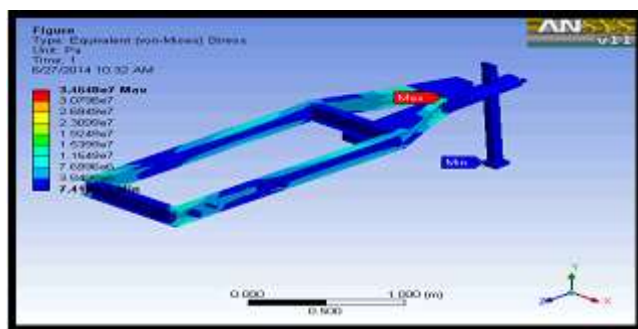


Fig. 17 Von-Mises Stress

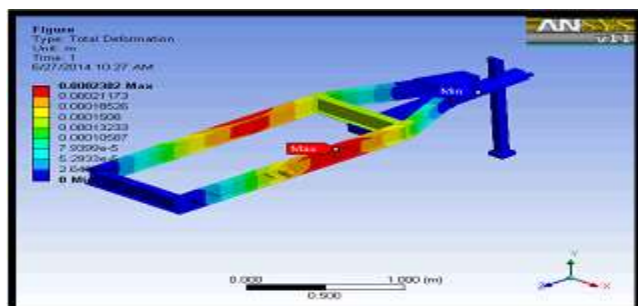


Fig. 18 Total Deformation

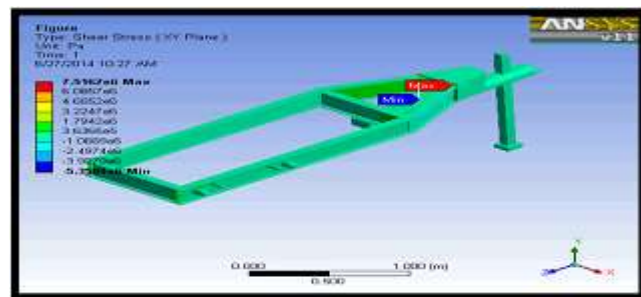


Fig. 19 Shear Stress

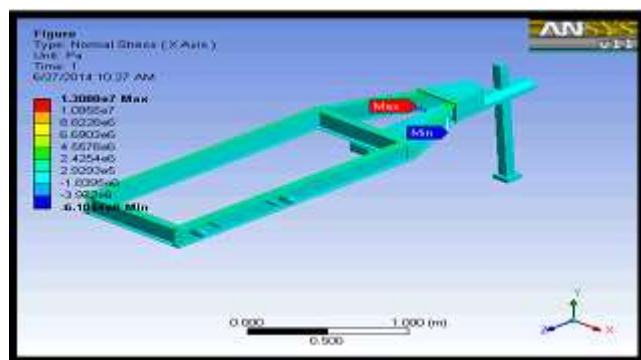


Fig. 20 Normal Stress

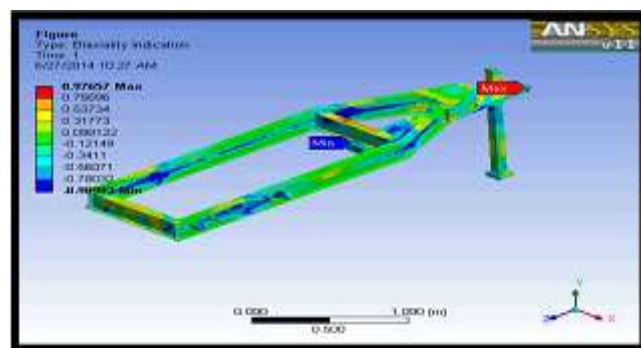


Fig. 21 Biaxiality Indication

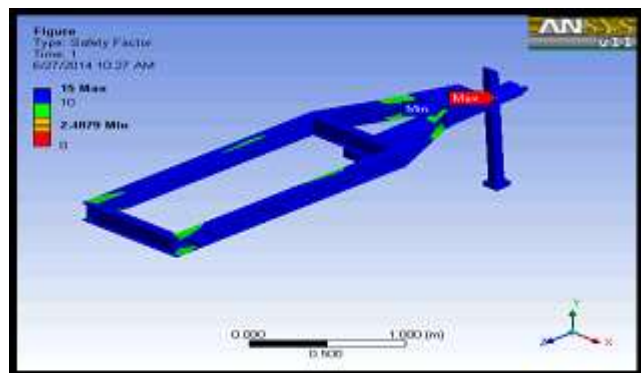


Fig. 22 Factor of Safety

Table 2 Comparison between Existing Chassis and Proposed Chassis Using ANSYS

SR NO	FACTORS	EXISTING 'C' SECTION	SUGGESTED 'I' SECTION
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1	Equivalent (Von-Mises) Stress	74.452 MPa	33.648 MPa
2	Total Deformation	0.001877m	0.0002382m
3	Shear Stress	2.0885MPa	7.5172 MPa
4	Normal Stress	4.0509MPa	1.3098MPa
5	Biaxiality Indication	0.99008	0.98657
6	Factor Of Safety	1.2424 to 5	2.3879 to 10
7	Mass	432.64Kg	398.85Kg

III.CONCLUSION

According to the finite element method, The newly designed 'I' section Chassis reduce weight as compared to the existing 'C' section Chassis , As raw material required is reduced. The Safer stresses are obtained in new suggested design and increase in Factor of Safety obtained in new suggested design.

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