DESIGN AND ANALYSIS OF TRAILER FRAME

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ABSTRACT

Automotive chassis is an important part of an automobile. The chassis serves as a frame work for supporting the body and different parts of the automobile. Also, it should be rigid enough to withstand the shock, twist, vibration and other stresses. Along with strength, an important consideration in chassis design is to have adequate bending stiffness for better handling characteristics. So, maximum stress, maximum equilateral stress and deflection are important criteria for the design of the chassis. This report is the work performed towards the optimization of the automotive chassis with constraints of maximum shear stress, equivalent stress and deflection of chassis. Structural systems like the chassis can be easily analyzed using the finite element techniques. A sensitivity analysis is carried out for weight reduction. So a proper finite element model of the chassis is to be developed. The chassis is modeled in SOLID EDGE. FEA is done on the modeled chassis using the ANSYS Workbench.

Keyword : - *Design of trailer frame , analysis of trailer frame, modification in trailer frame, modeling in solid edge, analysis in anasys workbench.*

1. INTRODUCTION:-

Automobile frame is the lower body of the vehicle which including the tires, engine, frame, driveline and suspension out of these the frame is a component of vehicle which support the vehicle component, which is placed on it. It should be strong enough to absorb the impact, vibration, bend and other stresses. The appearance of frame should like the side member attaches with multiple cross member. Since the chassis frame is the major component in the automobile vehicle. the convectional design of the trailer frame is based on strength and load. Then given it to increasing stiffness of trailer frame with very little consideration to the weight of the trailer frame. The design of frame with sufficient strength and lower weight provide the motivation of this project. The main aim of the structural design to obtain minimum component weight and satisfying requirement stresses, stiffness etc.

1.1 AIM OF THE PROJECT

To design and analysis for the trailer frame

1.2 OBJECTIVE OF THE PROJECT

The objective of the project are :-
(1) To Design and analysis of trailer frame
(2) To analysis different frame
(3) To Modeling of trailer frame
(4) To analyze the different material for frame
(5) To compare the analytical and software result.

The main purpose of this project is to analysis for different cross-section and different material for the frame. the frame is consist of the side long members, one main long member joined with a series of number of cross-members. The sizes of side long member and cross section , main long member and the cross members becomes the design variables. here the chassis frame is analyze by the FEA method and the frame is develop in the SOLID EDGE software

2. DESIGN CALCULATION :-

Load intensity:

$$p = \frac{GrossladenWeight}{SurfaceArea} = \frac{F}{A}$$

Design for bending stress

$$M_c = (P_1 \times l_1) + \left(\frac{w \times l_1^2}{2}\right)$$

Allowable bending stress,

$$\sigma_{bt} = \frac{\sigma_y}{Factorofsafety}$$

Modulus of section required

$$Z_{required} = \frac{M_C}{\sigma_{bt}}$$

Effective area of web,

$$A_w = d \times t_w$$
$$= (D - 2 \times t_w) \times t_w$$

Average shear stress

$$\tau_\theta = \frac{V}{2 \times A_w}$$

Allowable shear stress

$$\tau_{av} = 0.577\tau \times \sigma_{bt}$$

Check for the deflection:-

Allowable deflection is

$$\delta_{allowable} = \frac{l_1}{325}$$

Maximum deflection occurs at free end

$$\delta = \left(\frac{w \times l^3}{8 \times E \times l}\right) + \left(\frac{P_1 \times l^3}{3 \times E \times l}\right)$$

NOTE:- This Design calculation is done for the all the member which are use in chassis frame.

3. Modeling :-

The modeling are done using solid edge software.

Modeling for the I section frame :-

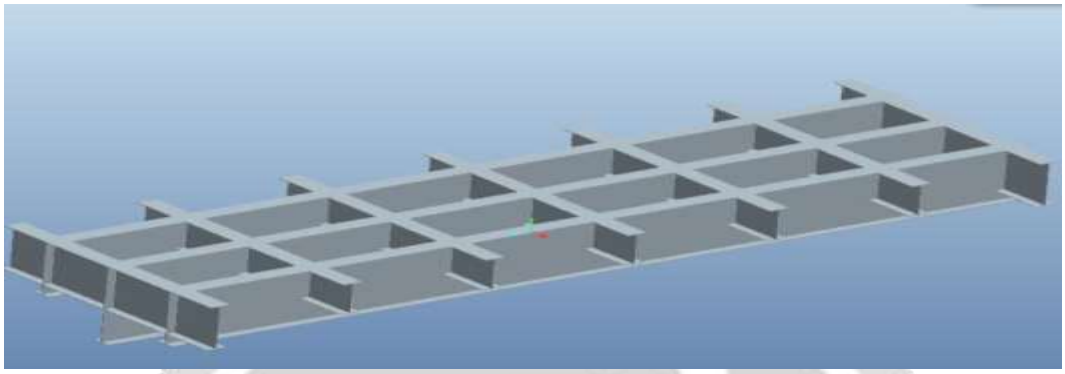

Fig -1: modeling of I section frame

Modelling for C- section frame :-

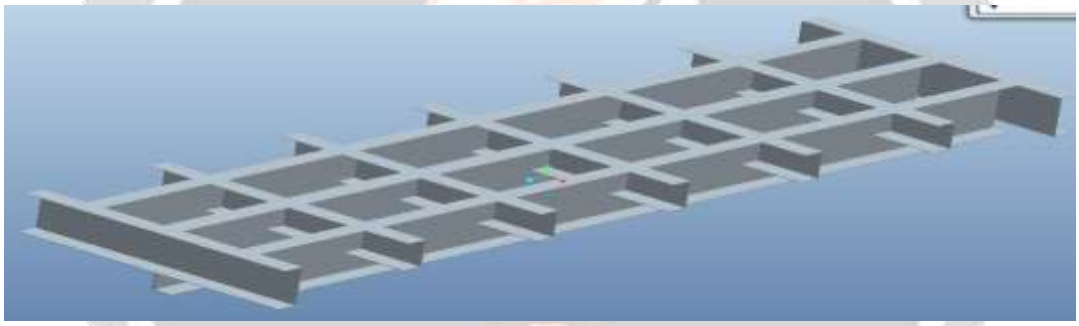

Fig -2: modeling of C section frame

Modelling for box- section frame :-

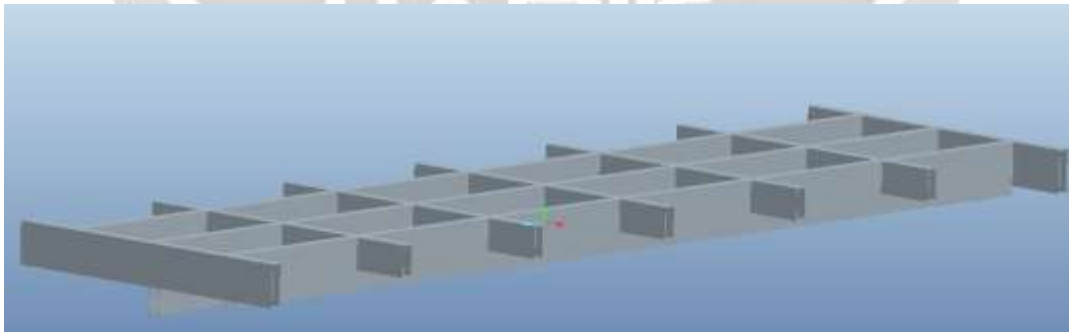

Fig -3: modeling of box-section frame

4.FEA RESULT FOR I-SECTION:-

The FEA Result are done in the ANSYS workbench software.

Applied load and applied fixed support on beam :-

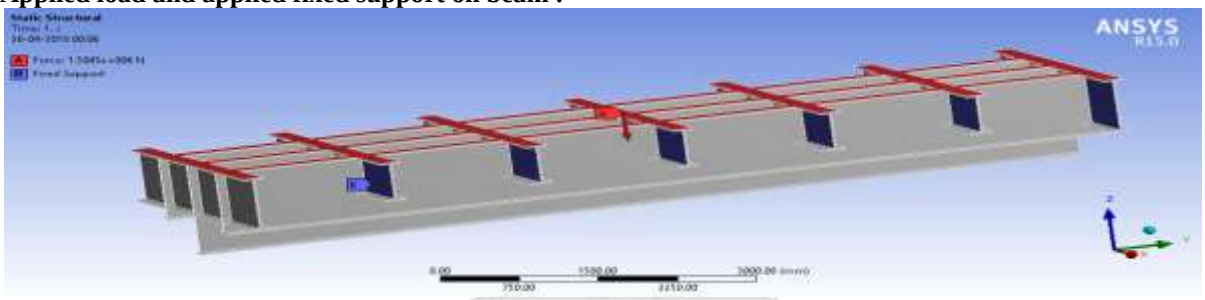

Fig -4: static data of I-section frame

Total deformation in frame:-

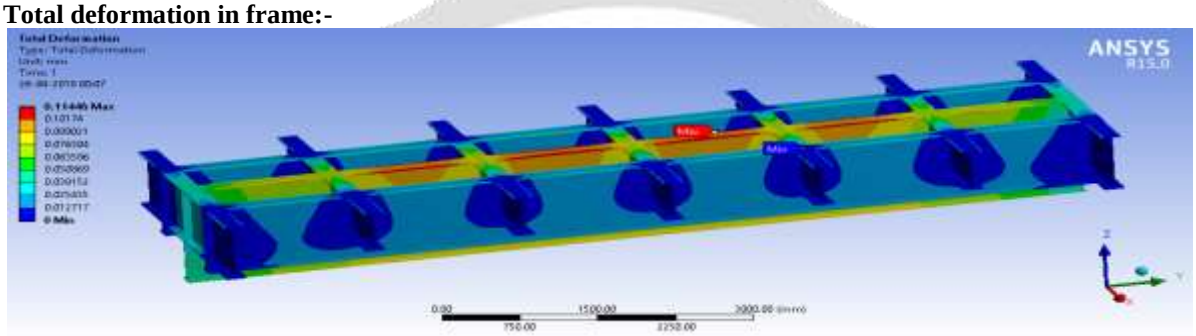

Fig -5: Deformation of I-section frame

Equivalent stress in frame:-

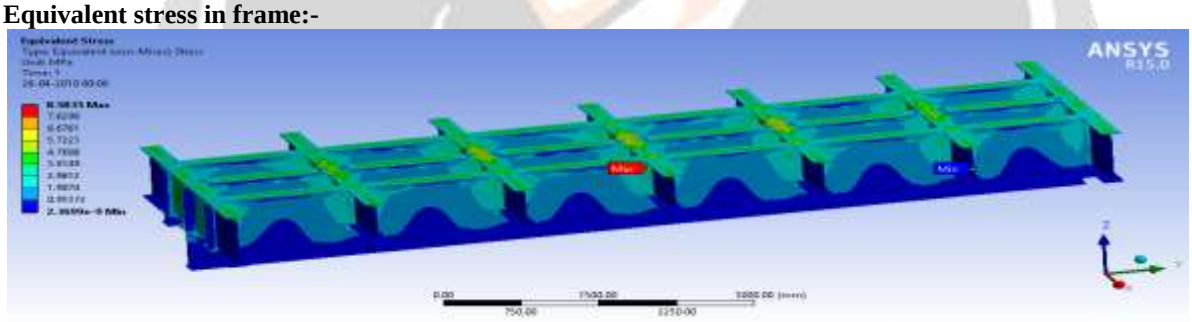

Fig -5: Equivalent stress of I-section frame

Maximum principle stress in frame:-

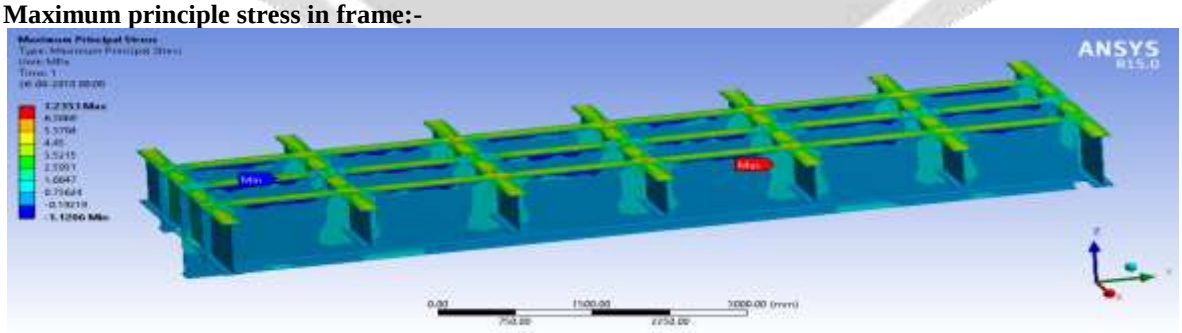

Fig -6: Maximum principle stress of I-section frame

5. RESULT TABLE:-

	Load	MAX. PRINCIPLE	EQUI. STRESS	DEFORMATION
Standard	**1504500**	**18.455**	**26.404**	**0.16855**
20mm thickness		**5.1737**	**4.7702**	**0.03032**
30mm thickness		**5.0575**	**4.6772**	**0.0284**
40 mm thickness		**5.0456**	**4.369**	**0.0195**

6. CONCLUSIONS

After analytical design result and FEA analysis Result we concluded the I section frame is more stiffer than the other Frame and we also change the cross section and material on to the I section And we get the 30% more stiffness design the comparison with the Standards gives the more light weight and 10% more reliable design. And we can also concluded that if the thickness of cross section is increased than the deformation are decreases.

7. REFRENCE

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