DESIGN AND ANALYSIS OF ROLL CAGE

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ABSTRACT

This paper over here deals with design and analysis of a roll cage. The roll cage is just a skeleton of an automobile. It also plays a very important role as a protestant for the driver and the vehicle. Here, design and analysis of a roll cage has been done with respect of various loading tests conducted like front impact, side impact and rear impact. The main focus has been done on the roll cage for improving the performance of vehicle without any failure.

Keywords: ***Roll Cage, Design, Analysis, Front Impact, Side Impact, Rear Impact***

I. INTRODUCTION

The roll cage (frame) is supporting component of automobile vehicle. It is the foundation for carrying the engine, transmission system and steering by means of spring, axles, rubber pads etc. The frame are made of box, tubular channels or U-shaped section, welded or riveted together. A roll cage is a safety feature installed in a vehicle used in environments where there is a high danger of rolling, such as race car driving as well as military and police use. Some cars are specifically designed with this feature installed, while others have had this device installed during a retrofit. The points which were considered while designing the roll cage were safety, ergonomics, market availability, cost of the components and standardization.

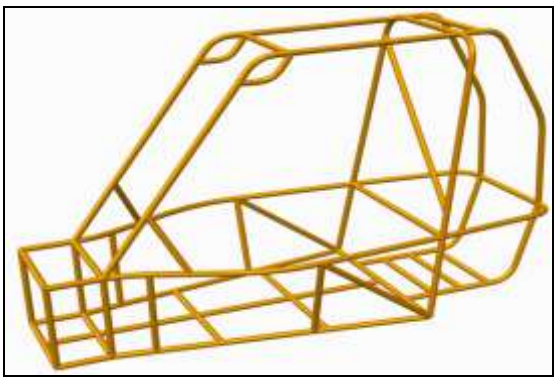

Fig1: Roll Cage Model

II. DESIGN METHODOLOGY

2.1 Development and Design

Design and analysis of the roll cage includes many factors like material selection, cross section and frame design. Material selection is one of the important factors while designing the roll cage as it ensures safety, reliability and performance.

2.2 Material Selection

The frame of the roll cage will be built by using a bent tube construction using pipe bending machine and welded joints. The material used for the frame of the roll cage is structural steel. Structural steel is chosen as it gives high strength, high toughness, high stiffness, etc.

2.3 Roll Cage Function

The main function of the roll cage frame is to provide the mechanical support to different parts of vehicle like engine, tires, suspension systems etc. It provides dynamic stability, strength, strength against vertical bending, and safety of driver against accidents and also acts as a vibration harness agent.

2.4 Roll Cage Analysis

The whole analysis of the design is done by using ANSYS R15.0. By using this software we sorted out various failures with respect to the deformation of the roll cage model. The analysis of the roll cage is done according to the selected parameters such as front analysis, rear analysis and torsion analysis. Following designs are the results of various analyses performed while keeping in mind the resultant of failures.

2.5 Front Analysis and Rear Analysis

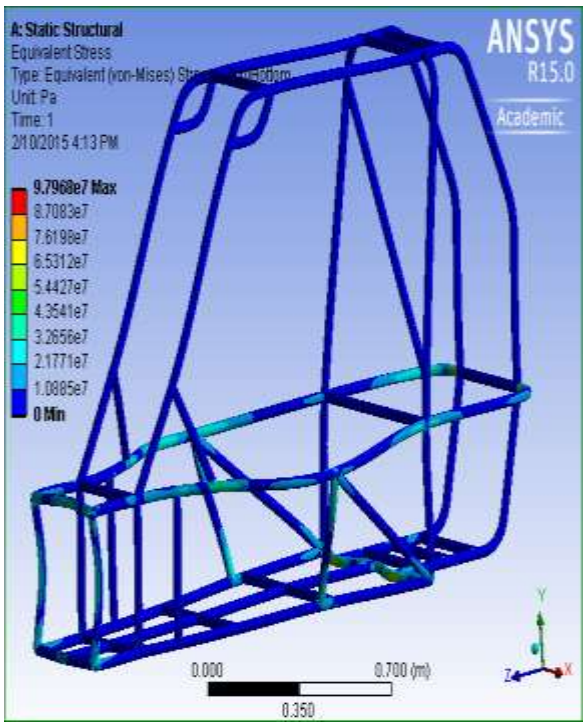

Fig2: Front Analysis of Roll Cage

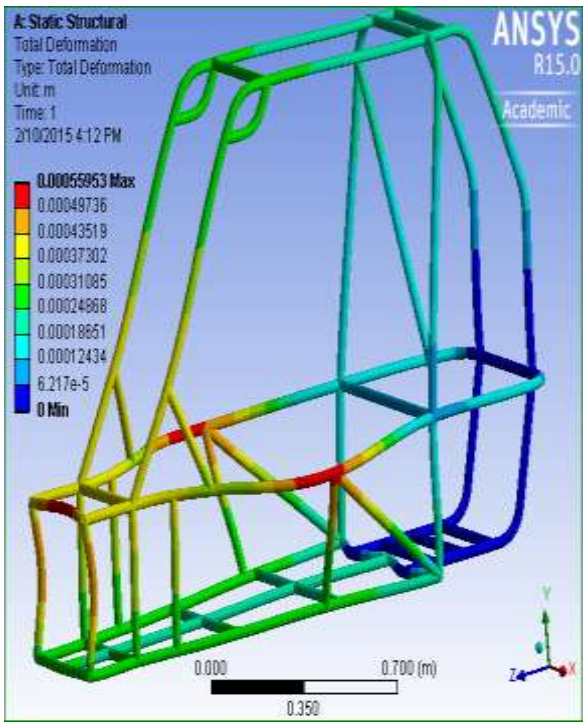

Fig3: Result of Deformation of Roll Cage

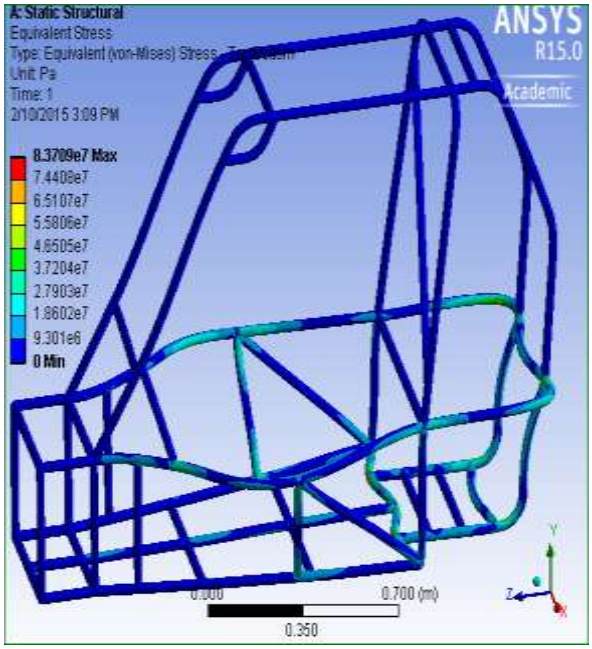

Fig4: Rear Analysis of Roll Cage

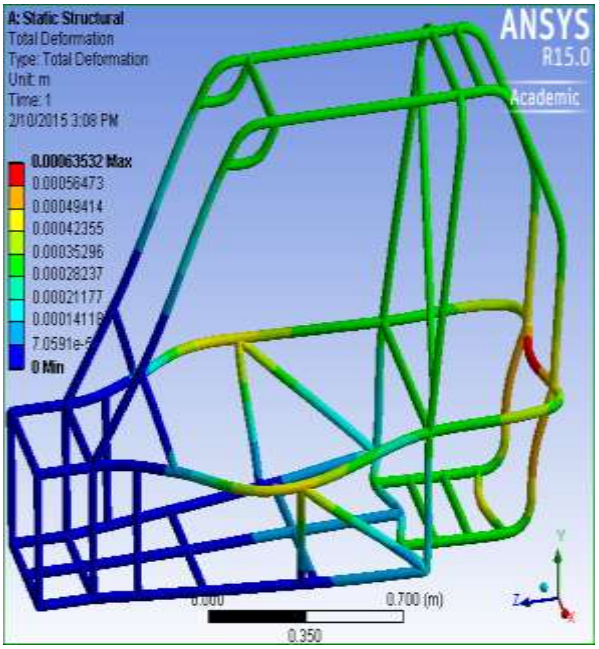

Fig5: Result of Deformation of Roll Cage

2.6 Torsion Analysis

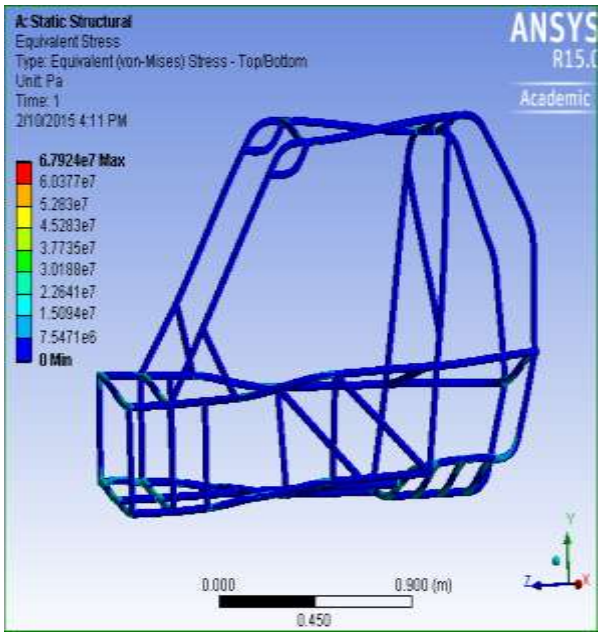

Fig6: Result of the Deformation of Roll Cage

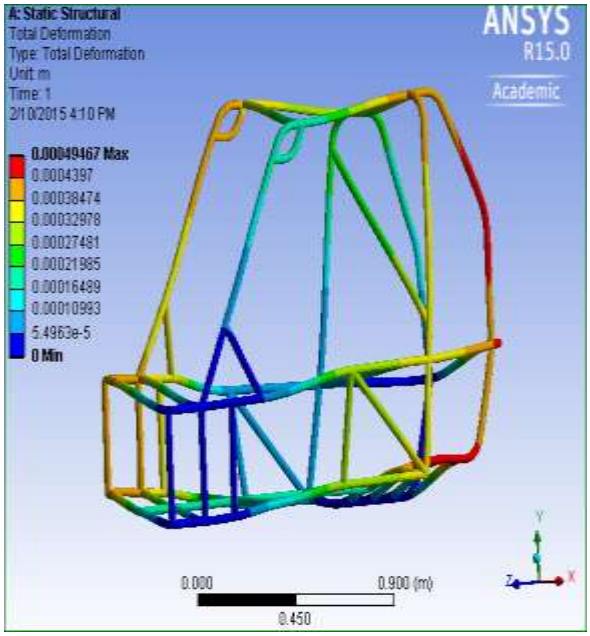

Fig7: Result of Deformation of Roll Cage

III. ANALYSIS RESULT OF IMPACT TESTS

TYPES OF IMPACT TEST	FORCE (KN)	VON-MISES STRESS (MPa)	MAX. DEFORMATION (m)	NO. OF NODES	F.O.S
Front	12	9.7968	0.497	4	
Rear	12	8.3709	0.635	4	
Torsion	12	6.7924	0.494	2	

IV. CONCLUSION

Finally after having lots of study, efforts and observations we came to the conclusion that our project results into light weight compared to other roll cages, reduced space requirements, reduction in material wastage, reduction in cost, multiple usage, easy for implementation, survival in un-ground surfaces and gives safety to the driver for smooth driving.

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