Design and FEA of Go Kart Chassis

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***Abstract*- Chassis is the basic foundation of any Automobile locomotive. Go-Kart is a primary form of the racing car where engineers can make use of theoretical knowledge with practical existence. There are various kinds of chassis out of which Tubular frame chassis are suitable for a small vehicles. The design of chassis is on the basis of rigidity, strength, and safety of driver by considering a car that is durable as well as reliable whose material easily available in India. The kart has been designed using sound design principles. Go-kart is a small four-wheeled vehicle without suspension light-powered vehicle used for racing. Basically, CREO, CATIA, AUTO-CAD software are used for designing of Chassis whereas ANSYS-BENCHWORK software is used for Analysis of Chassis. Chassis is made up of joining various small links by using welding with a limited number of joints so to avoid the increase of weight and make the chassis strong enough to withstand high load.**

Index Terms- Sound; Design Principles; Go-Kart

I. INTRODUCTION

Chassis word derived from French which is divided into two parts, one as running gear and another one is a power plant. Running gear consists frame, steering system, brakes, wheels, and the tires. The power plant includes the engine assembly and power transmission assembly. Important things in chassis are it must be rigid, having high strength, good impact resistance, better rigidity, good compressive and tensile properties within the structure, etc. along with that weight is an effective parameter in case the chassis is for racing purpose. Go-Kart is a good example of that where engineer faces the above problem. Go-kart frame should be enough strong to withstand shocks, twists, and vibrations and all other stress. This Paper deal with the design of Go-Kart Chassis and various loading test like a front-impact test, side-impact test, rare impact test, all these tests have done on ANSYS software by application of 1Ton load. The Chassis is designed to withstand a 1 Ton load by using a limited welded joint so that Chassis doesn't look like a bulky and make it lighter.

II.OBJECTIVE OF PAPER

1. To get knowledge of Go-Kart Chassis Design for a beginner in a stepwise manner so to avoid unnecessary things and focuses on competition.
2. Focusing area of analyzing Software to get the desirable results.
3. To make use of the welding alternative of the hydraulic press.

Use of the welding Principle effectively without increasing the weight of the chassis and make it simple.

III. SCOPE OF PROJECT

1. Go-kart is gaining wide popularity as it is suitable for most of the people to make their own playing car as well as a working car by using their knowledge and competition with others in racing.
2. Making advance engineering Knowledge to use at chassis for making it better and lightweight.
3. Using a variety of material to make better chassis for various applications and mostly for racing purposes.
4. Practice Engineering knowledge with budgeting for making Cost-effective chassis.

IV. METHODOLOGY

For the compilation of project following steps have to be performed:

1. Selection of Material.
2. Material Purchasing.
3. Designing.
4. Analysis.
5. Manufacturing

6. Testing.

V. SELECTION OF MATERIAL

As the project is focusing on manufacturing of Go-Kart chassis for racing purpose so project developed team have followed the material list provided by the Racing organizer and National Event Rule these are as follows:

Table I. Selection of Material

Properties of Material	AISI 1018	AISI 1022	AISI 4130
Modulus of elasticity (GPa)	205	200	210
Carbon content %	0.15-20	0.20-23	0.28-33
Yield strength (MPa)	370	375	435
Ultimate strength (MPa)	440	400	560
Density (Kg/m3)	7.87×103	7.70×103	7.85×103

From Table Material AISI 4130 having desirable properties for chassis, we can clearly see.

We can also use the Hybrid or composite material but the team has to justify their material selection this stage is better for an expert person but for a beginner should avoid it for short time period availability and taken into consideration in case of excessive time.

Cross-section of small link for the chassis formation is given in Rulebook. We can follow that procedure.

VI. MATERIAL PURCHASING

This is the next step followed by Material selection, for this student has sufficient knowledge of the market. Students can fulfill this requirement by surveying the market, use of social media contact, use nonsocial contact, getting help from an expert, etc.

Note: This is a vast Process student or beginner must start this process at the beginning of the project.

VII. DESIGNING

Before going to do design our team has done the theoretical calculation by using engineering knowledge to find out SFD, BMD. After making of rough calculation the team moves towards software designing.

There are various software's are available for design as well as analysis our team has used different software for designing and analysis.

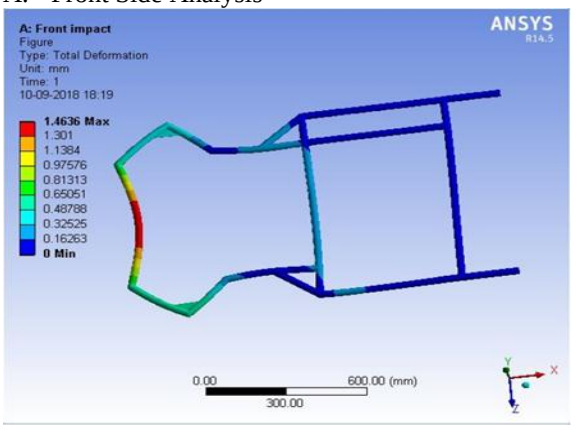
The procedure followed by the team is:

- Drawing a rough diagram on the drawing sheet for a finding of the required dimension.
- Drawing an actual model on SOLIDWORKS as this gives a 3D and 2D view for better understanding.
- Assembled various parts of chassis because of the welded joint.
- Converting the 3D model file into a .stp format for analysis purposes.

VIII. ANALYSIS

Our team has done analysis in ANALYSIS which gives the following Result for the load of 1 Ton:

A. Front Side Analysis



In Front side analysis of chassis, it is clearly seen that after impact major deformation takes place at the side of the bumper and reduced its effect toward chassis.

B. Side Analysis

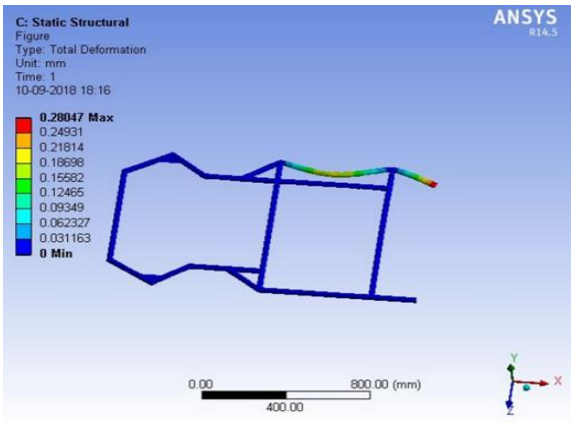


Fig.3. Side Impact Analysis

We can see the same condition happen as in the result of Left Hand Side Impact.

C. Rare Side Analysis

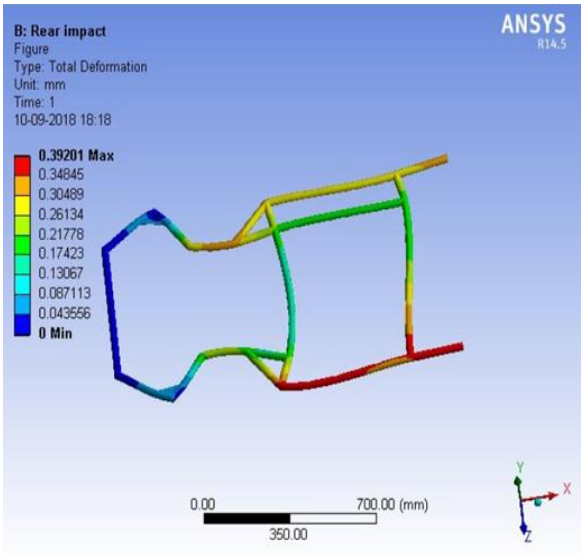


Fig.4.Rare Hand Side Impact Analysis

In the rare side Analysis impact effect if more on end of bumper and less on chassis this means that our chassis is safe in the rare side.

As analysis gives a result which shows chassis is safe from all sides of the impact load of 1 Ton.

Table II. Analysis Result

Analysis Type	Force Applied	Number Nodes	Type of Solution	Min Results	Max Results
Static Structural	10000 N	668675	Total Deformation	0 mm	7.6406 mm
Static Structural	10000 N	668675	Equivalent Stress	0 MPa	59.32 MPa
Static Structural	10000 N	668675	Equivalent Strain	0 mm/mm	0.0038857 mm/mm
Static Structural	10000 N	668675	Life	702.79 cycles	1e6 Cycles
Static Structural	10000 N	668675	Factor of Safety	0.56118	15

IX. MANUFACTURING

Manufacturing is done by Oxy-Acetylene welding on the outer side frame as per heavy part location and Arc welding is used for the inner side.

X. TESTING

Testing is done by applying loads up to design criteria and tests the chassis. We have to find chassis is safe for that load.

XI. CONCLUSION

So we have manufactured Go-kart Chassis with a very simple manner and simple manufacturing technique i.e. welding only. This saves our time and makes our chassis simple which can withstand a load of 1 ton. Chassis have a number of the weld which affects its strength can be overcome by the use of the hydraulic press to make the continuous shape and increase its strength but it results in cost increment.

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