International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 04 Issue: 08 | Aug -2017 www.irjet.net p-ISSN: 2395-0072

Design and Analysis of Go-Kart Chasis According to fsae Constrains

A.P.D.SALMAN BASHA[1], P.CHANDRAKANTH[2], J.SARATH CHANDRA[3]

[1,2,3] *Assistant professor Professor , Dept. of Mechanical Engineering,SSSISE*

---***---

Abstract - Go-Karting is a big craze to the Americans and Europeans. It is initially created in United States in 1950s and used as a way to pass spare time. Gradually it became a big hobby and other countries followed it. In India go-karting is getting ready to make waves. The first criteria have to be consider is that would be certain amount of Rigidity in the chassis but not too much that would reduce the strength of the kart. Therefore, the design will focused on the front end and the middle section of the chassis. In order to ensure that the design of the chassis achieve the standard level. Type of simulation used is Finite Element Analysis (FEA) by using SolidWorks. The purpose of this simulation was implementing to investigate the strength and the flexibility of the chassis. The simulations carried out with several altered parameters for flexibility investigation. The maximum stress of all cases are normally acting upon at the point of the bending parts but the value is under the maximum allowable stress of AISI 4130 steel which is 760 MPa and, but we prefer EN22-MS steel pipe with is 480 MPa and achieved the factor of safety as well.

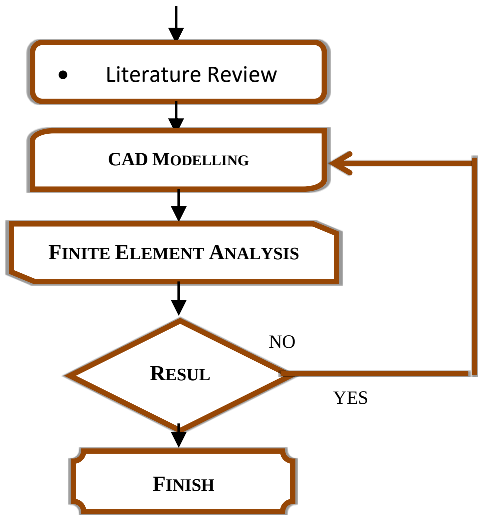
Key Words: Design and Finite Element Analysis (FEA), Formula Society of Automobile Engineers (FSAE), Simulations studies, Design methodology and Prototype.

1.INTRODUCTION

There are many motor sports in the world. Bikes, Cars, Formula one are examples of them. The drivers in these are very professionals and accurate. They can drive it very fast. But there are also motor sports which do not need professional drivers and need no great speed. The vehicles used are also very cheap. Such a motor sport is Go-Karting. They resemble to the formula one car but it is not as faster as F1 and also cost is very less. The drivers in go-karting are also not professionals. Even children can also drive it. Go-karts have 4 wheels and a small engine. They are widely used in racing in US and also they are getting popular now in India. Kart racing is usually used as a low-cost and relatively safe way to introduce drivers to motor racing. Many people associate it with young drivers, but adults are also very active in karting. Karting is considered as the first step in any serious racer's career. It can prepare the driver for highs-speed wheel-to-wheel racing by helping develop guide reflexes, precision car control and decision-making skills. In addition, it brings an awareness of the various parameters that can be altered to try to improve the competitiveness of the kart that also exist in other forms of motor racing.

1.1 Research Design Objective

To develop a design of a go-kart using Formula Society of Automobile Engineers (FSAE) rules and constrains, then studying Finite Element Analysis of the Design through suitable FEA software packages.



- ✓ To develop an optimal design with lost cost.
- ✓ To design dynamically balanced and better endurance go-kart.
- ✓ To evaluate the design using Finite Element Analysis by simulation and studies.

1.2 Major Parts of our Go-Kart

In a Go-Kart, there are mainly six parts.

1. Chassis
2. Engine
3. Steering
4. Transmission
5. Tyres
6. Brakes

1.3 Material Selection Criteria for Design

Chassis - EN22-MS (Chrome steel)
Composition:

Element	Content (%)
Iron	97.03
Chromium	0.8010
Manganese	0.4006
Carbon	0.2800
Silicon	0.1503
Molybdenum	0.150
Sulphur	0.04
Phosphorus	0.035

Table -1: Chassis Composition of EN22-MS

Mechanical Properties:

Ultimate Tensile strength	560 Mpa
Tensile yield strength	460 Mpa
Modulus of elasticity	200 Gpa
Bulk modulus	140 Gpa
Shear modulus	80 Gpa

Table 2: Chassis mechanical Properties of EN22-MS

1.4 Reasons for Selection-

- Good Rigidity
- High Durability
- High Tensile strength
- Max resisting force is 4500N
- Good weldability
- Extreme torsional resistance

4. Design and Finite Element Analysis of Chassis

The vehicle must have four (4) wheels that cannot be in a straight line in longitudinal direction. The vehicle must have a wheelbase within the range of 42 inches to 56 inches. The wheelbase is measured from the centre of contact on ground of the front to rear tires with the wheels pointed straight ahead. The mountings and designing of chassis should be such that there should be minimum 2 inches (gap) clearances between the driver and any component of the vehicle in static and dynamic condition – hands, torso, thigh etc. Body parts making contact with the parts at normal seating position are excluded from the rule.

The following constrains to design a chassis are:

Vehicle Configuration: The vehicle must have four (4) or more wheels not in a straight line. The vehicle may only use one engine of a model specified below. The vehicle must be capable of carrying one (1) person 190cm (75 in) tall maximum weighing 113kg (250lbs).

Maximum Vehicle Dimensions: Width: 50 inches at the widest point with the wheels pointing forward at static ride height. Length: 80 inches from front end to rear end.

Wheel Base and Track Width: Difference between front track and rear track width must not be less than 20% of wider track (Front or Rear). Wheel base must be at least 40 inches with smaller track width (front or rear) not less than 80% of the wheelbase.

3D Sketcher Construction of chassis on Solidwork2012

Figure 1.1 3D Sketch of the Chassis on the Solidworks

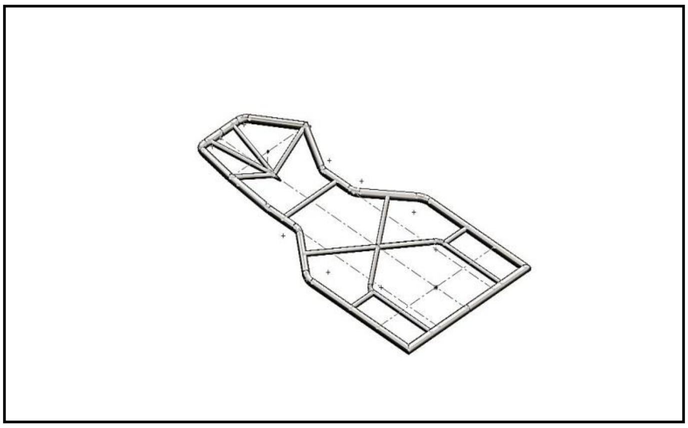
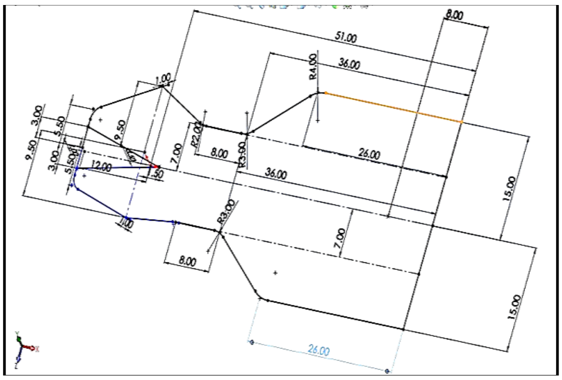
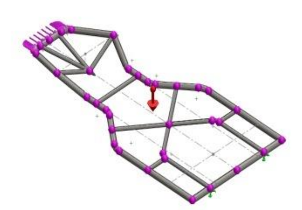


Figure 1.2: Applying weldments and Material to chassis as per requirement on Solidworks 2012





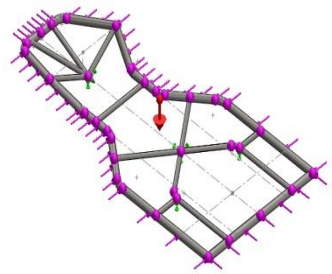
Beam Bodies: Front Impact

Document Name and Reference	Formulation	Properties	Document Path/Date Modified

FINITE ELEMENT ANALYSIS

Simulation of static force by applying 4G load on the chassis:

Figure 1.4: Simulation of Static force by applying 4G load on the chassis – front impact

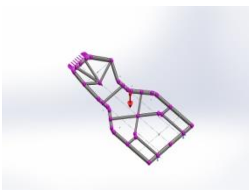


Beam Bodies: Around Impact

Document Name and Reference	Formulation	Properties	Document Path/Date Modified

Figure 1.4: Simulation of Static force by applying 4G load on the chassis - around impact

Load Fixtures

Fixture name	Fixture Image	Fixture Details
Fixed -1		Entities: **2 Joint(s)** Type: **Fixed Geometry**

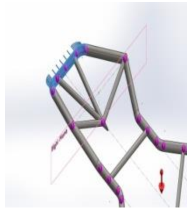
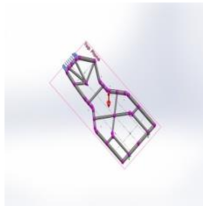
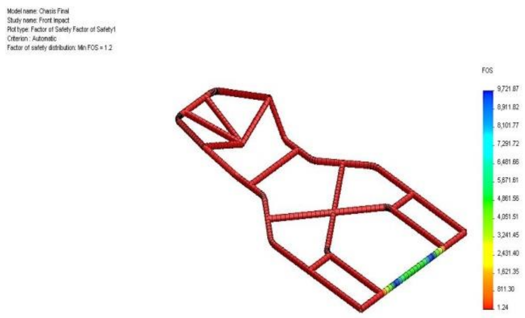
Load name	Load Image	Load Details
Force-1		Entities: **1 plane(s), 4 Beam(s)** Reference: **Right Plane** Type: **Apply force** Values: **---, ---, 4514 N** Moments: **---, ---, --- N-m**
Gravity -1		Reference: **Top Plane** Values: **4 X 0 +9.81** Units: **SI**

Table 1.4:Simulation Study Details of Static force

Name	Type	Min	Max
Factor of Safety- Front Impact	Automatic	1.24427 Node: 139	9721.87 Node: 153



Chasis Final-Front Impact-Factor of Safety

3. CONCLUSIONS

CHASSIS

The chassis has been designed by taking human ergonomics as a priority. In the beginning some previous go-kart chassis and design reports were preferred as it is the first attempt go-kart design. Then moving forward a basic chassis frame of circular pipes of 1 inch diameter and 1.5mm thickness was designed and selected by taking the points of strength, availability and cost into consideration. The chassis dimensions were selected by taking the approachable distances of our driver which began by selecting the wheelbase of vehicle as 42.5 inches, after that the track width of 43 inches i.e. 80% of the wheel base was finalized by taking the placement of transmission, braking and steering were taken into consideration.

FEA - Front impact analysis:-

The vehicle was assumed to be hit by a stationery object while at the speed of 65km/h i.e. 18.055m/s which would create an impact of 4514N at the four corners of the front portion of the vehicle. Assuming the construction of chassis frame to be made by being able to maintain deformation at an impact of 4514N the analysis was done and some changes were made according to it. Only the seat support was assumed to be the fixed potion of the vehicle.

As the main transmission portion, fuel tank, gear box and other important equipment's of the vehicle are placed at the rear portion, the vehicle was analyzed for the impact of 4514N to be able to bear deformation during the collision. Changes were made according to the analysis of the portion.

REFERENCES

[1] Thomas D.G. Fundamental of Vehicle Dynamics.Pennsylvinia: Society of Automobile Engineers (2002).

[2] Wong, J.Y. Theory of Ground Vehicles. 3rd Ed. New York: John Wiley & Son (2011).

[3] Rimin K, Shah, M.S.M., Yusoff, K.A., Hamzah, Z. and Hamidon, M.W., The Go-Kart Design and Construction By Sky-RC Team. Technical Report for Vehicle Dynamics Module. Malaysia: KUTKM (2005).

[4] Milliken W.F. and Milliken D.L., Race Car Vehicle Dynamics, Society of Automotive Engineers (1995).

[5] Johnston B., Vector Mechanics for Engineer-Dynamics, 3rdE McGraw-Hill Ryerson 2009.

[6] Saripuding, S., Yasin, S.M., Mansoor, N. Ismail, R.S. and Ahmad, B., Designing and Building. The Pro-Kart Race Vehicle.Technical Report for vehicle Dynamics Module. Malaysia: KUTKM (2010).

[7] Grieve D. J. (20th January 2006). Errors Arising in FEA. Retrieved 13 April 2011, from http://www.tech.plym.ac.uk/sme/mech335/feaerrors.htm

[8] Kart, T. Company. Retrieved 13 August 2010, from http://www.tonykart.com/uk/tonykart/index.asp

[9] L. Solazzi, S. Matteazzi. (2002). Structural Analysis and Development of a Frame for Kart Competition. Paper presented at the Italian Association for Stress Analysis (AIAS) National Congress 18-21 September 2002, Parma

[10] Moaveni, S. (2003). Finite Element Analysis: Theory and Application with ANSYS (2nd Ed). Pearson Educatoin Inc.

[11] Ing. JornsenReimpell., ing. Helmut Stoll., Dr.-Ing.Jurgen W. Betzler., The Automotive Chassis: Engineering Principles, Butterworth Heinemann (2nd Ed).

[12] Keith J. Wakeham., Introduction to Chassis Design., Mechanical Engineering Undergraduate., (2009).

[13] Matt Lombard., Solidworks 2009 Bible ., Wiley Publishing, Inc. (2009).

[14] David A. Crolla., Automotive Engineering ., BH Elsevier. (2012).