

## DESIGN AND STATIC ANALYSIS OF GO-KART CHASSIS

**PATHELA KASI VISWANADH**

Mechanical-CAD/CAM

Nimra collage of engineering and  
technology jupudi, JNTU Kakinada,  
Ibrahimpattanam, Vijayawada,

**Email id:** [Kasiviwanadh324@gmail.com](mailto:Kasiviwanadh324@gmail.com)

**SRIDHAR KAKARLA**

M. tech, Associate professor

Advanced Manufacturing Systems

**Email id:** [sridharkakarla@yahoo.com](mailto:sridharkakarla@yahoo.com)

**K. KOMALI**

M. tech, Associate Professor

CAD/CAM

**Email id:** [komali10@gmail.com](mailto:komali10@gmail.com)

### ABSTRACT

*A Go-Kart is a small four wheeled vehicles without suspension or differential. It is a light powered vehicle which is generally used for racing. This paper is aimed to model and perform the dynamic analysis of the go-kart chassis which is of constructed with circular beams. They are usually raced on scaled down tracks, but are sometimes driven as entertainment or as a hobby by non-professionals. 'Carting is commonly perceived as the stepping stone to the higher and more expensive ranks of motor sports. Kart racing is generally accepted as the most economic form of motor sport available. 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. Gradually it became a big hobby and other countries followed it. In India go-karting is getting ready to make waves. A racing track is ready in Nagpur for go-karting and Chennai is also trying to make one. Indian companies are also producing Go-Karts in small scale. But to make go-karts popular, the price must come down the design and engineering aspects of making a Go-Kart .This report explains objectives, assumptions and calculations made in designing a Go-Kart.*

### 1. INTRODUCTION

Go-kart is a simple four-wheeled, small engine, single Seated racing car used mainly in United States. They were initially created in the 1950s, Post-war period by airmen as a way to pass spare time. Art Ingles is generally accepted to be the father of karting. He built the first kart in Southern California in 1956. From then, it is being popular all over America and also in Europe. A Gokart, by definition, has no suspension and no differential. They are usually raced on scaled down tracks, but are sometimes driven as entertainment or as a hobby by non-professionals. Karting is commonly perceived as the stepping stone to the higher and more expensive ranks of motor sports. Kart racing is generally accepted as the most economic form of motor sport available. As a free-time activity, it can be performed by almost anybody and permitting licensed racing for anyone from the age of onwards. 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 high-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. We approached our design by considering all possible alternatives for a system and modeling them in CAD software subjected to analysis using ANSYS based on analysis result, the model was modified and retested and a final design was fixed. The design process of the vehicle is based on various engineering aspects depending upon Safety and Ergonomics, Market Availability, Cost of the Components and Safe Engineering Practices.

#### **DESIGN OBJECTIVES OF CHASSIS ARE**

- Provide full protection of the driver, by obtaining required strength and torsional rigidity, while reducing weight through diligent tubing selection
- Design for manufacturability, as well as cost reduction, to ensure both material and manufacturing costs are competitive with other Go-Karts.
- Improve driver comfort by providing more lateral space in the driver compartment
- Maintain ease of serviceability by ensuring that chassis members do not interfere with other subsystems

- Calculation of stresses acting on the chassis of the vehicle under different loading conditions
- The product can prove to be very efficient in all the aspects such as cost, drivability, maintenance, easy usage, safety etc.

#### **2. LITERATURE REVIEW**

*Koustubh Hajare, Yuvraj Shet (2016)* 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 not much speed. The vehicles used are also fewer amounts Such a motor sport is Go-Kart. They resemble to the formula one car but it is not as fast as F1 and also cost is very less. The drivers in go-kart are also not professionals.

*Ammar Qamar Ul Hasan (2015)* A Go-kart is a small four wheeled vehicle. Go-kart, by definition, has no suspension and no differential. 'Carting is commonly perceived as the stepping stone to the higher and more expensive ranks of motor sports. Kart racing is generally accepted as the most economic form of motor sport available.

*Shubham Kolhe , Vrushabh U. Jojode (2016)* A Go Cart also spelled as Go-Kart is a four wheeled vehicle designed and meant for racing only. It is a small four wheeler run by I.C Engine. It is a miniature of a racing car. This report documents the process and methodology to produce a low cost go-kart.

*Kiral Lal, Abhishek O S,(2016)* The chassis is an extremely imported element of the kart, as it must provide, via flex, the

equivalent of suspension to give good grip at the front. Karts have no suspension, and are usually no bigger than is needed to mount a seat for the driver.

**Prof. Alpesh V. Mehta, Mr.Nikunj (2011)** The fiber to take load in the form of a structural element, but the matrix phase only sustains small amount of applied load. In addition, beside the matrix material is ductile; it also protects the individual fibers from mechanical abrasion or chemical reaction with the environment which will cause surface damage.

### 3. METHODOLOGY

The primary objective of the roll cage is to provide a 3-dimensional protected space around the driver that will keep the driver safe. Its secondary objectives are to provide reliable mounting locations for components, be appealing, low in cost, and low in weight. These objectives were met by choosing a roll cage material that has good strength and also weighs less giving us an advantage in weight reduction. A low cost roll cage was provided through material selection and incorporating more continuous members with bends rather than a collection of members welded together to reduce manufacturing costs. The modeling of the roll cage structure is done by using this design and is checked by Finite Element Analysis. We have focused on every point of roll cage to improve the performance of vehicle without failure of roll cage. We began the task of designing by conducting extensive research of Go-Kart roll cage through finite element analysis.

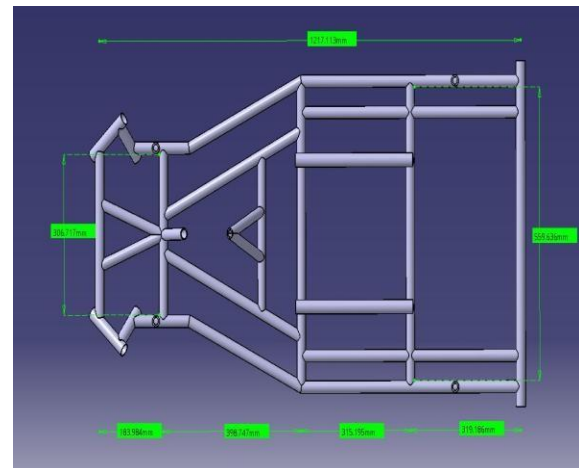


Figure 3.1: Chassis with dimensions

Finite Element Analysis Structural integrity of the frame is verified by comparing the analysis result with the standard values of the material. Analysis was conducted by use of finite element analysis FEA on ANSYS software. To conduct finite element analysis of the chassis an existing design of chassis was uploaded from the computer stresses were calculated by simulating three different induced load cases .The load cases simulated were frontal impact, side impact, and rear impact. The test results showed that the deflection was within the permitted limit.

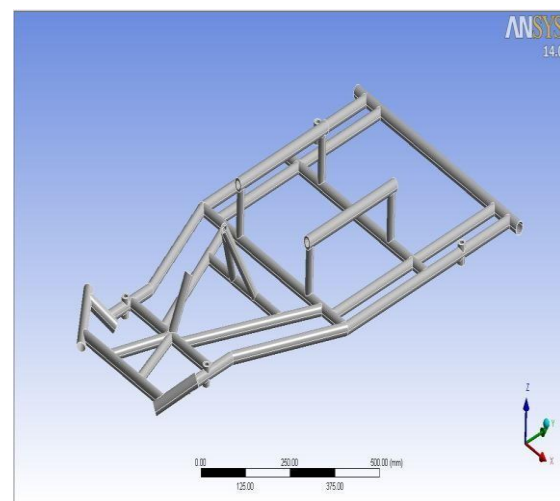


Figure 3.2: Go-Kart Frame in Ansys

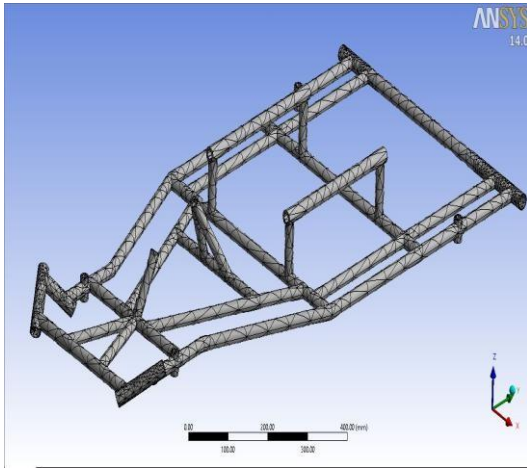


Figure 3.3: Meshing model

Roll Cage is a skeleton of any vehicle which is used to provide support and mounting points for primary and secondary systems of vehicles. For Go-Kart the main consideration in design of roll cage is that due to no suspension it should have flexibility which will be act as suspension while in motion. For that the cross section of material chosen is of pipe cross-section which will have high strength with flexibility also so from survey we got 2 materials as per the requirements which are AISI 1018, AISI 1045 Every material having own specifications and properties which are making it proper to use but we chose AISI 1018 as having good strength with flexible in nature against the load.

Properties Material	AISI 1018	AISI 1045	AISI4 130	Aluminum alloy
Modulus of Elasticity (Gpa)	<b>205</b>	<b>200</b>	<b>210</b>	<b>71</b>
Caron Content %	0.15-20	0.20-23	0.28-33	0.20-27
Yield	370	375	435	280

Strength (Mpa)				
Ultimate Strength (Mpa)	440	400	560	310
Density (kg/m <sup>3</sup> )	7.87 x103	7.70 x103	7.85x 103	2770

Table 3. 1: Materials used and their properties

Cost, availability, weight, strength & weld ability are the four key factors which determine the material selection. Tubing is available in standard fractional sizes to the 1/8th of an inch: 1, 1.12, 1.25 and 1.5. The wall thickness is limited to the common Birmingham Tubing Gauges.

#### 4. STATIC STRUCTURAL ANALYSIS RESULTS

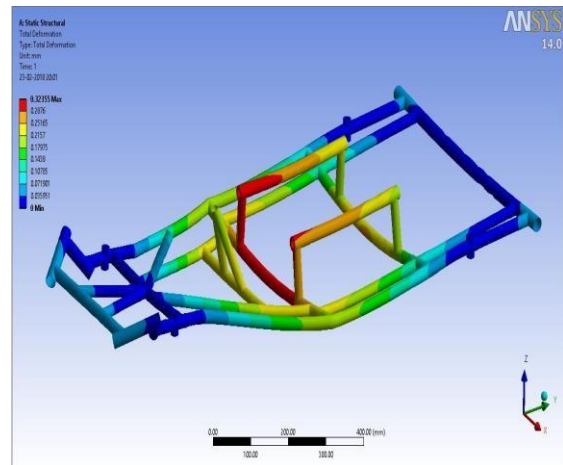


Figure 4.1: Total deformation of AISI 4130 material

From the above image, frame which has AISI 4130 material shows the total deformation, when we applied 150kg of load on it. When we right click on the ANSYS solution, number of options that are available, and those options has deformation, stress and strain. Also, we can gain the values in different values. In

these values, resultant deformation is selected, and can see in the above image. In these the color red shows maximum deformation. The dark blue shows minimum deformations. The minimum deformation of the frame is observed in the bottom place, because we have applied the all degree of freedom fixed at the bottom of the sole. And also we can get maximum deformation on the top of the sole which is shown in the red color, and the value is 0.32353mm of deformation

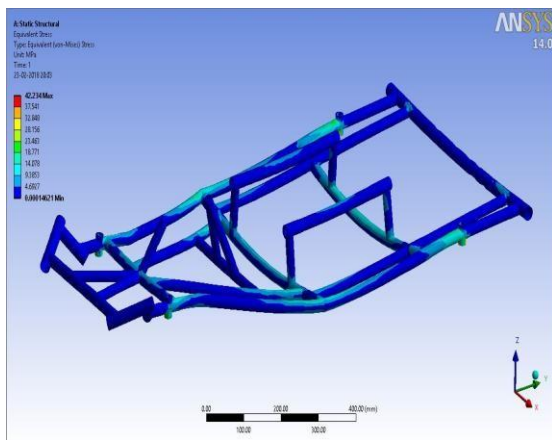


Figure 4.2: Stresses at Shoe sole using AISI 4130 material

The above image shows the Von-Mises stresses of AISI 4130 material frame. Generally these stresses also called as resultant stresses. These stresses of the frame should be below the yield limit of the particular material. The above image shows stresses while we apply 150kg of load. The maximum stresses are observed at the edge corners of the base that we constrained. The stress value of the frame is 42MPa which is lower than the yield stresses of the material.

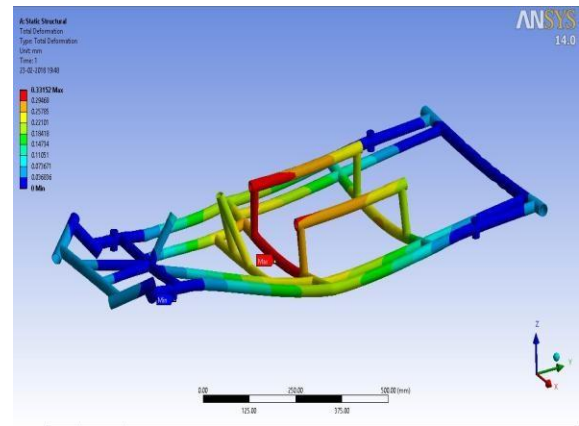


Figure 4.6: Total deformation of AISI 1018 material

The above image shows the total deformation of the frame using AISI 1018 material. In this image, red color shows maximum deformation, whereas the dark blue shows, minimum deformation. The maximum deformation occurred at the top side edges of the frame. The value of deformation is 0.33152 mm and the minimum deformation occurred at the top frame ends.

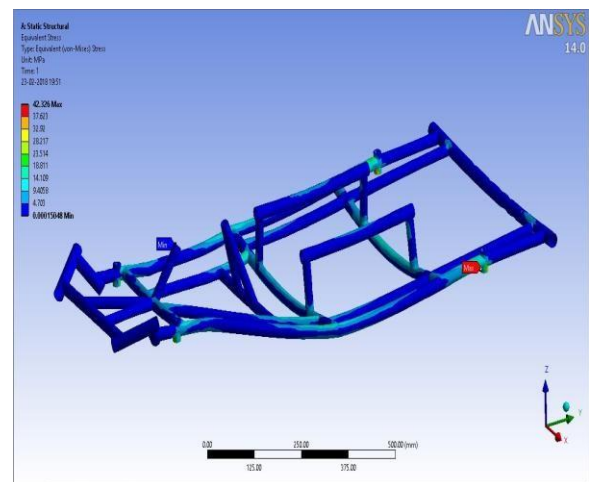


Figure 4.7: Stresses in AISI 1018 material frame

The above image shows, maximum stresses present in the frame using AISI 1018 material. When we applied 150kg load on the frame, red color indicates

maximum stresses and dark blue indicates minimum stresses. The maximum stresses are seen in the bottom corner edges of the frame where constrained. But the values are below the yield material. The minimum stresses are seen throughout the image, and the maximum stress value is 42.326 MPa.

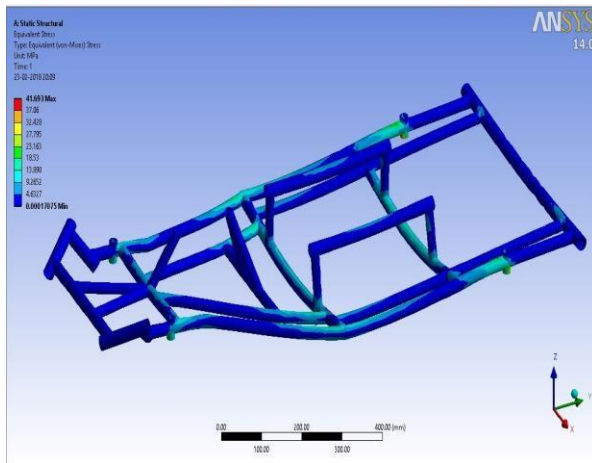


Figure 4.11: Stresses in the frame using Aluminum material

We applied a load on the frame of AISI 1045 material of about 150kg as seen in the above image. Like other materials, stresses occurred in the corners parts of the frame where constrained but there is very negligible change in the stress value when compared to that of other material. The maximum stress value is 42.326MPa. The minimum stresses are seen in most of the areas of the frame.

## 6. CONCLUSION

Static analysis using finite element method was successfully carried out to determine maximum deflection and its location on chassis structure. The results of analysis revealed that the location of maximum deflection agrees well with theoretical maximum location of simple beam. This

study found out that there is not much difference in the values for Low Carbon Steel materials and Aluminum material. So depending upon the design and requirement either of the material can be used. The designed go-kart is able to withstand against any adverse condition on road as each component is designed specifically considering all types of failures and safety issues; it is the best vehicle for racing on circuit.as there is no suspension used in kart roll cage id designed in such a way that it having maximum flexibility in slight twisting motion to accommodate the role of suspension while turning and other twisting motions.

## FUTURE SCOPE

As of now, Go-Karts are only used for recreational purposes in India. But there are Automobile manufactures which produce high performance Go-Karts which are street legal. For example, Ariel Atom manufactured by Ariel Motor Company and KTM X-Bow manufactured by KTM. So in future, Go-Karts can be used as a people's mover, which are safer and gives high comfort.

## REFERENCES

- [1] Koustubh Hajare, Yuvraj Shet, Ankush Khot, "A Review Paper On Design And Analysis Of A GoKart Chassis", IJETMAS, Volume 4, ISSUE 2, ISSN 2349-4476, February 2016.
- [2] Ammar Qamar Ul Hasan, "SIMULATION OF ATV ROLL CAGE TESTING", IOSR-JMCE, e-ISSN: 2278-1684, P-ISSN: 2320-334x, Volume 12, Issue 3 Ver. Ii, Pp 45-49, May. - Jun. 2015
- [3] Shubham Kolhe , Vrushabh U. Jojode, "ROLL CAGE DESIGN AND ANALYSIS FOR FORMULA STUDENT RACE CAR", IJESRT, ISSN: 2277-9655, July 2016.



[4] Ravindra Laxman Gaikwad, Prathmesh Vishwas Waghmare, Lalit Daulatrao Deore, Akshay Mukesh Mutake, Design of Go-kart vehicle system, International Journal of Advanced Technology in Engineering and Sciences, Vol.No.4., Issue No.03,ISSN 2348-7550, March 2016.

[5] Koustubh Hajare, Yuvraj Shet, Ankush Khot, A Review Paper on Design and Analysis of a Go-Kart Chassis, International Journal of Engineering Technology, Management and Applied Sciences, Volume 4, Issue 2, ISSN 2349-4476, February 2016.

[6] Anjul Chauhan, Lalit Naagar, Sparsh Chawla, Design And Analysis Of A Go-Kart, International Journal of Aerospace and Mechanical Engineering, Volume 3 – No.5, ISSN (O): 2393-8609, September 2016.

[7] Abhinay Nilawar, Harmeet singh Nannade, Amey Pohankar, Nikhil Selokar, Design of Go-Kart, International Journal for engineering Applications and Technology, ISSN: 2321-8134.

[8] D.Raghunandan, A.Pandiyan, Shajin Majeed, Design and Analysis of Go-Kart Chassis, international journal of engineering sciences & research technology, volume: 3.00, ISSN: 2277-9655, November 2016.

[9] Kiral Lal, Abhishek O S, Design, Analysis and Fabrication Of Go-Kart, International Journal of Scientific & Engineering Research, Volume 7, Issue 4, ISSN 2229-5518, April-2016

[10] Prof. Alpesh V. Mehta, Mr.Nikunj Padhiar, Mr.Jaydip Mendapara, Design and Analysis of Hybrid Go-Kart, International Journal of Advanced Engineering Technology, Vol 2, Issue 1, E-ISSN 0976-3945, /January-March 2011

[11] Aritra Nath, C.Jagadeesh Vikram, Lalchhanchhuah, Lalrinsanga, Lamphrang Nongrum & Philic Marboh, Design and fabrication of a Go-kart, International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Issue 9, ISSN: 2319-8753, September 2015.