

Design & Development of Go-Kart

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Abstract— Go-kart (a simple racing car) is not a factory made product. It can be made by Mechanical and Automobile engineers for racing competitions. Go-kart emerged in India from MRF, which has 250cc, two stroke engine producing 15 bhp. This costs around 3 lacs. Lately the craze of go-kart has been on a rise in India along with many racing competitions held all over India. Design and development project of simple go-kart has been undertaken by developing chassis formed by hollow circular pipe powered by Briggs and Stratton 190cc engine, fitted with single disc brake mounted on rear axle. There is no suspension, therefore chassis have to be more flexible to work as suspension and stiff enough not to break or give way to turn. The speed of the vehicle is 40 kmph. The developed go-kart was participated in an event Elite Go-Karting held by Elite Techno Groups at RPM International Go-Kart Racing Circuit, Bhopal. Developed go-kart is found economic, compact, light-weight and easy to drive kart.

Keywords — Go-kart (racing car), Generator engine, Efficient..

1 INTRODUCTION

THERE are many motor sports vehicle in the world such as bikes, cars, Formula One cars. The drivers in these are very professionals and skilled. They can drive the vehicle very fast.

But there are also motor sports which do not require professional drivers and also no great speed. This need is fulfilled by a very cheap vehicle named as go-kart. They resemble to the Formula One cars but it is not as faster as F1. Even children can also drive it. Go-karts have four wheels and a small engine. They are widely used in racing in US and are also getting popular in India.

American Art Angels is generally accepted to be father of karting. A veteran hot rodder and a race car builder at Kurtis Kraft, he build the first kart in southern California in 1956. It becomes instantly popular and spread rapidly to other countries. The first kart manufacturer was an American company – Go Kart Manufacturing Co. (1958). In 1959, McCulloch was the first company to manufacture engines for kart.

Go-kart emerged in India in 2003 through MRF. It was a new invention in motor sports and expensive too. It was not much known to common people in that period. Nowadays it becomes a public attraction as new transformations came into the vehicle. Till date go-kart is the most known popular and cheapest motor sports car as compared to Formula One car and ATV (All Terrain Vehicle).

Go-kart comes in all shapes and forms, from motor-less model to high powered racing machines, like super-karts, being able to beat racing car on long circuits. Go karts used in amusement parks can be powered by four stroke engine or electric motors, while racing karts use small two stroke or four stroke engines.

Most of them are single seater but recreational models can sometimes accommodate a passenger. Go-kart, by definition, has no suspension and no differential. They are usually raced on scale 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. As a free time activity it can be performed by almost everybody.

2 METHODOLOGY

2.1 Assumptions used in design

- Length and width of chassis must be around 70" and 50" respectively.
- Weight of vehicle around 100 kg.
- Engine of 100-200cc and 4.5 bhp.
- No differential is required.
- Ground clearance minimum 4".
- Gear ratio approx. 1:2.5 to get initial torque.
- Steering ratio 1:1.
- To accommodate a driver of height 110cm.

2.2 Design Elements Of GO-KART

a) Chassis

Chassis is an extremely important element of the kart. Generally it is made of square steel tubes of different grades. But strong hollow circular SAE rated pipes has been used from economic and light weight perspective. size of the chassis developed is 67"×48"(length×breadth).

Following components are mounted on chassis –

- Engine having 190cc developing 4.5bhp.
- Transmission system consisting of chain, sprocket and rear axle with axle hangers.
- Tyres.
- Brakes.
- Steering assembly.

b) Engine

An engine of go-kart is usually a small around 100-200cc. Since there is only requirement of power and not the mileage, Briggs and Stratton 190cc, two stroke engine developing 4.5bhp is used.

c) Steering Assembly

Go-kart steering can be complex, overwhelming and a source of major problems in the complex design of go-kart.

There are many ways of making a steering assembly in go kart like Ackermann and Bogie steering system. The simplest, easiest go-kart steering mechanism of 1:1 ratio has been used.

d) Transmission

Transmission means the whole of the mechanism that transmits the power from the engine crankshaft to rear wheels. In this vehicle the power from the engine is transmitted to rear wheels using chain and sprocket mechanism. The driver sprocket has 12 teeth and driven sprocket has 44 teeth. Usually go-karts do not have differential. Chain drive has been used because it is capable of taking shock loads.

Centrifugal clutch has been used in the kart to avoid direct acceleration after starting the engine.

e) Tires

For go-karts, wheels and tyres are much smaller than those used on a normal car. The tyres will have increased grip and can withstand high temperature. In this kart, two tires having 5.5" diameter for front and 7.5" diameter for rear are used. The tyres must have pressure of at least 16 psi.

f) Brake

Typically, go karts have single rear drum brakes, which is situated on the rear axle. The brake will be capable of stopping the kart running in 40 kmph. For this purpose, single disc brake directly attached to rear axle has been used.

g) Kill Switch

Kill switch is a device used for stopping the ignition. Electric kill switch directly connected to engine was used.

3 DESIGN SPECIFICATIONS

The material SAE 1018 is used in the frame design because of its good weldability as well as good manufacturability. A good strength is required because the roll cage needs to absorb as much energy as possible to prevent it from fracturing at the time of high impact.

Sr. No.	Properties	Values
1.	Ultimate Tensile Strength	450 MPa
2.	Yield Tensile Strength	380 MPa
3.	Bulk Modulus	200 GPa
4.	Shear Modulus	80 GPa
5.	Poisson's Ratio	0.29

Table 1: Material properties

4 ANALYSIS OF CHASSIS

4.1 Front Impact Analysis:

Considering $M = 180 \text{ kg}$; $V = 64 \text{ kmph}$ and $F = 6648.32 \text{ N}$

Fig.1 shows ANSYS result after applying the calculated force on front part of the frame by keeping the rear part fixed.

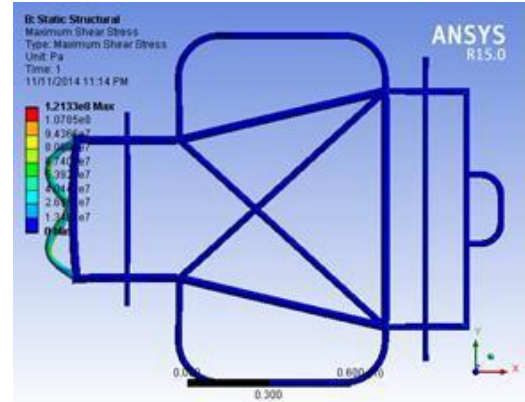


Fig 1: Structural Analysis of Front Side

4.2 Side Impact Analysis:

$V = 48 \text{ kmph}$;
 $F = 3458.25 \text{ N}$

Fig.2 shows ANSYS results after applying the calculated force on right side of the frame by keeping the left side fixed.

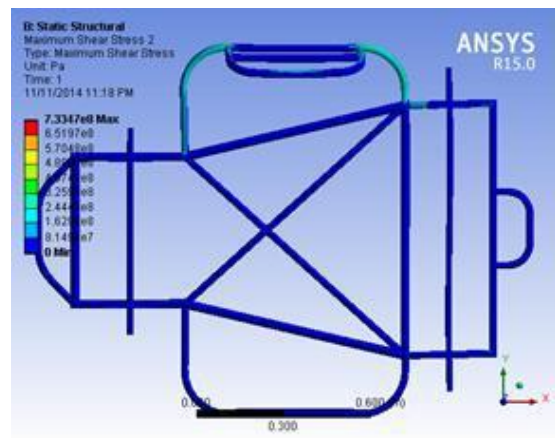


Fig 2: Structural Analysis of Right Side

4.3 Rear Impact Analysis:

$V = 50 \text{ kmph}$
 $F = 3484.5 \text{ N}$

Fig.3 shows ANSYS result after applying the calculated force on rear part of the frame by keeping the front part fixed.

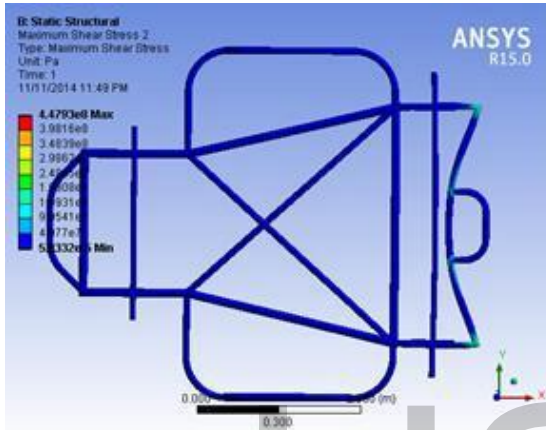


Fig 3: Structural analysis of Rear Side

After analyzing the results of ANSYS for applied loading on the chassis, it is found that the developed chassis design is safe. Fig.4 shows the developed model of Go-Kart after implementing all design considerations.



Fig.4 : Developed Model of Go-Kart

5 PRECAUTION

- Engine oil should be replaced after every 500 km of running.
- The nuts and bolts should be properly tightened.
- The air filter should be checked from time to time and replaced accordingly.
- For protecting the kart from atmospheric corrosion paints are applied.

6 RESULTS AND REVEALS

The various experimental runs has been conducted on the developed go-kart and following results are obtained

- The vehicle runs at a speed of 40 kmph.
- The vehicle stops within a range of 1 meter after applying the brakes.
- It is a light weight and compact vehicle.

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