DESIGN OF A GO KART VEHICLE

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ABSTRACT

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 cars 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 in India. 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. 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. MRF and Indus motors are the major bodies in karts and they are offering karts between 2 lakh and 3 lakh. But to make go-karts popular, the price must come down. For that, many people are trying to build one under 1 lakh and we had also take up the challenge and make our under 78 K. This is a dream come true. A go-kart just under Rs. 100000/-. So we are sure that our project will have a high demand in the industry and also we are hoping to get orders from the racing guns.

This paper concentrates on explaining the design and engineering aspects of making a Go Kart .This report explains objectives, assumptions and calculations made in designing a Go Kart. The design is chosen such that the Kart is easy to fabricate in every possible aspect.

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 Go-kart, 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 8 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 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. 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.

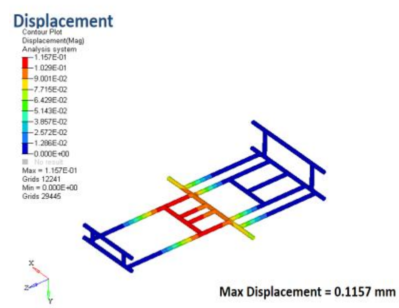
GO-KARTS IN INDIA

Home of go-karts in India. Many people take part in the racing and is getting popular. Go-karts emerged in India in 2003 from MRF, which has a 250cc two-stroke engine, which produce 15 bhp of power, which costs around 3 lakh. Indus motors are also offering Go-karts for 1 lakh to 3 lakh. There are racing tracks in Nagpur for go-karting, which is known as the home of go-karts in India. Many people take part in the racing and is getting popular.

PARTS OF A GO – KART : In a Go-Kart, there are mainly six parts. They are 1. Chassis, 2 .Engine, 3. Steering, 4. Transmission 5. Tiers 6. Brake, and 7. Electric Starter.

SYSTEMS USED IN A GO – KART:

Like every automobile, go-karts also have various systems. Mainly there are 4 systems in this kart. Fuel system ,Ignition system, Lubrication system and Cooling system. Engines. Generally, there are two main types of cooling system. Water cooling and air-cooling. In twostroke petrol engine, air-cooling system is employed.



OUR WORK HAS BEEN DIVIDED INTO FOLLOWING GROUPS.

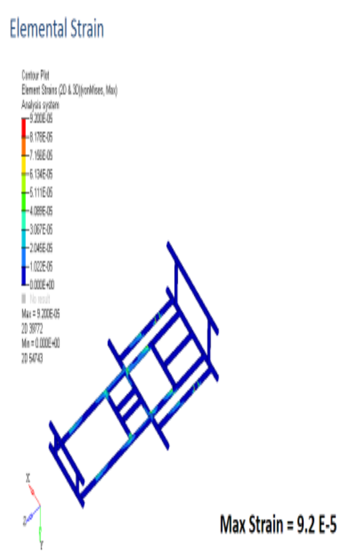
- **Design**
- **Engine and**
- **Transmission**
- **Steering**
- **Brakes**

First of all, the chassis is constructed. The GI pipe is taken as per dimensions and bends in required places using bending machine. Then the pipes are welded rigid

DIMENSIONAL SPECIFICATIONS

Round tube of dimension = 24mm OD

Thickness = 2mm Round hollow tubes are light in weight are used. The fabrication is done on Lathe Work, Cutting, Drilling, Milling, Shaping ,



Grinding, Polishing, Finishing, Welding

Using the gross weight of the vehicle is 120kg

The impact Force was calculated

Maximum stress induced: 23.13 Mpa ,max strain = 9.2 e-5,

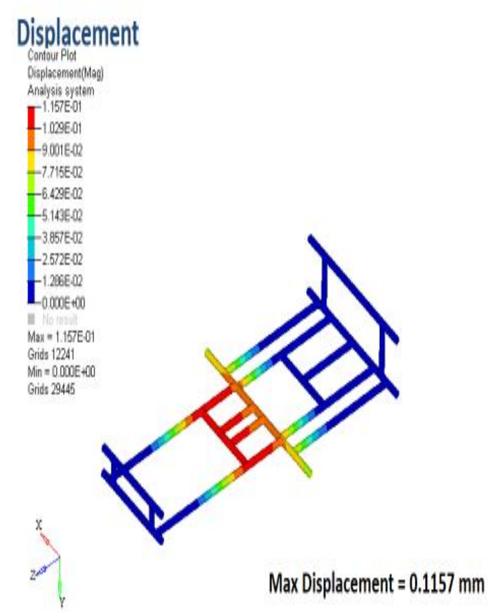
Max displacement :0.1157mm

Wheel Hub Analysis

The following are the considerations took for the design of wheel hub for 24 mm shaft :Material: Mild Steel Braking torque: 905N-m Load: 1000N Maximum stress : 160Mpa Yield strength: 180Mpa
Factor of safety: 1.15

Disc Hub Analysis

The following are the considerations took for the design of



wheel hub for 24 mm shaft:Material: Mild Steel Braking torque: 905N-m

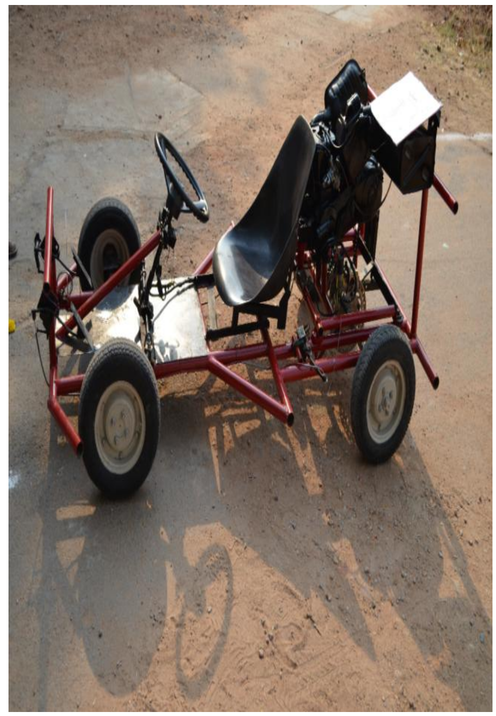
Load: 1000N Maximum stress: 140Mpa Yield strength: 180Mpa Factor of safety: 1.37

DESIGN PARAMETERS

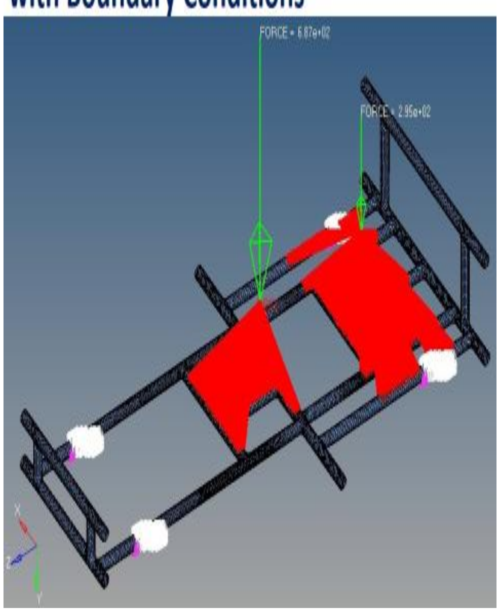
Engine Displacement (cc)	98 cc
No. Of cylinders	1
Type of Fuel	Petrol
No. Of Strokes	2
Maximum power (bhp)	7.7 bhp @ 5600 rpm
No. Of gears / variator	Variator
Max. Torque	1.0 kgm @ 5000 rpm
Overall Length (mm)	1650
Height (mm)	710
Wheel Base (mm)	1270
Ground Clearance (mm)	203
Kerb Weight (kg)	120
Fuel tank capacity	1 litre
Brake	Drum
Type of cooling	Air cooling

STEERING SYSTEM

Mechanical arrangement is planned to be used this type of steering system was selected because of its simple working mechanism and a steering ratio of 1:1 so to simple we have used mechanical type linkage.



Meshed / Descretized Model of GO-KART with Boundary Conditions



STATIC STRENGTH EVALUATION

Our steering geometry is having 99% Ackerman and also gives **60degree** lock to lock turn of steering wheel which is very suitable for the race track as it allows quick turns with a small input and being more precise at the same time. We also attain a perspective turning radius of 2.37meter.

COMPONENTS AND DIMENSIONS

Tie Rod 14 inch x 0.5 inch ϕ, King-Pin 3 inch x 1.5 inch x 11mm ϕ, Bracket 3.5 inch x 2.5 inch x 0.5 inch 1 inch x 2 inch x 10 mm ϕ, Pit-man arm Bolt10 mm ϕ, Steering shaft 20 inch x1 inch ϕ, Steering wheel 10 inch ϕ

According to the Ackermann geometry the front tyres will rotate about the mean point as a result the entire force will act on the outer front tyre on a corner. Thus the cornering traction will be primarily governed by the outer tyre.We have chosen the mechanical linkage because it is cheap, light in weight and easy to manufacture.

CONSIDERATIONS FOR STEERING SELECTION

Caster Angle 12 degrees
Camber Angle 0 degrees
King pin Inclination 10 degrees
Combined Angle 10 degrees
Toe-in 5 mm
Scrub Radius 9 mm
Minimum Turning Radius 1.15 m
Maximum Turning Radius 2.89m

CALCULATIONS

Discs, calipers and master cylinders which were used for considering suitable vehicle after market survey

Inner lock angle (θ) = (total steering wheel rotation * 360) /steering ratio = 50 degrees

Outer lock angle(ϕ)= cot ϕ – cot θ= w / l = 32degrees

Ackerman angle calculation: Tan α = (sin ϕ – sin θ) / (cos ϕ +cos θ – 2) = 40 degrees

Ackerman inside angle: Ψ = tan-1 (WB / (WB / tan ϕ – TW)) – ϕ= 14 degrees

Ackerman percentage: %Ackerman = ((inside angle - outsideangle) / (Inside 100% Ackerman)) * 100% = 99.97%

Turning Radius(R max) Calculation R min = length of wheel base / tan θ = 1.15m

R max 2= [R min + Wheel track width] 2 +Length of wheel base 2] = 2.89 m

BRAKING SYSTEM

The **braking system** has to provide enough braking force to completely **lock the wheels** at the end of a specified acceleration run, it also proved to be cost effective. The braking system was designed by determining parameters necessary to produce a given deceleration, and comparing to the deceleration that a known braking system would produce.

Considerations for braking system selection:

Master cylinder Dia. 10 mm Caliper piston diameter 25.4 mm Brake Pedal Lever ratio 4:1 Stopping distance 2.237 m

CALCULATIONS:

1. Gross weight of the vehicle W = weight of the vehicle (with load conditions) in kgs * 9.81= 120*9.81=1177.01 N

2. Brake line pressure: p = force on the brakes / area of master cylinders (as pedal ratio is 4:1)
(Assume the normal force applied on the pedal: 300n) =pedal ratio *force on the pedal / area of master cylinder
= 4*300/(π/4)*(0.01)2 = 15.28mpa
3. Clamping force (CF): Cf= brake line pressure *(area of caliper piston*2) = 15.28*((π / 4) * (25.4 * 10-3) 2 * 2)
= 16384.625N
4. Rotating force:
RF = CF* number of caliper pistons * coefficient friction of brake pads
=16384.625N *0.3*2 =9830.35N
5. Braking torque (tn) = rotating force* effective disc radius =9830.35*0.09
=884.346N-m
(torque available at the two tires of the rear shaft)
6. Braking force=(braking torque /tire radius)*0.8 =5614.877N.

7. Deceralation: f=-ma(-ve sign indicates force in opposite direction) a=-B.f/m=5614.87/120 =-46.57m/s
8. Stopping distance: $v^2 – u^2 = 2*a*ds$
(v=0,u=12.5m/s) Stopping Distance =2.237meters

ENGINE AND TRANSMISSION
Gross Torque 7.7 bhp @ 5600 rpm
Displacement 127cc
Dry Weight 14 Kg
Fuel Capacity 1L

Overall Length (mm)	1650
Height (mm)	710
Wheel Base (mm)	1270

Assuming transmission efficiency = 80%
Gross weight of the Kart = 120kgs
Number of teeth on CVT output = 67
Number of teeth on rear shaft sprocket = 44
Ratio = 0.66:1

SPEED (RPM)	CVT RATIO	SPROCKET RATIO	FINAL RATIO
1850	16	0.66	11
2750	10	0.66	6.6
3600	6.4	0.66	4.22

CALCULATIONS
Speed = (circumference of the wheel * rear
shaft rpm) / (60*1000) m/s
= (∏*11*24*800)/(60*1000)
= 11.05 **mt/sec**. = 40 km/hr

Drive torque =

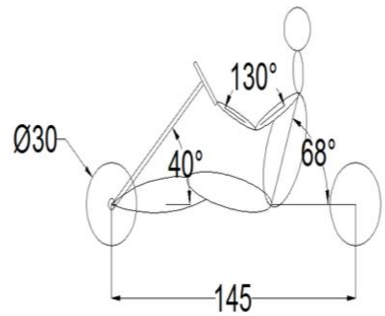
engine torque * reduction *efficiency
=7.7*16*0.66*0.8 = **63.36 Nm**

Drive force = drive torque/radius of wheel

= 63.36*1000/5.5*25.4 = **453.54 N**

Acceleration Drive Force/mass

= 453.54/120= **3.755** /s2



LINE DIAGRAM OF GO-KART

CONCLUSION:

The 98cc, 2 stroke, 4 wheeled racing car, Go-Kart, we finally made one under 25K which is a big truth. But we made just a proto type of that performance machine. The materials we used are not up to the mark of automotive standard. Big companies will design one go-kart at a minimum of 2 years. But we made this from within two months. We do not recommend driving this go-kart at a speed of 80 km/hour but it is best suited in 30-40 km/hour speed. An old men aged about 50+ and women can also drive this gokart. The report is prepared in such a manner that every layman can understand the details pertaining to the project. The report is prepared in simple language and described well. The report give adequate idea and design guide lines for making suitable report is expected to prove valuable to the successor students of mechanical engineering to know the essentials of a project and project report. The matter discussed in the early pages just give a broad outline of small-scale industries. We have, tried to cover all the aspects concerned with our project. The design and construction for GO-KART DESIGN has become more challenging due to number of constraints. Thus this report provides a clear insight in design and analysis of our vehicle. The making of this report has helped us in learning of various software.

FUTURE SCOPE

Go Karts can develop by using 4 stroke engine. Bio-Fuels which are of low cost can be used in place of petrol. Solar Energy can also utilized by solar panels where they are pollution free with moderate cost. Suspension system can also be added in system to lower vibrations and shocks. Body development of kart can be done preventing it from environmental conditions and aero dynamic shape of body increases its speed.

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