Calculation and Analysis of Extremely light weight GO-KART

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ABSTRACT: *As an increase in the craze of the motorsports racing day by day and the formula vehicles are not made for non-matured or untrained people. So for the increase in the craze Go-kart was created to provide experience of the formula cars so that everyone can feel the experience of driving a racing vehicle. It can also be used by children as fun rides. It can also be used to train people for formula racing at small rate and low cost.*

This paper aim is to design lightest go-kart. Objective behind making this go-kart with minimum weight fuel efficient and a secured vehicle which even untrained people and small children can drive, this paper also focus on the analysis, calculations, engine and material used in Go-kart to make the kart lightest at all respects. Entire analysis is done in Solidworks (CAD Software).

Keywords: material selection, analysis, calculations, engine, weight management.

1. INTRODUCTION:

Karting is form of racing in a small four wheel vehicle known as a Go-kart. In the beginning, the first ever Go-kart was created in Los Angeles by Art lngels in 1965. The first official organized race took place with several dozen home built machines in 1957 in the parking lot of the famed Rose Bow in Pasadena, California.

2. TECHNICAL SPECIFICATION:

Table 3.1 (vehicle measurements)

S.no.	TECHNICAL DESCRIPTION	SPECIFICATIONS
1	Overall width	47 inch
2	Overall length	60 inch
3	Front track width	38 inch
4	Rear track width	42 inch
5	Wheel base	41 inch
6	Ground Clearance	1.5 inch
7	Tyre front and rear outer diameter	Front-10inch Rear -12 inch
8	Tyre front and rear Inner diameter	Front-5.5inch Rear-7.5 inch
9	Tyre width	7.0 inch
10	Maximum speed	70kmph
11	Weight without driver	32 kg

3. ANALYSIS/RESULT:

(Material used aluminum alloy)

3.1. TOTAL DEFORMATION (FRONT IMPACT):

For deformation first load of 1254N (Compressive) is applied on front end and rear end at the engine is fixed. (F.O.S-2.8)

Result is shown in Fig below.

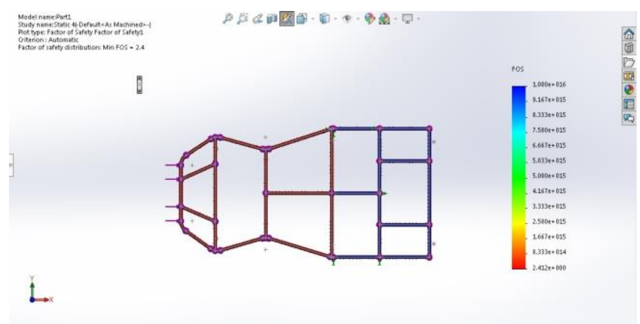

Fig-3.1 Front Analysis

3.2. TOTAL DEFORMATION (SIDE IMPACT):

For deformation second load of 1254N (Compressive) is applied on left end and right end is fixed. Result is shown in Fig below.

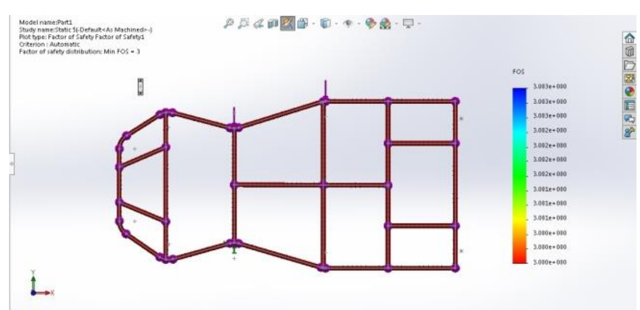

Fig.3.2 Side Analysis

3.3. TOTAL DEFORMATION (REAR IMPACT):

For deformation second load of 1254N (Compressive) is applied on rear end and front end is fixed. Result is shown in Fig below.

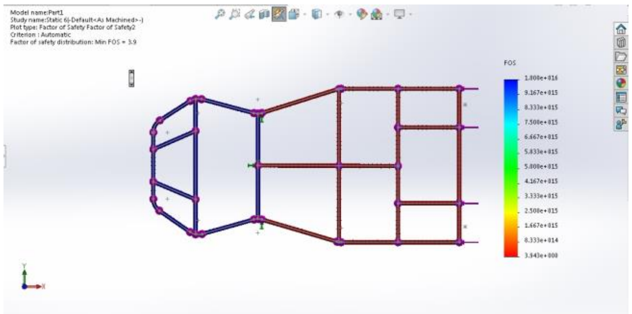

Fig-3.3 Rear Analysis

3.4. EQUIVALENT STRESS (front analysis):

Equivalent stress of 1254N load is applied on the front and fixed at rear end. Result is shown in Fig below.

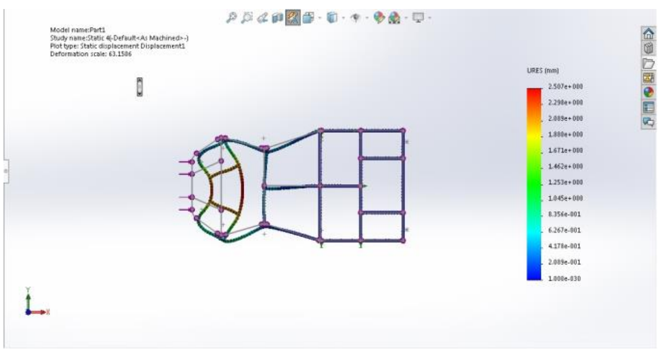

Fig-3.4 Front Stress Analysis

3.5. TOTAL DEFORMATION OF SHAFT:

For deformation a load of 1000N is applied, here one end is fixed and on other the compressive force is applied.

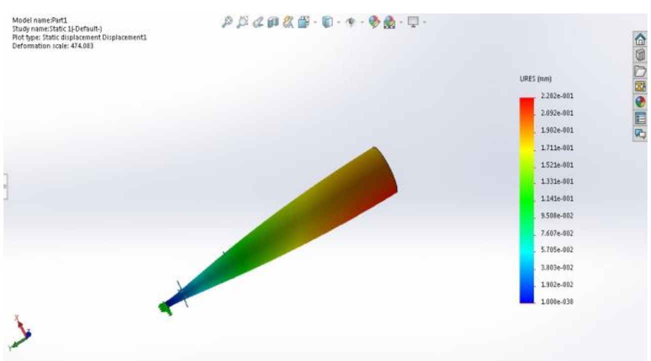

Fig-4.5 Shaft Stress analysis

3.6. TORSIONAL DEFORMATION OF SHAFT:

For deformation of 984N is applied where one end is fixed and on other load is applied for the `torsional deformation. Result is shown in figure below.

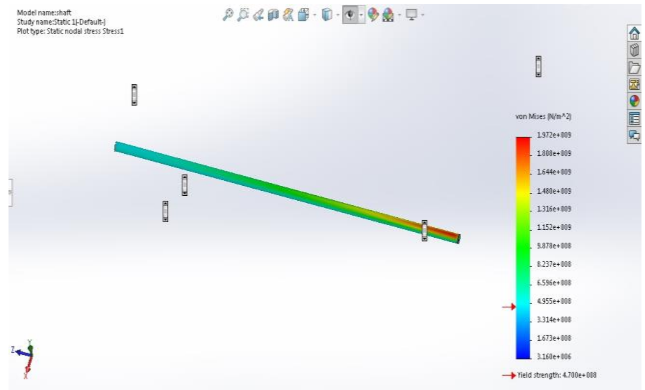

Fig-3.6 Shaft deformation

4. CALCULATIONS:

4.1. GEAR RATIO:

Gear ratio= number of teeth in driven gear number of teeth in drive gear

=42/14

=3:1

4.2. BRAKING CALCULATIONS:

V= 60km/h = 16.7m/s
g=9.81, weight= 329kg
C.O.F (Dry road) = 0.7
C.O.F (wet road) = 0.4
Gross weight= weight of vehicle*g
=32*9.81
=313.92N

A. Braking force is force exerted by driver on the brake paddle (can be measured by using a weighing machine*g)

=32*9.81
=313.92N

B. Braking Force=work/distance
work= kinetic energy $=1/2mv^2$

$=1/2*32*16.7^2$
=4462.24 Joule

C. Stopping Distance **=** work/B.F
= 4462.24/313.92
=14.215m

D. DE-ACCLERATION:

By newton law of motion $v^2-u^2=2as$, where v is 0

$$\Rightarrow 0-16.7^2= 2a*14.215$$
$$a=-16.7^2/14.215$$

$a=-9.8m^2/s$ (-ve sign indicate De-acceleration)

E. STOPPING TIME:

By newton law of motion v-u=at, where t is

(-16.7)/-9.8=1.7 sec

4.3 STEERING CALCULATIONS:

Φ (outer angle) θ (inner angle) = (let us assume 30°) cot θ= (38/41) + cot30° then θ=20.60°

ACKREMANN ANGLE=29.85°
ACKERMANN %= 84.75%

TURNING RADIUS FRONT: 2.92m

front inner 2.032m rear inner 1.77m front outer 2.91m rear outer 2.77m

5. ENGINE SPECIFICATIONS:

Briggs and Stratton 450E series Dry weight 8.2 kg
Engine Technology: Single cylinder, 4-stroke, air-cooled, OHV (Overhead Valve)

Fig.6.1 Engine

Gross Torque* (Nm) @ 2'600 rpm: 6, 10

Cylinder: Aluminum

Stroke (mm) 44, 5

Oil Capacity (l): 0.47

Dimensions Length (mm): 347

Dimensions Height (mm): 244

Model Number: 08P5

Displacement (cc): 125

Bore (mm): 60, 0

Fuel Tank Capacity (l): 0, 8

Dry Weight (kg): 8, 2

Dimensions Width (mm):310

6. CONCLUSION:

Go-kart are very important part of motorsports thus we design our go-kart according to the driver safety and comfort we have designed a go kart with a minimum weight of 32 kg by using aluminum as a chassis and mounting material with a 125 cc Briggs and Stratton engine and hydraulic braking. As weight is distributed in 40:60 ratios to maintain stability.

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