

Design and Fabrication of a Motorized Tricycle for Physically Challenged Persons

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ABSTRACT :To improve the existing indigenous model design and fabrication of a motorized tricycle for physically challenged persons was carried out. The focus is laid on the simplicity in design, high performance, easy maintenance and safety at very reasonable price. Most of the components are chosen keeping in mind the easy availability and reliability. This paper provides the details of components used, and designing parameters taken in consideration while designing the tricycle. This tricycle is very efficiently designed and can be proved as a better replacement for the indigenous models used by the handicapped keeping in mind the factors such as safety, cost & performance.

I. INTRODUCTION

A successful effort to include motor disabled employees into the work force not only involve adjustment to the work place and environment but also the issues facilitating the transportation of the employees to and from work. Disability could be caused by birth, by injuries sustained mainly from motor accidents or during turnkey project work or in manufacturing industries as well those caused naturally. Due to the enormous number of disabled people in the society, a motorized tricycle has been fabricated and designed to specification. The design of a motorized tricycle is an improvement on the existing ones. It is carried out to benefit the user conveniently, physically, and comfortably such that when a little effort is exerted, a greater output (movement) is achieved as a result of the fast transmission generated by the motorized system.

II. DESIGN METHODOLOGY

The design methodology involved in the development of the trike design consists of mainly two steps which lead to a design which is economical, safe, ergonomic and easy to manufacture. The design methodology has the following process[2]:

Recognition of customer's need: The various processes associated with the program are listed below:

- Identifying customer needs by surveying places like government hospitals and centers meant for disabled.
- Analyzing dissatisfaction which results into needful changes
- Creating ideas which are relevant for the customer's needs by R & D.

Weight Distribution

According to designing data book

FOS of mild steel varies from 1.725 to 2

From the weight distribution:

[1] 35% at front = 154 kg

[2] 65% at rear = 286kg

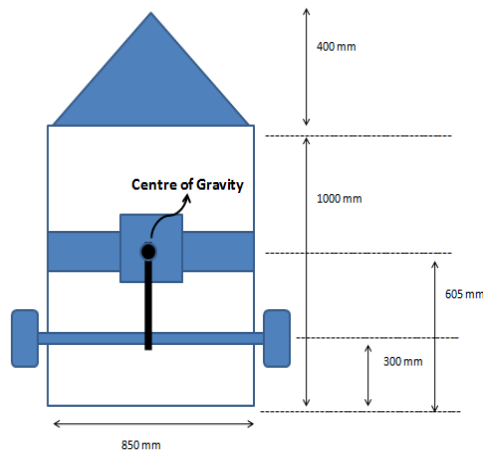
154kg at front wheel

286kg at the rear wheel (s)

This means 143 kg at single rear wheel

Centre of Gravity for placing the Frame

The engine is placed at the centre of Gravity of the tricycle and from that point chain drive is given to the rear wheel with the help of a shaft. The centre of gravity is calculated[3]:



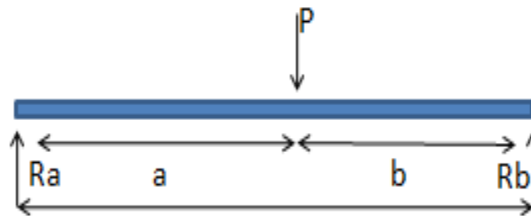
$$X = 0$$

$$Y = \frac{a_1y_1 + a_2y_2}{a_1 + a_2}$$

We get after calculating 605.83 mm
Hence Centre of Gravity (COG) from rear of the vehicle is 305 mm.

According to load distribution point of placing the engine

Suitable place for placing the engine so that the tricycle remains balanced (along Y axis) [3]:



L = length of span

$$R_a = P - \frac{P}{L} (L - b)$$

$R_a = 755.37 \text{ N}$ (According to load distribution)

$b = 385 \text{ mm}$ (Engine will be placed at this distance from the rear axle)

III. ENGINE REQUIREMENT

Keeping in mind that the disabled person can even use the tricycle for a high pay load. We have taken an engine which will be of 8 BHP at 7500 rpm. It will be single cylinder 4 stroke engine. This engine will occupy a area of 560 X 230 X 230 mm making it easily fit at the centre of gravity of the tricycle.

Determination of Required power

The required power for the tricycle to move over rough terrain is given as [6]:

$$P = \frac{Wv}{3.733};$$

where:

P = power (W);

W = weight of the tricycle (N);

v = optimum linear speed (m/s).

$$P = \frac{220 \times 9.8 \times 30 \times 5}{18 \times 3.733}$$

From Eq, the power required to drive the tricycle is determined to be 4,816 W.

Power developed by engine :

$P = 8 \text{ BHP}$ or $P = 6 \text{ KW}$

So the power generated by the engine is sufficient to propel the vehicle

Vehicle Performance on Road

Total weight of vehicle,

$$w = 2158.2 \text{ N}$$

$$W_{\text{rear}} = 1402.83 \text{ N}$$

The static coefficient of friction for rubber = 0.7

The frictional force on rear type,

$$F_f = \mu \times w$$

$$= 980.325$$

Torque for rear wheel [4]

$$T_{\text{max}} = F_t \times r$$

$$T_{\text{max}} = 245.245 \text{ Nm}$$

Determination of Stopping Distance

Stopping Distance will be,

$$D = \frac{1}{2} \times \frac{w}{g} \times \frac{v^2}{F_f}$$

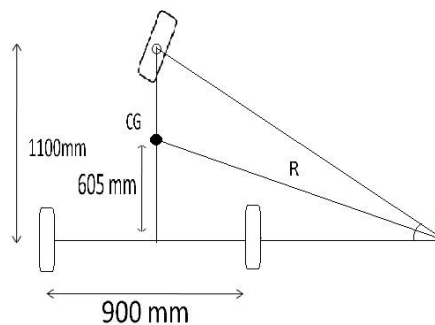
$$D = 0.79 \text{ m}$$

Steering System

The wheel strictly follows Ackerman steering system; [5]

Turning radius = COG-Turn centre

Steering angle is δ . We have taken δ as 40° As it is chosen generally and considered most suitable.



Now , for normal speed :

$$\delta = L/R$$

$$40^\circ \text{ in radian} = 1100/R$$

$$R = 1225.43 \text{ mm}$$

Conclusion

The objectives of the design and fabrication of a motorized tricycle using available local materials was successful to a great extent and it was discovered that the tricycle will lessen the burden of the disabled people due to its affordability.

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