Design and Fabrication of Two Wheeler Frame

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ABSTRACT

The basic aim behind our project is to make a powerful vehicle that can drive comfortably in the on and off-road with the help of streamline design with high fuel efficiency at affordable price. We also keeping in mind the parking problems now days, so we decided to make it compact in structure. The objective of our team is to design a unique, affordable, lightweight, and modular vehicle which is to be used in on and off-road in order to transport a person and light cargo. The frame part bear the total load of the vehicle. The modified frame model was designed and anlyzed in through CATIA Software. The optimized design was fabricated and tested.

Keywords : Two wheeler Frame, Analysis, Design

1. INTRODUCTION

Scooters are a subclass of motorcycles and are very popular for transportation in urban and rural areas. A scooter is a type of motorcycle with a step-through frame and a platform for the rider's feet. This design is possible because most scooter engines and drive systems are attached to the rear axle or under the seat. Unlike a conventional motorcycle, in which the engine is mounted on the frame, most modern scooters allow the engine to swing with the rear wheel, while most vintage scooters and some newer retro models have an axle-mounted engine.

Modern scooters starting from late-1980s generally use a continuously variable transmission (CVT), while older ones use a manual transmission with the gearshift and clutch control built into the left handlebar. There is often some integral storage space, either under the seat, built into the front leg shield, or both. Scooters have varying engine displacements and configurations ranging from 50 cc single-cylinder to 850 cc twin-cylinder models. Traditionally, scooter wheels are smaller than conventional motorcycle wheels and are made of pressed steel or cast aluminum alloy, bolt on easily, and often are interchangeable between front and rear. Some scooters carry a spare wheel. Many recent scooters use conventional front forks with the front axle fastened at both ends. In the context of sustainable mobility, the Powered Two Wheel vehicle has been used. The term Powered-Two (or Three)-Wheel (PTW) vehicle is being used cover a range of two or three wheel vehicles from mopeds (low power motor cycles typically with engines less than 50cc and usually with a maximum speed of 50 kph) to motor scooters and motorcycles are used to reduce traffic congestion and emissions. In the last decade, the growth in motorcycling and the associated road trauma has largely been among riders aged 25 and over who already have car license and are taking up riding for the first time or returning to riding, mainly for recreation.

2. EXPERIMENTAL DETAILS

The main aim of choosing internal combustion engine is that in mobile equipment, internal combustion is advantageous since it can provide high power-to-weight ratios together with excellent fuel energy density. Generally using fossil fuel (mainly petroleum), these engines have appeared in transport in almost all vehicles. A 125 cc single cylinder petrol engine delivers a maximum output of

8.58 bhp @ 7000 rpm and torque of maximum 10.2 Nm @ 5000 rpm utilizing CVT (Continuous Variable Transmission) to transmit power from engine to wheel.

Table 2.1 Engine Specifications

Engine	124.5cc
No Of Cylinder	1
Max Power	8.58 bhp @ 7000 rpm
Max Torque	10.2 Nm @ 5000 rpm
Valves Per Cylinder	2
Fuel Delivery	Carburettor
Cooling System	Air Cooled
Clutch	CVT (Continuous Variable Transmission)
Front Suspension	Telescopic
Rear Suspension	Single side Swing Arm Type

The frame is, in an effort to both minimize weight and manufacturing complexity, a step-through frame. This frame allows for simple load transfer, and the frame is to be made of stream line design, allowing for minimal manufacturing time, and allowing for the use of automated manufacturing techniques. This design has been used successfully in commercial vehicles, which is the strongest configuration between the front wheel assembly and the frame.

Figure 2.1 Frame without engine

Figure 2.2 Frame with engine

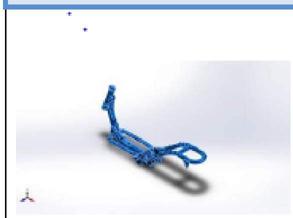
The frame is fabricated successfully according to the design specifications. Fabrication techniques included arc welding, bending, cutting, grinding and assembly of various parts required. Fabrication was carried out in two phases, namely phase-I which included initial spot welding of all the joints for assuring proper shape of the frame and phase-II included complete welding of all the joints in the frame.

3. RESULT AND DISCUSSION

3.1 MATERIAL PROPERTIES

The material used in this scooter is 1.25inch stainless steel pipe with overall length of 83 inches. It has given a clearance of 200mm. Initially we bought all the materials such as stainless steel pipe, square rod, cone set other connecting pipes from shop and then we bended all those pipes and rods as per the design in the private shop. After that, all the pipes, rods, cone set and connecting rods are welded together in welding shop. In the first stage, the disc braking system was selected. But it’s is quite costly and not easily available in the market, so we think about its alternative and used drum brake system. Due to the compact structure and engine mounting problems, we are not able to provide double side swing arm suspension. So, single side swing arm suspension is used.

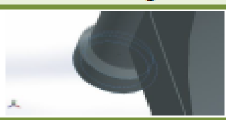
Table 3.1Modified Model of the Frame

Model Reference	Properties	Components
	**Name:** AISI 316 Stainless Steel Sheet (SS) **Model type:** Linear Elastic Isotropic **Default failure criterion:** Max von Mises Stress **Yield strength:** 1.72369e+008 N/m^2 **Tensile strength:** 5.8e+008 N/m^2 **Elastic modulus:** 1.93e+011 N/m^2 **Poisson's ratio:** 0.27 **Mass density:** 8000 kg/m^3 **Thermal expansion coefficient:** 1.6e-005 /Kelvin	SolidBody 4(Imported1)(frame after1), SurfaceBody 1(Surface-Imported2)(frame after1), SurfaceBody 2(Surface-Imported3)(frame after1), SurfaceBody 3(Surface-Imported1)(frame after1)
Curve Data:N/A		
	**Name:** AISI 316 Stainless Steel Sheet (SS) **Model type:** Plasticity - von Mises **Default failure criterion:** Max von Mises Stress	<Material_ComponentList1/>
Curve Data:N/A		

3.2 LOADS AND FIXTURES

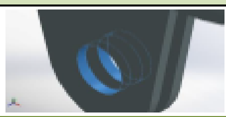
In scooter design, there are key dimensions in sizing which determine handling, steering, and controllability. These, in part, are wheelbase, steering angle, fork offset and wheel radius. In addition to these, ground clearance and stand-over height are important constraints for realistic usability, determining where the vehicle may operate and rider size. Modelling, Meshing and Analysis were given below.

Table 3.2 Design of the Parts

Fixture name	Fixture Image	Fixture Details
Roller/Slider-1		**Entities:** 2 face(s) **Type:** Roller/Slider

Resultant Forces

Components	X	Y	Z	Resultant
Reaction force(N)	-7.39922	-20.3732	0.00017605	21.6752
Reaction Moment(N.m)	0	0	0	1e-033

Fixture name	Fixture Image	Fixture Details
Fixed-1		**Entities:** 2 face(s) **Type:** Fixed Geometry

Resultant Forces

Components	X	Y	Z	Resultant
Reaction force(N)	-7.08268	6.01686	-0.79431	9.32727
Reaction Moment(N.m)	0.0244001	0.0530991	0.00236389	0.0584848

Fixture name	Fixture Image	Fixture Details
Fixed-2		**Entities:** 3 face(s) **Type:** Fixed Geometry

Resultant Forces

Components	X	Y	Z	Resultant
Reaction force(N)	10.4353	-5.56253	0.163807	11.8264
Reaction Moment(N.m)	-0.00191876	-0.00141094	0.00758777	0.00795278

Fixture name	Fixture Image	Fixture Details
Fixed-3		**Entities:** 16 face(s) **Type:** Fixed Geometry

Table 3.3 Meshing Details

Mesh type	Mixed Mesh
Mesher Used:	Standard mesh
Automatic Transition:	Off
Include Mesh Auto Loops:	Off
Jacobian points	4 Points
Jacobian check for shell	Off
Element Size	13.0356 mm
Tolerance	0.651782 mm
Mesh Quality Plot	High

Fig 3.1 Meshed Model

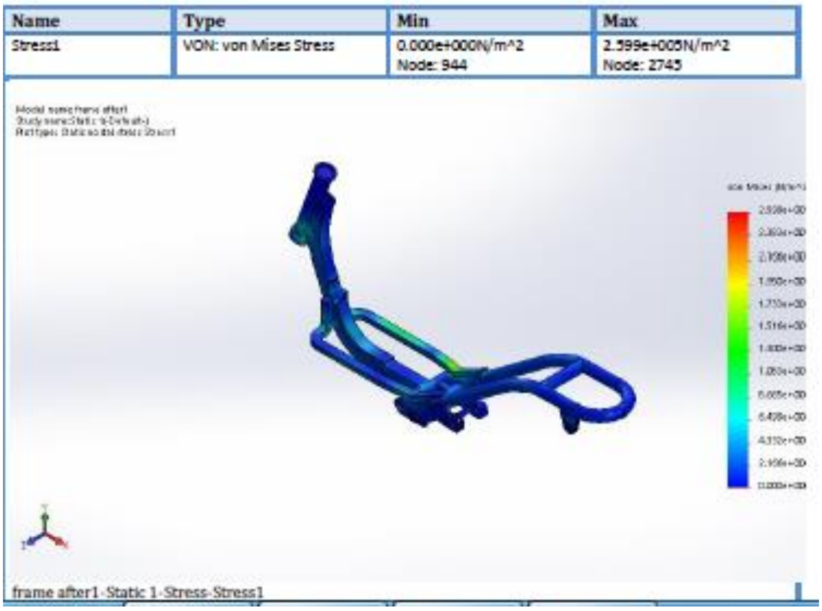


Fig 3.2 Analysis Results

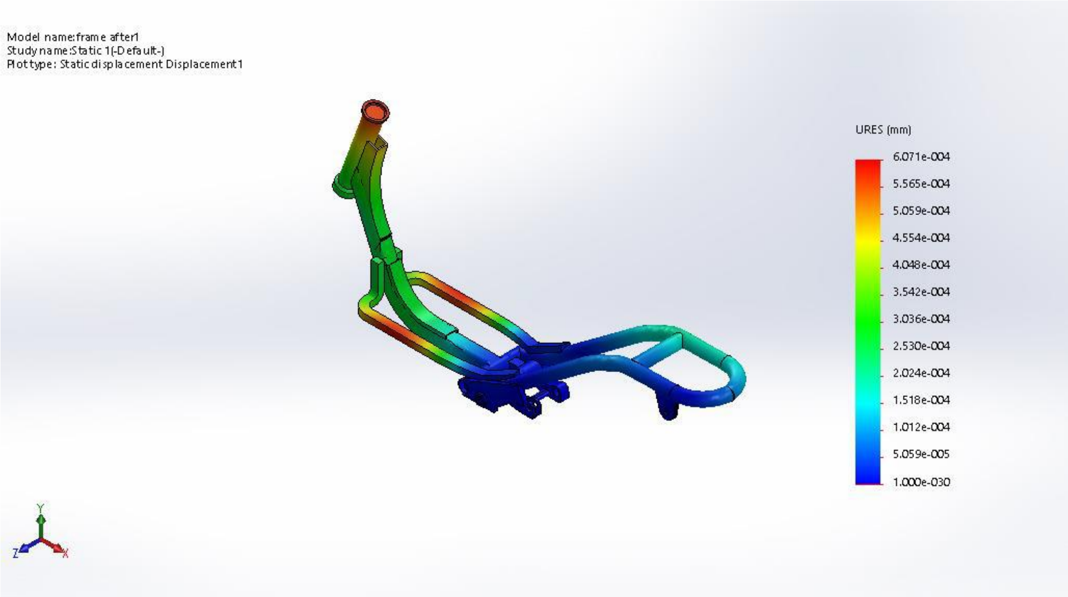


Fig 3.3 Analysis Results

3.3 TESTING OF THE MODEL

Followed by the fabrication of the actual model, the model has been tested for different road, different load and various environmental conditions to identify any defects or flaws in the design or fabrication processes, and eventually no defects or flaws where noticed or observed.

Fig.3.1 Fabricated Two Wheeler

4. CONCLUSION

Due to the many problems of congestion, pollution, high fuel cost and urban mobility, increasingly seem to be a vehicle that can able to run in all condition of roads to widespread automobile use. The Ergonomic evaluation also demonstrated that this scooter is easy to use in normal use situations, including situations involving obstacles, for a broad cross section of users. This scooter would also use to transfer moderate loads and use for long distances. The reliability and safety of this scooter helps to reduce traffic problem.

5. REFERENCES

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