# Development and Fabrication in Spring Stiffness Measurement System

Dr.vivek B. vaidya, Pratham sunil rangari[2], roshan sunil mahore[3], avi sewakram shiv [4], ankush Ramesh nimje[5]

[1]*Project Guide , Department of Mechanical Engineering , KDK College Of Engineering, Nagpur , Maharashtra*

[2345]*Students, Department of Mechanical Engineering, KDK College Of Engineering, Nagpur, Maharashtra*

**Abstract- As we all know the fuel prices especially the petrol is rising steadily day by day. Again the pollution due to vehicles in metro cities & urban areas is increasing continuously. To overcome these problems, an effort is being made to search some other alternative sources of energy or to move back on the non-conventional sources of energy for the vehicles. Again, it is also not affordable to purchase vehicles (mopeds, scooters or motorcycles) for all the class of society. Moreover the vehicles which use the non-conventional sources of energy are not economic feasible for all the class of the society of Human life. In the concept of smart cities, quickness is something which everyone craves for. People prefer the fastest means while travelling from one place to another. Generally, while maintaining a trade-off between speed, comfort and cost public transit comes out to be the best solution. But since these vehicles have specific routes and stations, people face difficulty in going to the station from source location and then from the other station to destination. Use of fuel powered vehicles is not recommended due to the depletion of fossil fuels, also these vehicles pose a major threat to the safety to the lives of many. Apart from the noise and air pollution, fuel powered vehicles are quite powerful and thus unsafe if don't used with care. Transportation has been one of the most important issues to be dealt with. Short distance traveling is tedious, time consuming and expensive task. It is very difficult to reach the nearest public transport facility and in many cases the destination will be very far from the main roads. To overcome this common problem an idea is conceptualized to design and fabricate a foldable cycle, which can be used to reach nearest public transport facilities, easy to fold around the bag and carry or can be utilized as a trolley**

**Keywords: bycycle, transportation, tricycle, foldable.**

## INTRODUCTION

In the modern societies, the increasing needs of mobility means sometimes increasing the number of vehicles circulating. Ambient concerns, as for instance local pollutant emissions for the atmosphere, influence also, in nowadays, the technical decisions related with all kind of vehicles. In this context, new alternatives to the existing internal combustion engines are mandatory. So, vehicles with electric propulsion seem to be an interesting alternative. As we all know the fuel prices especially the petrol is rising steadily day by day. Again the pollution due to vehicles in metro cities & urban areas is increasing continuously. To overcome these problems, an effort is being made to search some other alternative sources of energy or to move back on the non-conventional sources of energy for the vehicles. Again, it is also not affordable to purchase vehicles (mopeds, scooters or motorcycles) for all the class of society. Moreover the vehicles which use the non-conventional sources of energy are not economic feasible for all the class of the society of Human life.
Generally, while maintaining a trade-off between speed, comfort and cost public transit comes out to be the best solution. But since these vehicles have specific routes and stations, people face difficulty in going to the station from source location and then from the other station to destination. Transportation has been one of the most important issues to be dealt with. Short distance traveling is tedious, time consuming and expensive task. It is very difficult to reach the nearest public transport facility and in many cases the destination will be very far from the main roads. To overcome this common problem an idea is conceptualized to design and fabricate a foldable

cycle, which can be used to reach nearest public transport facilities

A foldable bicycle may be possible solution to these problems. The weight of the bike is kept such that it may easily be carried on shoulders without the feeling of uneasiness. This bicycle is ideal to use for short distance (around 40-50 kilometers) trips. The major target of this foldable bicycle for commercialization are the people who travel by metros and public transport means for their daily routine work. This bike can be sold in cities where people needs a solution to travel shorter distance at low price.

All vehicles on the road pollute the environment, and the cost of gasoline is rising every day. To compensate for fluctuating fuel costs and pollution, a simple solution, namely our transportation system, is required. Due to the ignition of hydrocarbon fuels in the vehicle, problems such as wear and tear can arise, necessitating additional attention to correct maintenance. Our vehicle is simple to operate and consumes no more fuel than other vehicles on the road.

## LITERATURE REVIEW

The following is a summary of research papers on foldable electric bicycles that are currently available in the literature.

Shishir S. and Manjunath P. have created a foldable bicycle that is light and elegant while being robust and safe, as well as easy to manage and maintain. The bicycle's seat and handle locations are adjustable, allowing it to be used by both youngsters and adults. The general system of this bicycle is to save energy in batteries through pedaling, which is subsequently used to power the bicycle. In the future, using this technology for autos, trains, planes, and shuttles can be extremely effective and efficient in terms of environmental protection.

Jayesh S. Renge has created a folding three-wheel vehicle powered by an electric motor. The main goal of this project is to create a portable vehicle that is easy to operate for both men and women and emits zero emissions. They employed a DC brush motor for power supply, which does not require fuel to run and hence does not cause pollution. The project is more affordable for middle-class individuals because the batteries can be charged. It can be used to reduce walking distance on college campuses and in industrial regions.

In India, foldable bicycles are manufactured of hefty materials that make them difficult to transport. Many of them are not foldable in a geometrically customizable order, making transit extremely challenging. By analyzing previous designs, the limitations of the designs were discovered, paving the path for the development of new foldable bicycle designs.

Shishir S, Manjunath P, Pavanasudan R, Ravi Sathyajith (June 2015) “Design and Fabrication of Foldable Bicycle”.

Shlok Desai, Kavan Mehta, ZinalKheni, Naitik Bhatt, Rahul Patel (May 2019) “Design, Analysis and Fabrication of Foldable Electric bicycle”.

Morteza Hanifezade and Arian Ashrafi (April 2014) “Folding and Self-Propelling Bicycle”.

AnopMundel, Ashwani Gupta, Devansh Dixit, Ganesh Patel, Mayank Aggarwal, Ajay Kumar Dhanopia (2017) “An Introduction to the Design of Foldable E-Bike for Clean& Safe Travelling in Smart Cities”.

Design and Fabrication of Foldable E-Cycle with Self Rechargeable Battery, IRJET, Volume: 08 Issue: 07 | July 2021

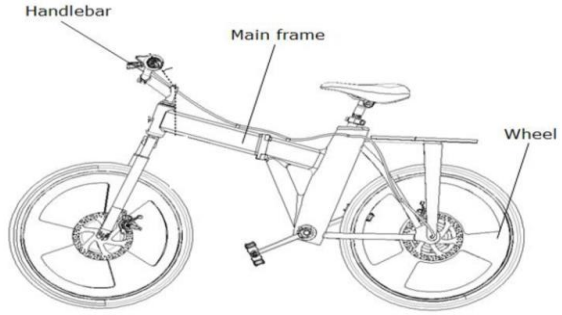
## OBJECTIVES

- To design and create a foldable bicycle
- To analyse the foldable bicycle under various loading conditions using ANSYS software.
- To determine the technological and economic viability of an foldable bicycle.
- The primary purpose of an bicycle is to reduce and eliminate pollution.
- In other words, by reducing their capacity, bicycles may be transported on trains, buses, or any other method of public transit, as well as kept in small residential and office spaces.
- The installation of a pivot in the frame permits folding of a bicycle; the frame may then be folded around the pivot, decreasing the bicycle's size.

## WORKING PRINCIPLE

Manufacturing procedures are the phases that raw materials go through to get a finished product. The creation of the materials from which the design is formed is the first step in the production process. These materials are subsequently transformed into the desired part through manufacturing methods. In an

bicycle, there are two modes of operation:




DESIGN TESTING AND ANALYSIS

1.1 Frame Analysis

Material: Aluminium 6061

Density: 2.7 g/cm3

Maximum Tensile Strength: 310 MPa=3.1e+8 N/sq. m. Maximum Yield Strength: 276 MPa=2.76e+8 N/sq. m. Maximum Stress: 1.389e+7 N/sq. m. (which is much less compare to allowable material strength)

Maximum Total Deformation: 1.329e-10 mm (which is much less for practical considerations)

Maximum strain: 1.516e-4

Maximum force applied: Due to weight consideration of rider as 70 kg.

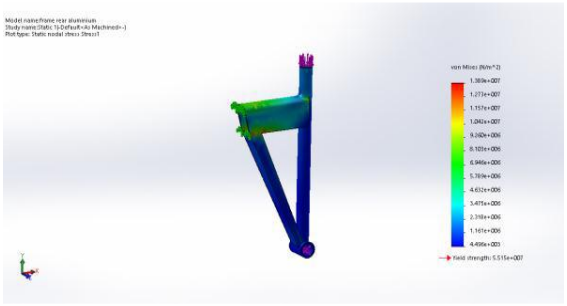


Fig -1: Stress, strain and deformation analysis under static load conditions for main frame.

1.2 REAR FRAME ANALYSIS

Stress, strain and deformation analysis under static load conditions for rear frame.

Material: Steel 4130 alloy

Density: 7.85 g/cm3

Maximum Tensile Strength: 560 MPa=5.6e+8 N/sq. m.

Maximum Yield Strength: 460 MPa=4.6e+8 N/sq. m.

Maximum Stress: 5.78e+5 N/sq. m. (which is much less compare to allowable material strength)

Maximum Total Deformation: 1.326e-5 mm (which is much less for practical considerations)

Maximum strain: 1.81e-6

Maximum force applied: Due to weight consideration of rider as 70 kg.

Factor of safety: FOS > 1

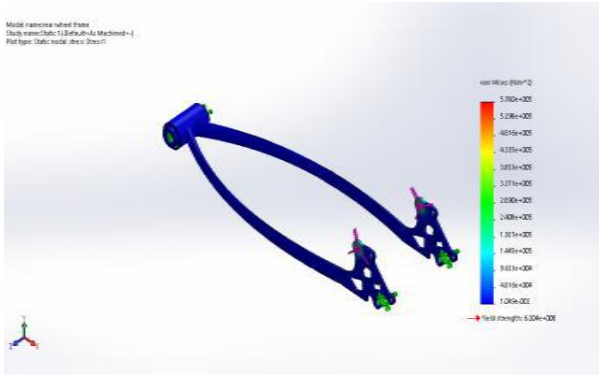


Fig -2: Stress, strain and deformation analysis under static load conditions for rear frame.

1.3 Hinge Analysis

Material: Mild steel

Density: 8 g/cm3

Maximum Tensile Strength: 440 MPa=4.4e+8 N/sq. m.

Maximum Yield Strength: 370 MPa=3.7e+8 N/sq. m.

Maximum Stress: 2.8e+5 N/sq. m. (which is much less compare to allowable material strength)

Maximum Total Deformation: 7.798e-5 mm (which is much less for practical considerations)

**Fig -3** left: direction of actual load consideration to justify the strength of axle used in hinge. (OEM part capable of handling standard cycle load and variation).

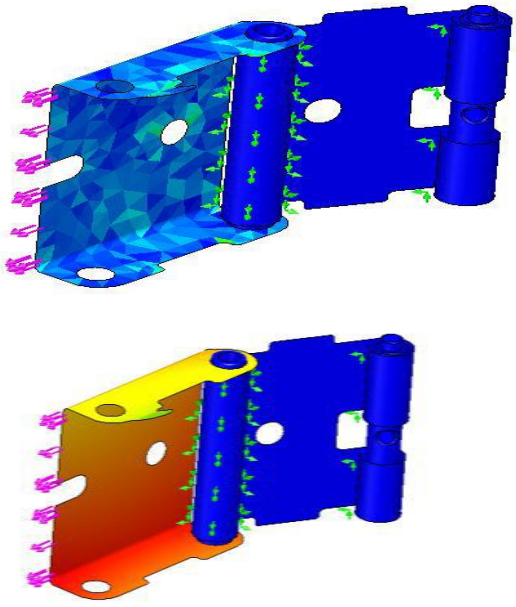


Fig -4 right: Deformation concentration zone.

## CONCLUSIONS

The foldable portable bicycle was created using industry-standard data. The fabrication was done with materials that were readily available in the area. The project's goal was to design and develop a portable foldable bicycle that would take up less space in parking and could be taken around. It can be used to reduce walking distance on college campuses and in industrial regions. The vehicle is small, lightweight, and has a simple design, making it portable. Manufacturing costs are moderate. In comparison to other foldable bicycles on the market, ours is more technologically advanced, cost-effective, and takes up less room.

The bicycle's seat and handle locations are adjustable, allowing it to be used by both youngsters and adults. Though the bicycle is foldable, sleek, and has small wheels, complete justice is given to the rider's ergonomics, making it comfortable. The idea of providing a foldable bicycle that is light and sleek yet rigid and safe, easy to handle, and easy to maintain was inspired by the idea of providing a foldable bicycle that is light and sleek yet rigid and safe, easy to handle, and easy to maintain. The notion of changing the bicycle to make it compact and easy to carry by offering folding joints, as well as to make it simple by using electric power, has been realized.

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