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MODIFICATION IN CARGO BICYCLE

SY B.Tech. Minor Project Report

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MAHARASHTRA (INDIA)

MAY, 2021

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SY B.Tech. Minor Project Report

submitted in partial fulfilment of the requirements for the award of the degree

of

Bachelor of Technology

in

MECHANICAL ENGINEERING

BY

Riddhesh Gandre , Yash Deshpande , Rohan Kotkar , Hitanshu Machhi

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CERTIFICATE

It is hereby certified that the work which is being presented in the SY B.Tech. Mini Project Report entitled **"*Modification in Cargo Bicycle*",** in partial fulfillment of the requirements for the award of the **Bachelor of Technology in Mechanical Engineering** and submitted to the **School of Mechanical & Civil Engineering of MIT Academy of Engineering, Alandi(D), Pune, Affiliated to Savitribai Phule Pune University (SPPU), Pune** is an authentic record of work carried out during an Academic Year 2020-2021, under the supervision of **Prof. Sudesh B. Powar, School of Mechanical & Civil Engineering.**

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ACKNOWLEDGEMENT

We would like to express our special thanks of gratitude to our guide Prof. Dilip Panchal sir , who gave us the golden opportunity to do this conceptual minor project and also for their constant encouragement and valuable guidance during completion of this project work.

We wish to express our profound gratitude towards respected School Dean Prof. Prafulla Hatte sir for his continuous encouragement .

We would be failing in our duty if we do not thank all the other staff and faculty members for their experienced advice and evergreen co-operation. We want to express our gratitude towards our respected project advisor/guide Prof Dilip Panchal Sir for his constant encouragement and valuable guidance during the completion of this project work.

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1. Yash Deshpande
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LIST OF FIGURES

Abstract

Taking increasing pollution into account researchers are tending towards electric vehicles for personal use as well as for transportation. Similarly cargo vehicle is one of the example that can help to resolve environmental issues. Studies are going on. One of the study has made the cargo bicycle which provides some different features in their model. We have studied that study and did some modifications and done some analysis. Came to certain conclusions, like our modified model can be used easily by everyone.

CONTENTS

1. INTRODUCTION

1.1 Background

In these fast growing world all are using the fossil fuels contained vehicle and some are using the electrical vehicle too as a result a pollution level on these earth is increasing day by day and is becoming a major issue. Moreover the human beings are also not taking care of their body which lead to many diseases in them.

So , for these problem we have came with the solution which will try to maintain the body and will help to reduce the pollution too. Cargo bicycles are basically human powered vehicles usually used for transporting loads. Now a days its beneficial to use environment friendly vehicles taking pollution into consideration.

1.2 Project Idea

Now a days , we know that to renounce the car in a city isn't hard in everyday life . Also we are facing the problems like pollution and traffic in urban area .By analysing this problems , cargo bicycles are coming in the market as solution for bikes for small transportation

But, the cargo bicycles are very tricky to handle due to their size . This bicycles are very hard to maintain and transport this bicycles were tough. For these reasons many people find them not suitable transportation.

Due to this reason we decided to modify this cargo bicycle and try to made it convertible from cargo mode to city mode.

1.3 Motivations

Our India is one of the most large population and developing country . And day by day due to industrialization pollution of major cities and areas like Mumbai , delhi is increasing and cross the limit of pollution , if it will be continue like this then pollution we will see as a greatest enemy for Indians after some years . So, in order to take a step toward the ideas to recude the pollution on our country this idea we got . As , major part of pollution is happening from vehicles. Hence , we have decided to work on this domain.

1.4 Project Challenges

Before designing , we had main challenge of material selection .Because , we require min weight of material with greater strength.

1.5 Proposed Solution

So we come with modification of cargo bicycle . mainly modification means we have tried to put the trolley in the normal cargo bicycle and which will help people to carry small things like vegetables , fruits etc. the main aim of our is to decrease the pollution and to give human beings a convertible bicycle which can be used to go for short distance instead of using the vehicles and by using these cargo bicycle the human being can also get some body workout which will help a lot in maintaining their body . So, many electric vehicles are coming into market to reduce use of fossil fuels and resolve pollution issues. Cargo cycle is also a vehicle which can help to reduce pollution as well as it can resolve one more issue of laziness, obesity among people.

CHAPTER 2 : LITERATURE SURVEY

The idea of creating a non-conventional, modern and creative design vehicle played a key in realizing the design from a sketch to a 3D model. The final model emerged from vigorous analysis through static and dynamic bike models exposed to real-life conditions. The bike's overall design and construction increase its road performance and meet customers' desires by keeping it an efficient and economical package. All-in-all, electric mobility is a solution to a rather bigger problem than just being a day to day commuter, it’s a step towards an eco-friendly and sustainable mode of transportation.

The project basically consists of a frame, a cycle, a movable link, two tyres and a basket which all will be assembled together in order to form the complete attached trolley. This can be used to carry heavy loads on a cycle which cannot be done on a normal cycle. Also the trolley in its detached state without the cycle can be used to carry things and can be easily moved. The link will be helping in keeping the load on the trolley steady even on irregular surfaces.

2.1 Related work And State of the Art (Latest work)

Fig 1 Conventional cargo Bicycle

Explanation :-

- When the LC circuit that is L1 and C1 has got any resonating frequency from any metal which is near to it, electric field will be created which will lead to induces current in the coil and changes in the signal flow through the coil.
- Variable resistor is used to change the proximity sensor value equal to the LC circuit, it is better to check the value when there is coil not near to the metal.
- When the metal is detected the LC circuit will have changed signal. The changed signal is given to the proximity detector (TDA 0161), which will detect the change in the signal and react accordingly.

- The output of the proximity sensor will be of 1mA when there is no metal detected and it will be around 10mA when coil is near to the metal.

Fig 2 : Traditional model of cargo bicycle

2.2 Limitation of State of the Art techniques

Cargo cycles can play a significant role in supplying urban centers, helping to decrease harmful commercial transport externalities. Some companies have already carried out initial pilot schemes using cargo cycles in order to assess technologically and economically feasible use cases. However, a structural overview of the relevant market segments for commercial cargo cycle use and suitable recommendations is lacking.

2.3 Discussion and future direction

These analyses support the theory that this convertible cargo bicycle can be converted into cargo mode to city mode. The (rendering image) shows how bicycle converts from cargo to city mode. In line with hypothesis maximum weight cargo can handle is Kg. Length of bicycle in cargo mode is 255cm and in city mode 185cm.The figure (ANSYS model) show maximum yield strength of cargo is 382.47 MPa and average yield strength is 17.158 MPa. Maximum deformation at maximum yield strength 4.56×10^(-3). Maximum frequency deformation obtained 483.82Hz is 0.87153m.

This data contributes a clearer understanding of how cycle be used as small transportation vehicle as a sustainable solution

The generalizability of the cargo bicycle is limited by steep slopes. As climbing steep slopes with weight is difficult. Further research is needed to establish gears system in cargo bicycle to climb easily on steep slopes

2.4 Concluding Remarks

From the above literature we found that all literature talks about detachable trolley , different positions of trolley , but none of them did convertible cycle . Therefore in this paper we are designing trolley that can use whenever we want. And we decided to use longtail model as it’s conventional .

CHAPTER 3 : PROBLEM DEFINITION AND SCOPE

One increasingly popular measure is the use of cargo bikes in city logistics due to their improved energy efficiency, lower emissions and lower traffic disturbance. The paper assess the impacts of electric cargo bikes, from a public policy perspective and, simultaneously, taking into account variables that cover the urban logistics operators' interests. Under a public policy perspective, the considered variables evaluate mobility, environmental impacts and indirectly, the quality of life. In terms of private interests, the studied variables cover costs levels (operation and driving) and efficiency.

3.1 Problem statement

While deciding problem statement the one thing which was common in our mind was pollution. We were also thinking about doing something related to cycles. While surfing on internet we come to know about term 'Cargo cycle' We decided to design and manufacture Modified cargo bicycle.

3.2 Goals and Objectives

- To modify the bicycle in order to decrease too long length and size of the cargo bicycle , also to make it convertible from city mode to cargo mode at the time of work only.
- To develop the normal bicycle for use as a small transport vehicle as a sustainable solution for urban logistic.

3.3 Scope and Major Constraints

After completion of this project ,

- We will able to make cargo cycle convertible from normal to cargo mode and vice versa .
- We will able to decrease the length of the cycle .
- We will able to increase the speed of the cycle.

3.4 Hardware and Software Requirements

We used design software as follows:

- Autodesk Fusion 360
- Ansys

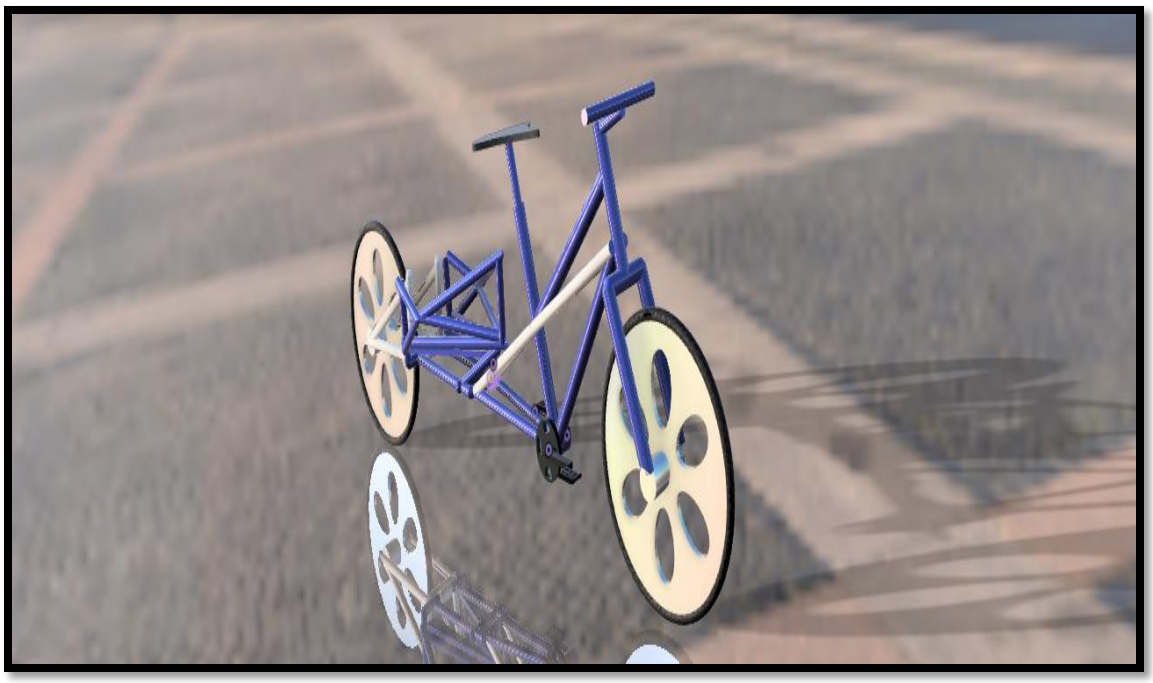
3.5 Expected Outcomes

We can expect that, this is latest and one of the best modifications in cargo bicycle, which is made in order to reduce the length (size) of the cargo bicycle by keeping the weight sustainable or loading capacity as it is. Also, it is modification because in this we are making the compact and convertible model of the cargo bicycle, that's why we called it, convertible cargo bicycle. This project step towards to research on the environment friendly transportation.

CHAPTER 4 : SYSTEM REQUIREMENT SPECIFICATION

4.3 CAD Model of Traulley

CAD (computer-aided design) process is a technology for design and technical documentation of the product., which replaces manual drafting, that is time-consuming. Here, we have used CATIA V5 software for our design It allows us to build a model incrementally, from adding individual features to making a complete assembled model of the product while retaining the capability to change features independently. CATIA V5 is a multi-platform software suite for computer aided design (CAD), PLM AND 3D, developed by the DASSAULT SYSTEMS. CATIA V5 offers a solution to shape design, styling, surfacing workflow and visualization to create, modify and validate complex innovative shapes. CATIA V5 enables the creation of 3D parts from 3D sketches, sheet metal, composites CATIA V5 can be applied to a wide variety of industries, from aerospace and defense, automotive and industrial equipment, to high tech, shipbuilding, and consumer goods.



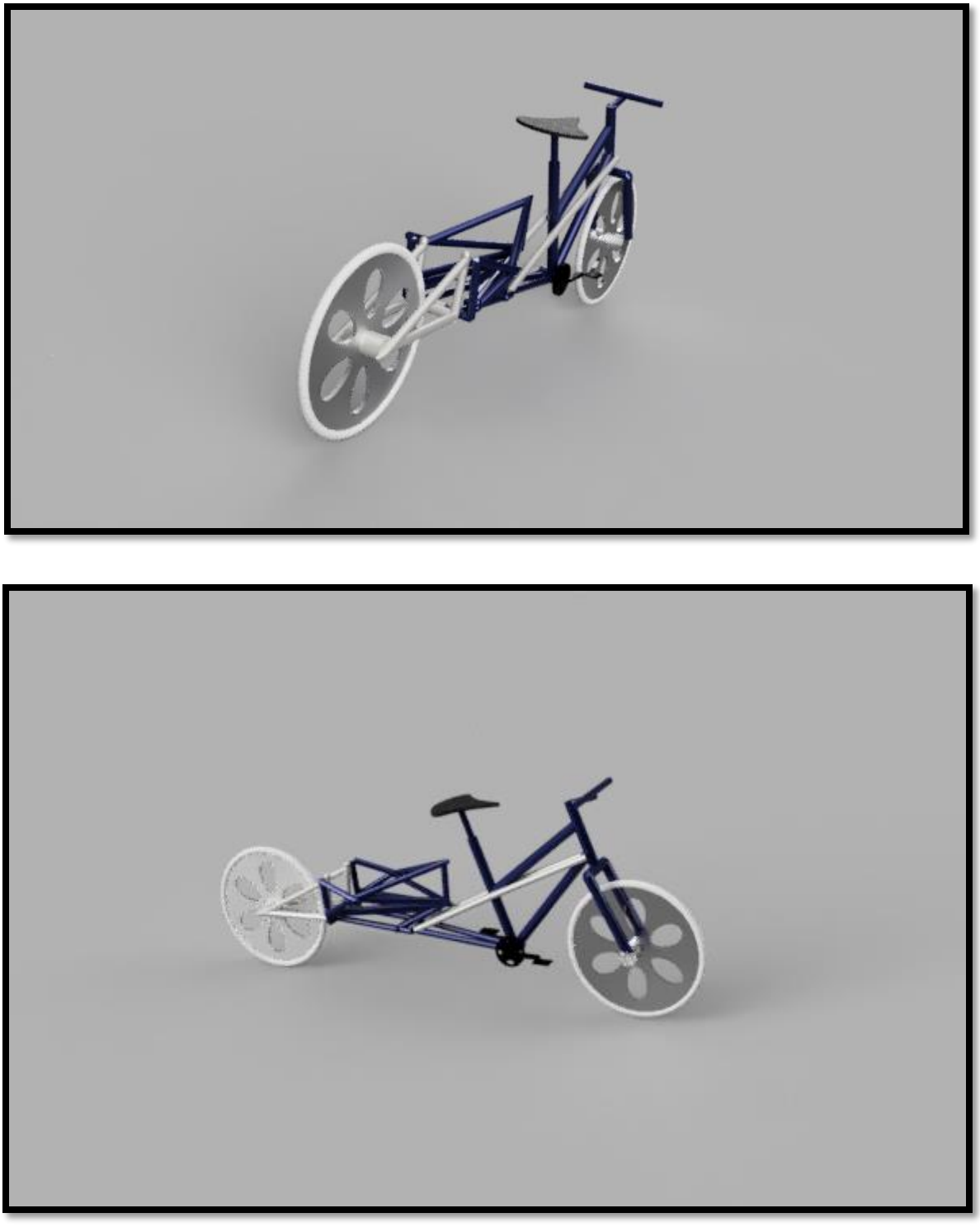


Fig 3 : CAD Model

Modified Design :

We have Modified design in order to reduce stress and increase the velocity of bicycle.

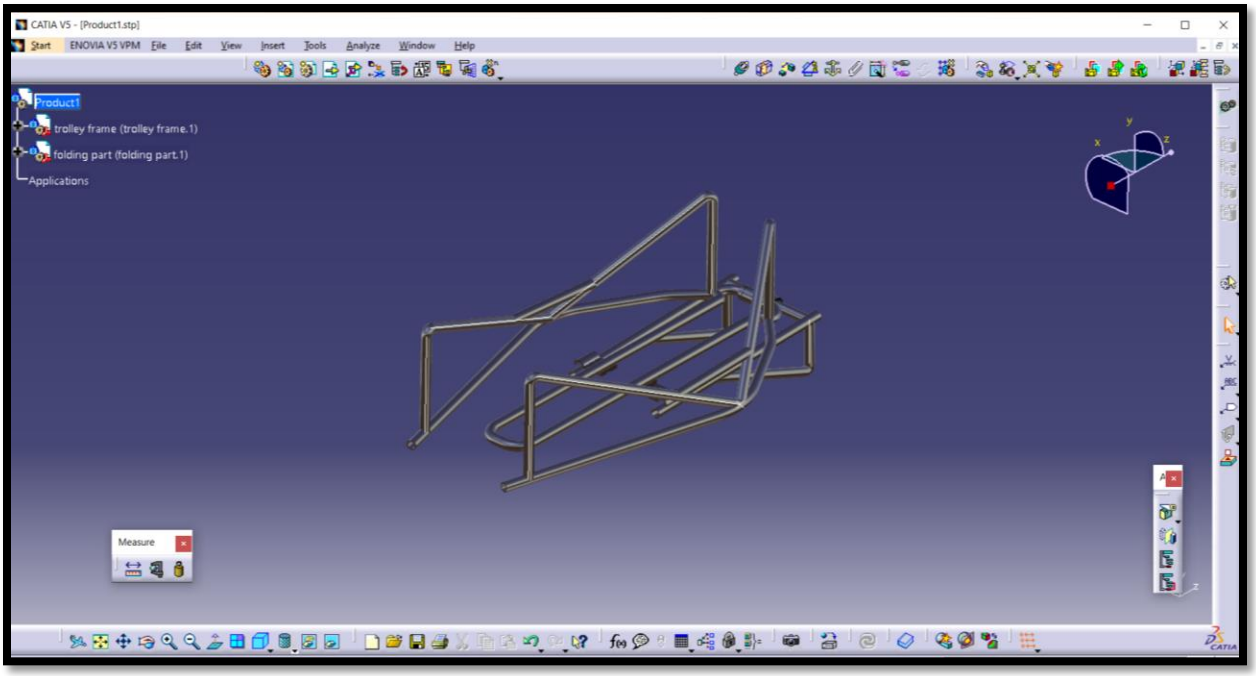


Fig 4 : Modified CAD Model

CHAPTER 5 : METHODOLOGY

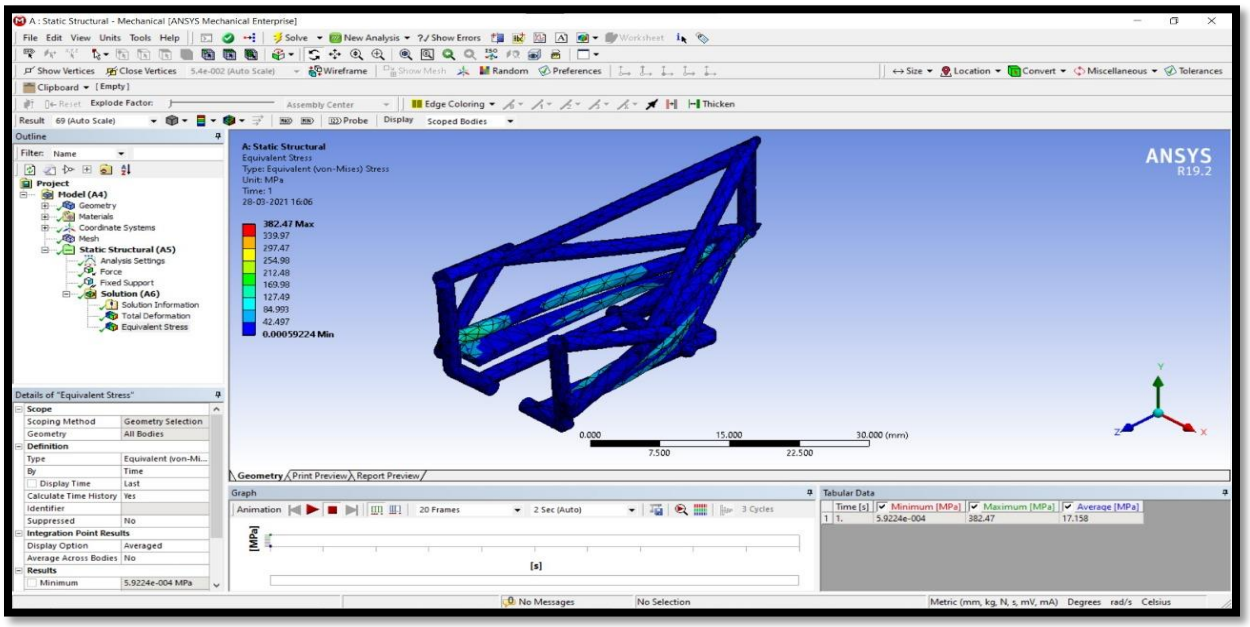
5.1 Analysis of frame

The engineering analysis done to overcome the drawback of the product design with the aid of computer systems is known as computer aided engineering (C.A.E). The FEA is the backbone of cae and assists in performing the validation of design. The CAE software used is ANSYS workbench which is a computer aided finite element modelling and analysis tool. The primary objective of frame is to have good structural rigidity and evenly spread load distributions. The frame model is first imported in the software, then set by material assignment and applying load conditions.

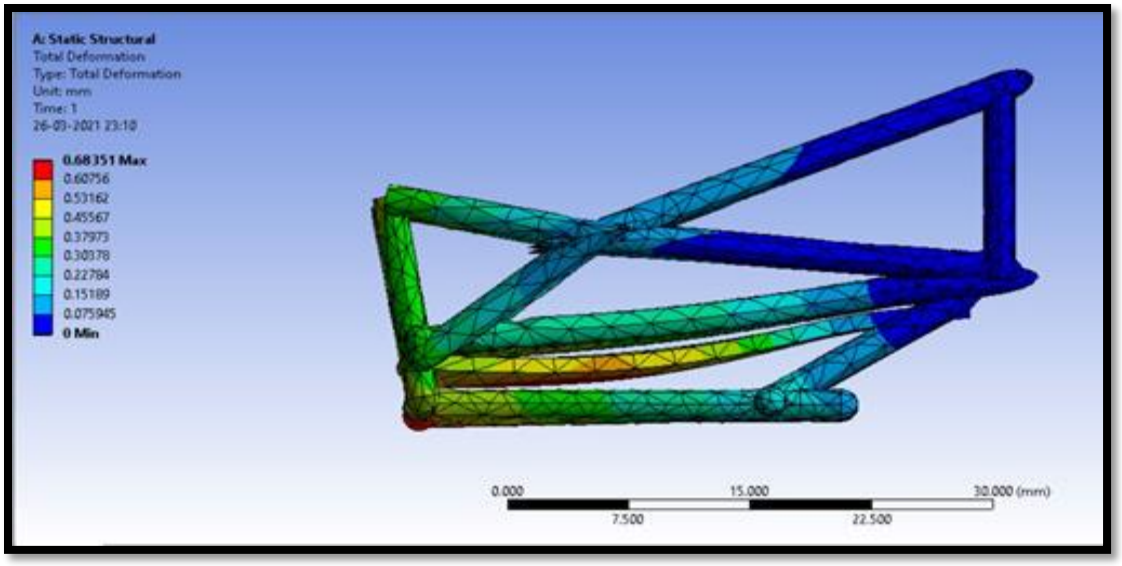
The model is imported into the static structural mechanical solver of ANSYS workbench. This is followed by material assignment and generating an automatic mesh dividing the model into 44353 nodes and 22695 elements. After this, the model frame is applied upon by the fixed constraints and the impact force in respective directions.

The traulley is tested for its strength while carrying the load. In this case the fixed geometries and magnitude of force is total maximum load able to carry by traulley. The net load can be taken as 60 kg at max, i.e. 584 n force is used for static analysis. The analysis yielded the following results: now, the model is analyzed for the defined constrained yielding the following results

Static structural analysis



Applied force : 584 N , **Max stress** : 382.47 Mpa



Total deformation : **0.045632** mm

Fig. 5 : Static Structural Analysis

Modal analysis

We have also performed modal analysis on our modified traulley to check whether the structure is able to wear the extreme frequency conditions or not.

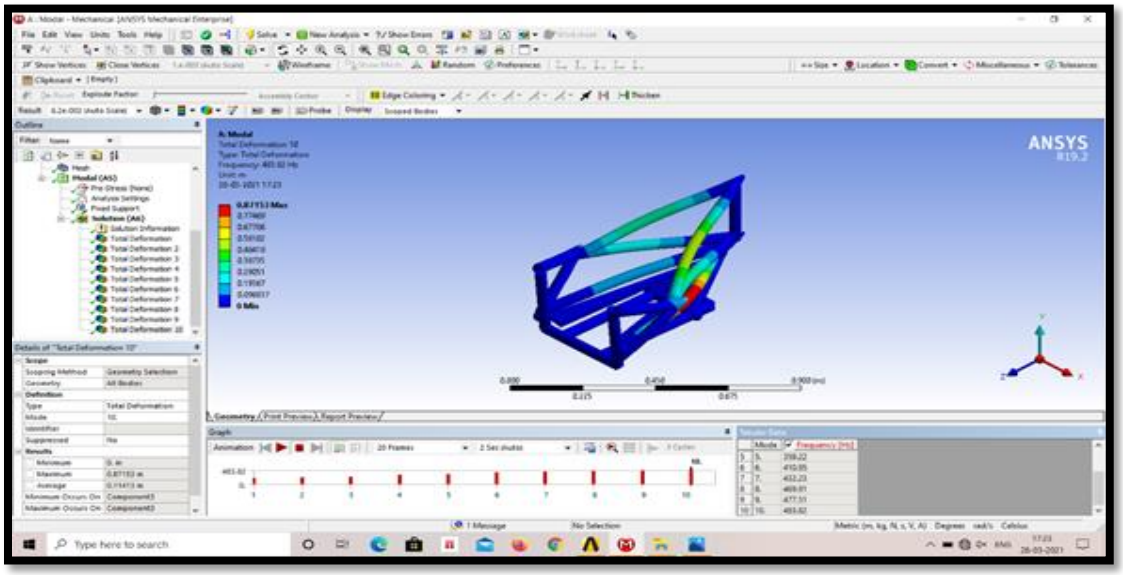


Fig. 6 : Modal analysis , Max frequency: 483.82 Hz

Modified Design Analysis :

Static Structural Analysis

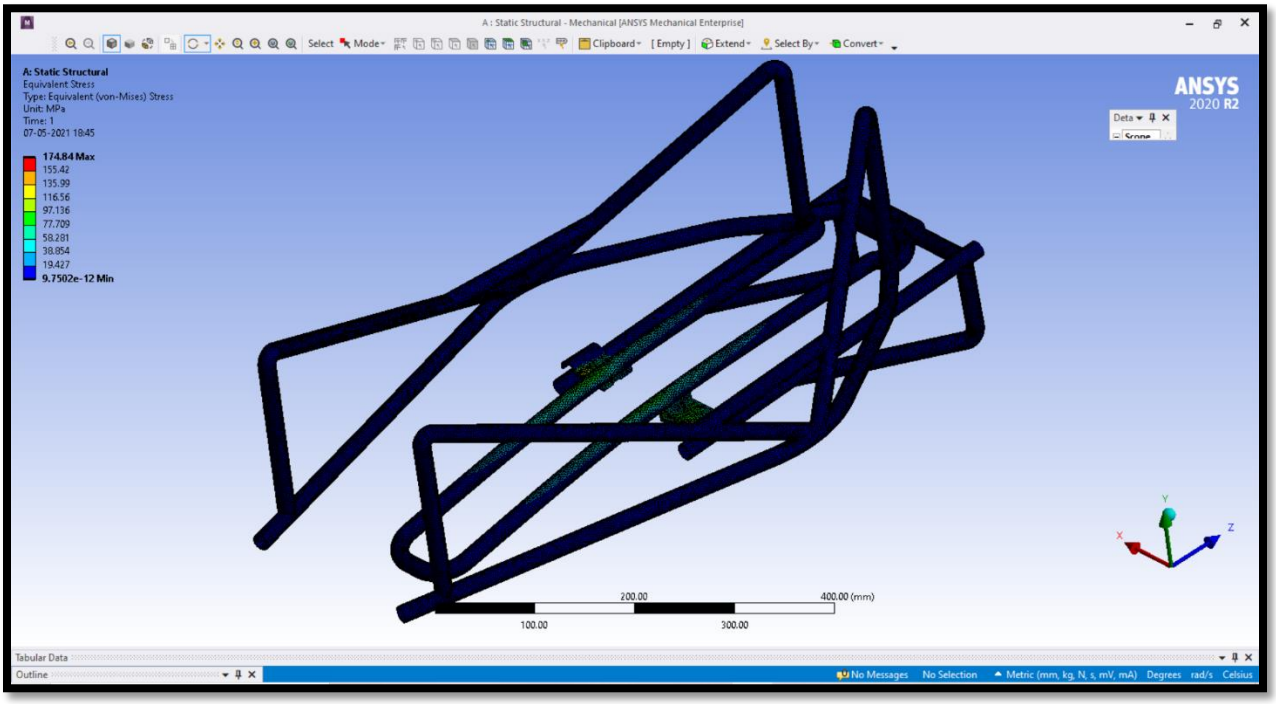


Fig. 7: Yield stress = 175 N Applied Force = 1000 N

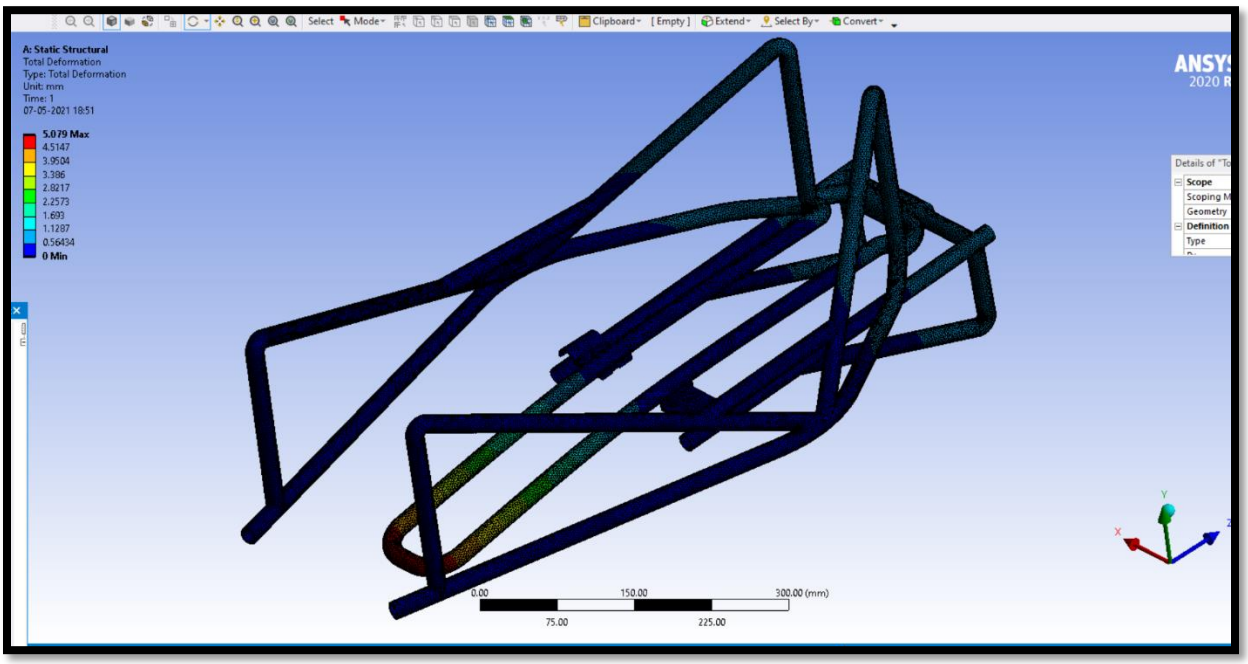


Fig 7 : Total Deformation – 5 mm

Dimensions :

Wheels	28"
Weight	18kg
Folded size	185cm | 72"
Total size	255cm | 100"
Trolley dimensions	Length- 75cm , width - 43cm
Frame size	One size
Suggested rider height	158cm-195cm | 5'2"-6'5"
Max rider weight	120kg
Loads capacity	60kg

Analysis Result and FOS :

Mathematical Calculations :

Calculation of Impact Force on Traulley ,

By Impulse- Momentum Theorem ,

$P = F_{impact} * \text{Delta } T$

$F_{impact} = P / \text{Delta } T$

Momentum generated of vehicles at top speed ,

$P = m*V$

$P = 60 (Kg) * 6.5 (m/s)$

$P = 39 Kg m/s$

Hence , $F_{impact} = 39 / 0.1$

$F_{impact} = 390 N$

CHAPTER 8 : CONCLUSION

8.1 Conclusion

We can conclude that , this is latest and one of the best modification in cargo bicycle , which is made in order to reduce the length(size) of the cargo bicycle by keeping the weight sustainable or loading capacity as it is . Also it is modification because in this we are making the compact and convertible model of the cargo bicycle , that's why we called it , convertible cargo bicycle . This project step towards to research on the environment friendly transportation

CHAPTER 9 : REFERENCE

Research paper printed in Journel	Sustainable city logistics- Making cargo cycles viable for urban freight transport Gabriele Schliwa, Richard Armitage, Sara Aziz, James Evans, Jasmine Rhoades http://dx.doi.org/10.1016/j.rtbm.2015.02.001
Research paper printed in Journel	Design and Operation of an Urban Electric Courier Cargo Bike System-Tanja neils, Moritz travis hof, Klaus bogenberger https://10.1016/j.trpro.2019.06.038
Research paper printed in Journel	Design and development of modern electric bike ISSN: 2278-0181 Vol. 9 Issue 11
Research paper printed in Journel	Design and Fabrication of Detachable Cargo Bicycle Trolley cum Hand Truck ISSN (online): 2349-784XVolume 4 | Issue 10