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REVIEW ON DESIGN AND FABRICATION OF FOLDABLE CARRIAGE BICYCLE

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Abstract - *Folding carriage cycle is a new folding cargo bike project combining the hauling capacity of an extended long-tail cargo bike with the maneuverability of a conventional short wheelbase city commuter. The idea is relatively simple – fold the rear wheel back to extend the bike's wheelbase & carrying capacity. But it is the clever pivoting solution & nesting rear end that makes it so easy to extend, maintains comfortable handling in either position, and opens up the possibility of pedal-assist. in its folded position its compact size is no different to a common bike. Therefore, it is easy to ride, park and lock at your destination. With a simple lifting move the rear wheel swings out under the basket, creating space for daily shopping, sports equipment or child seats. Its volume offers space for two bigger crates of water.*

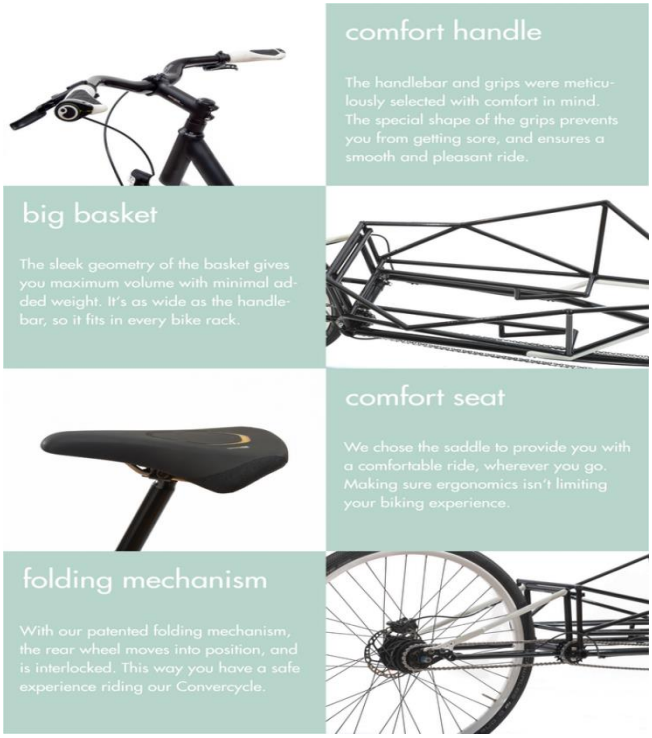
Keywords: Modeling, motorcycle frame, ANSYS

1. Introduction

There are plenty of reasons to choose a bike for transportation, especially in an urban setting. But when you have to pick up groceries or bigger objects, you'd typically opt to hop into a car. Folding carriage cycle looks like a standard bike, but the back lifts and extends to transform it into a cargo bike when needed. The rider can use only one hand to perform this smooth movement, for more convenience. The cargo version can haul 45 kgs and can even fit two big water crates. The storage space suits everything from kids seats to luggage and grocery bags. To renounce the car in a city isn't that hard in everyday life. Traffic jam, few parking lots and air pollution are good reasons for cycling. However, if there are bigger objects to be transported one easily jumps to the car.

Common cargo bikes are usually a solution but they are tricky to handle due to their size. Steering gets hard when the weight is located on the front wheel. The bike's size makes it impossible to secure in bicycle racks, transport on a train or take inside a lift. For these reasons many people find them not suitable for daily use. The two conditions of the Folding carriage cycle eBike make it adaptable, flexible and spontaneous for different fields of application. This is also a plus compared to a trailer. With different systemic add-ons like a lockable box the Folding carriage cycle adapts to the needs of the driver. They offer a unique vehicle that integrates seamlessly into modern everyday life and offers a whole new level of flexibility to urban lifestyle. The chain drive is the heart of our bike. Therefore, we put a lot of effort to ensure that it has a long service life and runs smoothly. The innovative chain drive is separated into three segments. The individual chain segments are connected via ball bearing double sprockets. Separating the chain into three parts allows us not only to increase the tension on the individual chain segments, but also to optimize the chain line considerably, giving us standard chain lengths and a bottom bracket in standard width. At Folding carriage cycle Bikes, we're not just thinking about mobility and transportation.

One of our main motivations is sustainability. We want to launch a product that is produced in an environmentally friendly way and lasts a long time In general, steel is considered a very resource intensive material. In our research, however, we found that this must always be seen in context. And in the context of bicycle frames, steel is far superior to other common materials such as aluminum and carbon fiber reinforced plastic in terms of resource consumption. There are small bikes and big bikes, new ones and old ones, heavy ones and light ones. All of them are unbeatable for our spontaneous journeys through the city. However, there is a downside when it comes to transportation: cars need a lot of space, they pollute the air and are mostly stuck in traffic jams. Cargo bikes are great, provided you have the parking space they need. What we need in our cities are small bicycles that only turn large when needed That's how our idea was born: We simply merged two bikes into one, a city bike and a cargo bike. This way you don't have to choose. Easy peasy. It wasn't that easy after all, but a few night shifts later and with the help of our awesome team, the Folding carriage cycle Bike came to life: A city bike and a cargo bike in one, which can be converted within 3 seconds. Yes, it works We want to offer high-quality products that are sustainable in production and us We are rethinking mobility so that we no longer have to ask ourselves why a single person in a 5-seater SUV drives to work alone every day.



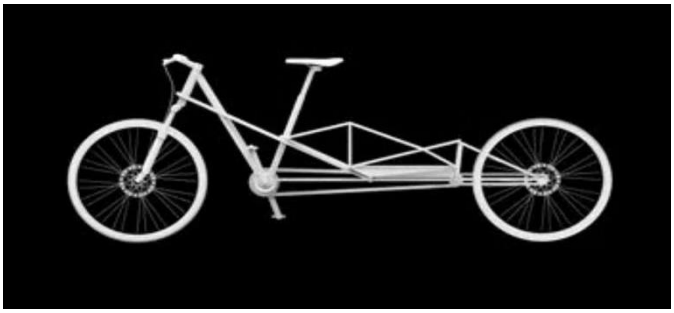
2. Problem Statement

It has been observed that the courier delivery service boys usually have a heavy bag packs on their scooter or bike which can slide to one side or the other which may result in accident. Also the heavy bag packs cause shoulder fatigue and the delivery boys generally have to pay for the fuel expenses. That, in turn, can exacerbate any discomfort you may have or may develop in the future. That includes ass pain, back pain and arm and hand pain. Let the bike carry the load, not you. The other types of carts lead to high risk of pushing by consuming more amount of energy. Which becomes tedious in summer and rainy seasons. So, In order to overcome such problems a new foldable carriage bicycle may be used for easy transport of goods. Foldable carriage is designed and fabricated on a bicycle. The deployment of such type of cycle will help to reduce the strain of expenses on the delivery boys as it will help in cutting down the cost of fuel used in their bikes. These types of cycles can be allocated to delivery boys thereby assigning a group to them to particular area in the city reducing the need excess travelling from one corner of the city to other for delivery work. Also it will help in reducing the traffic congestion and reduce the pollution level which are very high at present time.

3. Design consideration

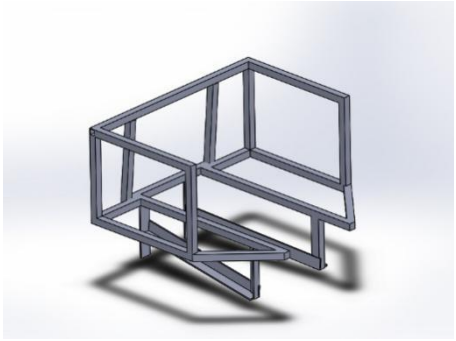
3.1 Folding cycle frame Design: -

Normal State



Extended Cargo State

While designing a frame for two-wheeler type of frame structure for required should be specified first. Available type of motorcycle frames in practice is as follows:



Carriage

Assembly

3.2 Materials used and stress analysis done:

1. Materials plays vital role in frame design, the chemical composition of various elements in existing conventional suspension frame steel plain carbon steel is as below.

Material Properties

Name: Plain Carbon Steel

Model type: Linear Elastic Isotropic

Yield strength: 2.20594e+08 N/m^2

Tensile strength: 3.99826e+08 N/m^2

Elastic modulus: 2.1e+11 N/m^2

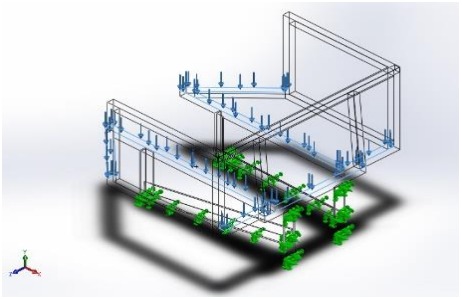
Poisson's ratio: 0.28

Mass density: 7800 kg/m^3

Shear modulus: 7.9e+10 N/m^2

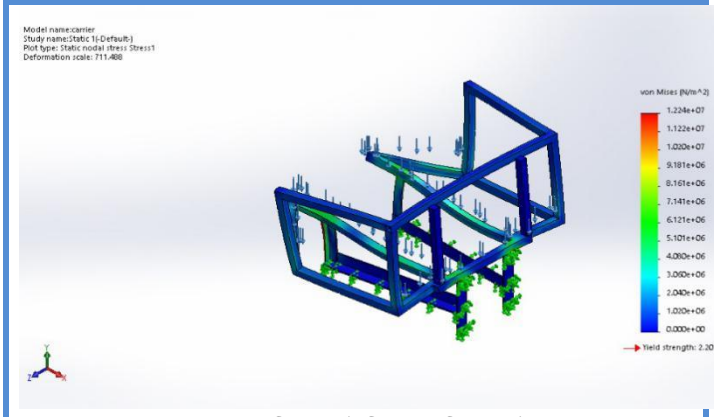
2. The mild steel is used for following reasons: Easily available in all sections, Weldingability, Machinability, Cuttingability, Cheapest in all other metals.

3. Programming can utilize workpiece in NX-CAD fordisplaying which can be analysed by ANSYS.



The blue line shown in fig is 600N load on carriage and bottom green arrows represents the supports

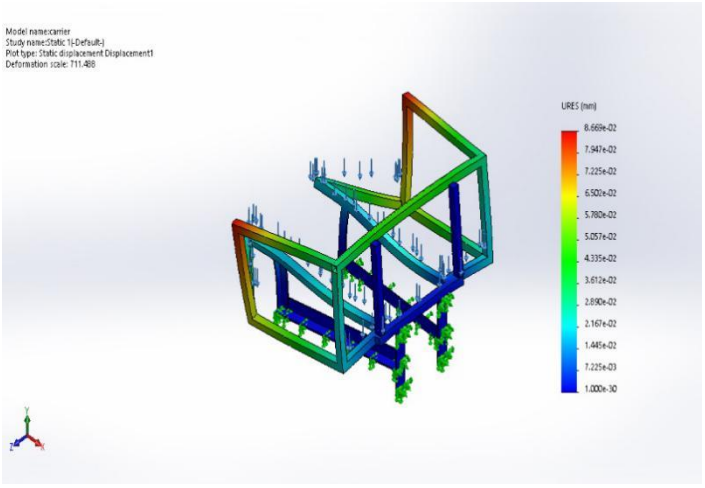
Name	Type	Min	Max
Stress1	VON: von Mises Stress	0.000e+00 N/m^2 Node: 1	1.224e+07 N/m^2 Node: 2248



carrier-Static 1-Stress-Stress1

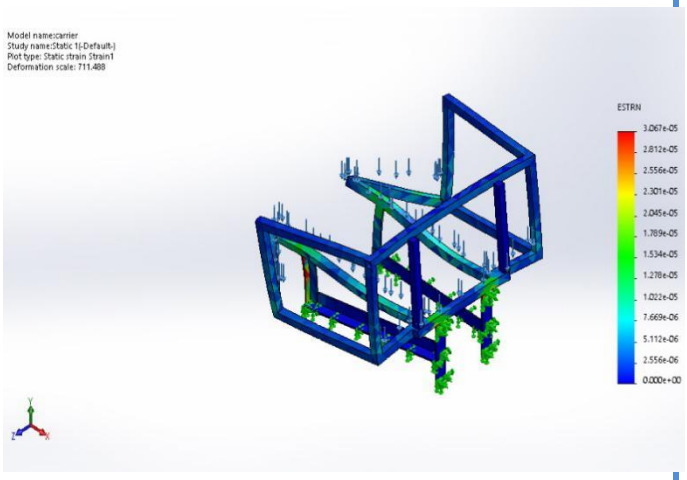
Name	Type	Min	Max
Displacement1	URES: Resultant Displacement	0.000e+00 mm Node: 1	8.669e-02 mm Node: 510

Name	Type	Min	Max



carrier-Static 1-Displacement-Displacement1

Name	Type	Min	Max
Strain 1	ESTRN: Equivalent Strain	0.000e+00 Element: 1	3.067e-05 Element: 1655



carrier-Static 1-Strain-Strain1

3. Methodology

1. The folding carriage cycle is constructed using tubular steel frame including the integrated cargo storage and pivoting mechanism and it weighs roughly around 18kgs.
2. The pivoting mechanism to extend the cargo space is very simple essentially lifting the bike and pivoting the rear wheel to reveal the cargo space.
3. The cargo space is made of same tubular steel frame as the rest of the cycle so it can carry a payload of over twice the weight of the cycle.
4. The chain drive at pivot point uses a twin sprocket design which allows the cycle to drive like normal cycle in both situations.
5. The cycle will have locking mechanism at both sides to prevent accidental dislodge of pivoting wheel. One of the lock to open the wheel and pivot it will be near the pedal and the rear locking mechanism will use friction to hold it in place when deployed.
6. It will have the footprint of the common cycle in its non-extended state so parking it in cycle parking spot will also be easy.
7. The seat and handle are designed in ergonomic and can be easily adapted to the rider's specification for prolonged use
8. The current style cargo transportation cycles are extremely heavy in comparison and occupy lot of space to store it.
9. Along with it they cannot be parked in conventional cycle storage spots due to their bulky nature.
10. Also in case of transporting the cycle from one spot to another can only be done which use of transport truck.
11. This limits the use of these cycles a they cannot be transported from place to place using common public transport means such as railways, metros, public buses etc.

5. Result and conclusion

1. It is concluded that, the analysis done on carriage frame for 60kg load the frame is made up of 15x15mm square pipe with 1.5mm thickness, it is light weight and also strong enough to withstand load. The deployment of such type of cycle will help to reduce the strain of expenses on the delivery boys as it will help in cutting down the cost of fuel used in their bikes.
2. These types of cycles can be allocated to delivery boys thereby assigning a group to them to particular area in the city reducing the need excess travelling from one corner of the city to other for delivery work.
3. Also it will help in reducing the traffic congestion and reduce the pollution level which are very high at present time
4. Finding alternatives to vans or trucks for deliveries in congested areas can improve

efficiencies, and therefore business costs, for delivery companies; it can also reduce emissions from urban freight and help reduce congestion on streets to help people and goods move faster through our cities. Improving goods movement in Toronto through cycle logistics will bring the following benefits

6. Acknowledgement

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