

A PROJECT REPORT

Entitled

**“ Modeling & Simulation of Modern Multi-Way
Dumping Hydraulic Trolley Mechanism ”**

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ABSTRACT

Trolley has lots of applications in today's world. In industrial and domestic considerations, tippers can pull a variety of products including gravel, grain, sand, fertilizer, heavy rocks, etc. The older dropping trolley/dumper has been conceived by observing the difficulty in unloading the materials. The survey in this regards in several automobile garages, revealed the facts that mostly some difficult methods were adopted in unloading the materials from the trolley. By considering wide scope of the topic, it is necessary to do study and research on the topic of tipper mechanism in order to make it more economical and efficient. Hence a Model of suitable arrangement has been designed. The vehicles can be unloaded from the trailer in three axes without application of any impact force. The Direction of the mechanism can be control with the help of ball and socket joint which attached the ram of the hydraulic cylinder which lifting the trailer cabin in require side. Further modifications and working limitations will put this work in the main league of use. This concept saves time & energy which leads to efficient working .

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Introduction

A dump trolley is a trolley used for transporting materials for construction. A typical dump trolley is equipped with an open-box bed, which is hinged at the rear and equipped with hydraulic pistons to lift the front, allowing the material in the bed to be deposited ("dumped") on the ground behind the trolley at the site of delivery.

Hydraulic System :

- In the development of the submarine from pre-war classes, many changes and improvements have occurred. One of the outstanding differences is the large variety of submarine devices which are now operated by hydraulic power. In early classes, there was no hydraulic system, and power requirements were met by means of air or electricity. Along with constantly improving submarine design has gone a constant extension and diversification of the use of hydraulic power.
- Comparative advantages of hydraulic power.
- Hydraulic systems possess numerous advantages over other systems of power operation. They are light in weight; they are simple and extremely reliable, requiring a minimum of attention and maintenance. Hydraulic controls are sensitive, and afford precise controllability. Because of the low inertia of moving parts, they start and stop in complete obedience to the desires of the operator, and their operation is positive. Hydraulic systems are self-lubricated; consequently there is little wear or corrosion. Their operation is not apt to be interrupted by salt spray or water. Finally, hydraulic units are relatively quiet in operation, an important consideration when detection by the enemy must be prevented.
- Therefore, hydraulic power makes its appearance on the submarine because of the fact that its operational advantages, when weighed against the disadvantages enumerated for electricity and air in the preceding paragraphs.

II. Major Components:

Major Parts The major parts “HYDRAULIC THREE AXIS MODERN TROLLEY” are described below:

- Hydraulic cylinder
- Trolley
- Chassis (Base frame)
- Spur Gear
- Connecting hoses
- Ball Bearing
- Hinges

i. Hydraulic Cylinder:

A Hydraulic cylinder (also called a linear hydraulic motor) is a mechanical actuator that is used to give a unidirectional force through a unidirectional stroke. The Single Acting hydraulic cylinder which is the simplest type of hydraulic motor, contains a spring-loaded piston, with a piston Rod that extends through one end of the cylinder. In my project, this single acting hydraulic cylinder is used.



ii. Trolley:

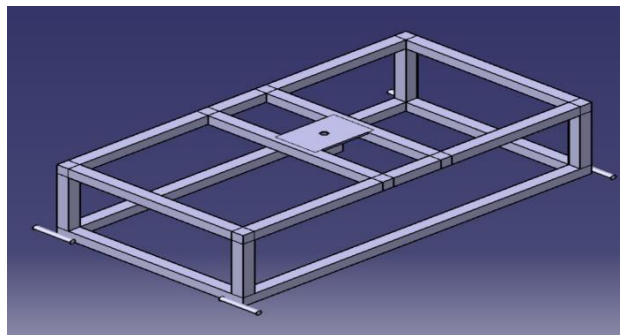
Tractor Trolleys are very popular and cheaper mode of goods transport in rural as well as urban area. Trolleys are widely used for transporting agriculture product, building construction material and industrial equipment. The main requirements of trolley manufacturing are high performance, easy to maintain, longer working life and robust construction. The varieties of trolleys are available and use of particular trolleys depends upon their application. They are available in various capacities like 3 tonne, 5 tonne, 6 tonne, 8 tonne etc.



iii. Chassis:

A chassis is one of the key components of the trolley. It consists of an internal frame work that supports the container of tractor trolley in its construction and use. It serves as a frame work for supporting the body. The Chassis is used to support the container on which the load is to be carried out. Functions of Chassis :

- To carry load of the goods carried in the body.
- To withstand the forces caused due to the sudden braking or acceleration.
- To withstand the stresses caused due to the bad road condition.



iv. Spur gear :

Spur gears are a cylindrical shaped toothed component used in industrial equipment to transfer mechanical motion as well as control speed, power, and torque. e or multiply torque by transmitting motion and power from one shaft to another through a series of mated gear.



v. Connecting Hoses:

Hydraulic hose fittings are used to connect hydraulic hoses, tubes, and pipes to pumps, valves, cylinders and other parts of the hydraulic system



vi. Ball Bearing:

A ball bearing is a type of rolling-element bearing that serves three main functions while it facilitates motion: it carries loads, reduces friction and positions moving machine parts. Ball bearings use balls to separate two “races,” or bearing rings, to reduce surface contact and friction across moving planes.



III. Methodology :

In our attempt to design a special purpose machine we have adopted a very careful approach, the System design mainly concerns with the various physical constraints and ergonomics, space requirements, arrangement of various components on the main frame of machine no of controls position of these controls ease of maintenance scope of further improvement; height of m/c from ground etc.

IV. Working Principle :

The material unloading process is done in three axis with the help of hydraulic system. The fluid is going to the hydraulic cylinder through the direction control valve and flow control valve. The direction control valve is used to control the flow direction of the hydraulic cylinder in both the direction and flow control valve is used to control the flow of fluid towards cylinder. It is mainly based on rotation of trolley and divided in two parts Rotation and Dumping. For rotation of tipper, we used spur gear mechanism. Spur is directly coupled with electric motor which is at horizontal position. On the lower side of dumper, the spur gears are meshed with worm wheel and the axis of rotation of spur gear is vertical, which is directly attached to tipper trolley. The power supply is provided to the electric motor by using rocker switch to complete the circuit of motor. As a motor start rotating the worm is also rotated at same speed and spur gear which is connected to worm wheel. The vertical shaft which is connected directly to the centre of tipper trolley, when worm complete its 1 rotation then 1 teeth of worm gear moves forward. Spur gear which having 40 teeth on its profile. When 10 teeth of spur gear are moved forward then trolley gets rotated by 90° from its initial position in 20 second. The rotating direction of trolley is changed or reversed rocker switch. When the trolley completes its required angle then material is dumped with the help of pneumatic cylinder. The compressed air is supplied by air compressor to cylinder. The air flow direction is controlled by solenoid valve. On the cylinder two forces are provided one on upper side & other on one side. For the upper movement of trolley air is supplied through the lower port and for downward movement of trolley air is

released from the same port.

*Fig. 3-D model
three way
dumping trolley*



V. System Design :

In system design we mainly concentrate on the following parameter

i. System selection based on physical constraints

While selecting any m/c it must be checked whether it is going to be used in large scale or small scale industry in our case it is to be used in small scale industry so space is a major constrain .The system is to be very compact it can be adjusted to corner of a room. The mechanical design has direct norms with the system design hence the foremost job is to control the physical parameters so that the distinction obtained after mechanical design can be well fitted into that.

ii. Arrangement of various component

Keeping into view the space restriction the components should be laid such that their easy

removal or servicing is possible moreover every component should be easily seen & none should be hidden every possible space is utilized in component arrangement.

iii. Mechanical Design

Mechanical design phase is very important from the view of designer as whole success of the project depends on the correct design analysis of the problem.

Many preliminary alternatives are eliminated during this phase. Designer should have adequate knowledge about physical properties of material, loads stresses, deformation, and failure. Theories and wear analysis, He should identify the external and internal forces acting on the machine parts

These forces may be classified as;

- a) Dead weight forces
- b) Friction forces
- c) Inertia forces
- d) Centrifugal forces
- e) Forces generated during power transmission etc

Designer should estimate these forces very accurately by using design equations .If he does not have sufficient information to estimate them he should make certain practical assumptions based on similar conditions which will almost satisfy the functional needs. Assumptions must always be on the safer side.

VI. Material Selection :

The proper selection of material for the different part of a machine is the main objective. In the fabrication of machine. For a design engineer it is must that he be familiar with the effect, which the manufacturing process and heat treatment have on the properties of materials. The Choice of material for engineering purposes depends upon the following factors:

1. Availability of the materials.
2. Suitability of materials for the working condition in service.
3. The cost of materials.
4. Physical and chemical properties of material.
5. Mechanical properties of material.

The mechanical properties of the metals are those, which are associated with the ability of the material to resist mechanical forces and load. We shall now discuss these properties as follows:

- | | |
|----------------|-----------------|
| A. Strength | B. Elasticity |
| C. Stress | D. Plasticity |
| E. Strain | F. Ductility |
| G. Brittleness | H. Malleability |
| I. Toughness | J. Resilience |

When a part is subjected to a constant stress at high temperature for long period Of time, it will undergo a slow and permanent deformation called creep. This property is considered in designing internal combustion engines, boilers and turbines.

Selection of the material depends upon factor of safety, which in turn depends upon the following factors.

1. Reliabilities of properties
2. Reliability of applied load
3. The certainty as to exact mode of failure
4. The extent of simplifying assumptions
5. The extent of localized
6. The extent of initial stresses set up during manufacturing
7. The extent loss of life if failure occurs
8. The extent of loss of property if failure occurs

VII. Solidworks Model :

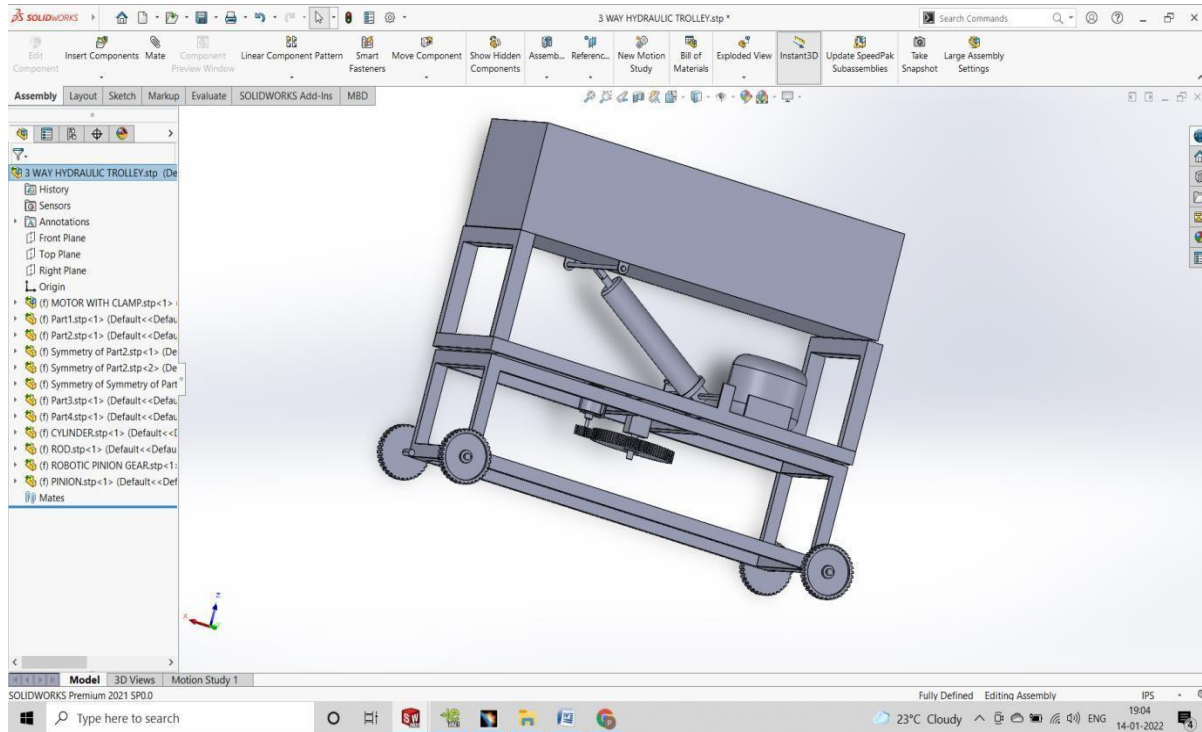
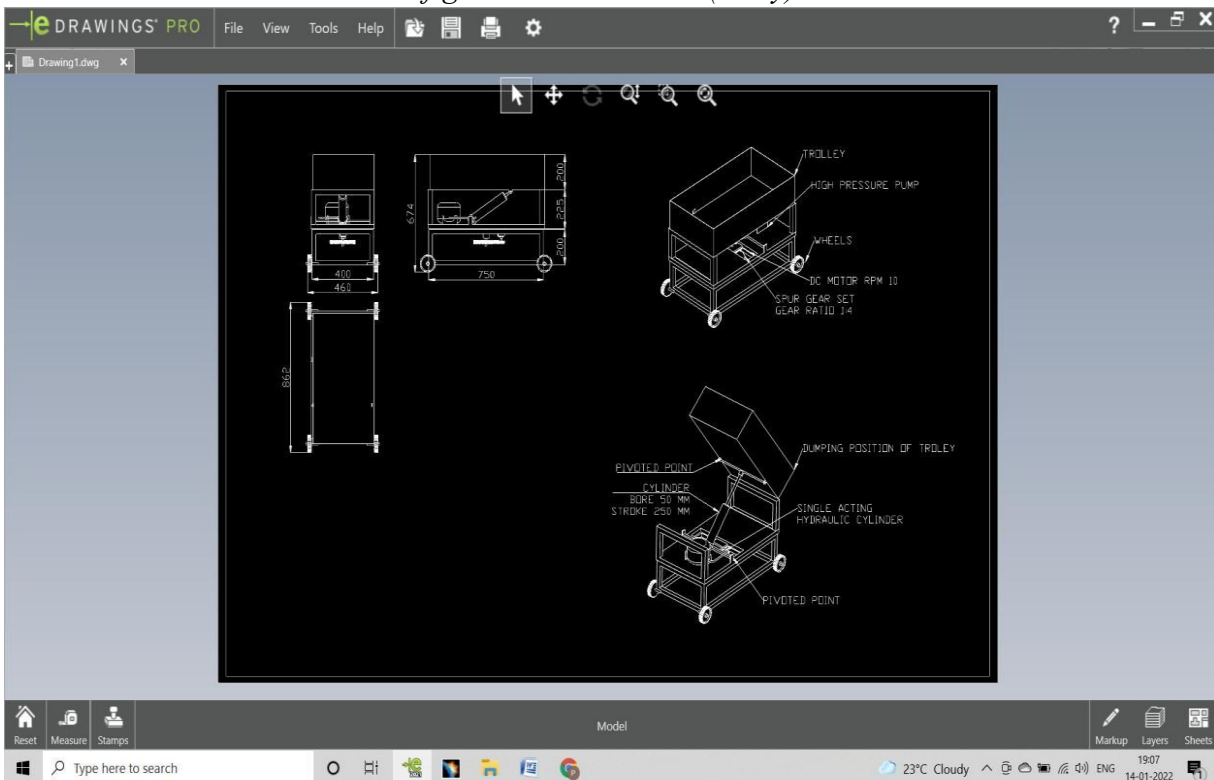


fig. solidworks model(trolley)



VIII. Ansys Simulation :

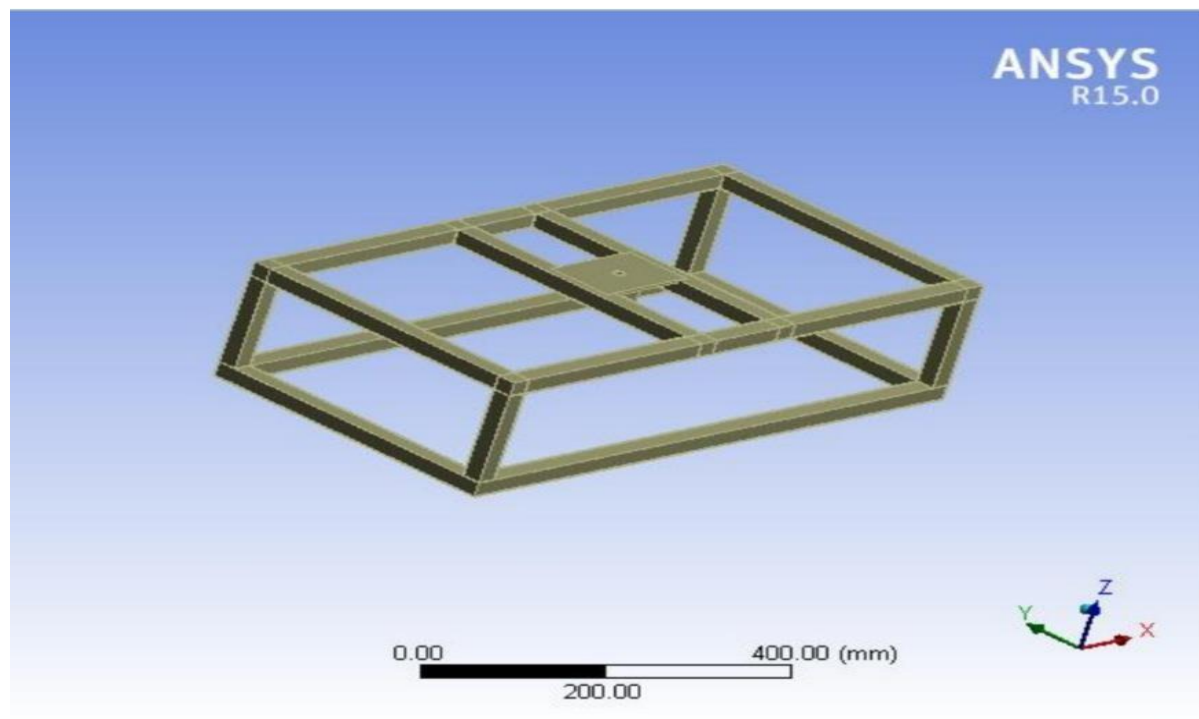
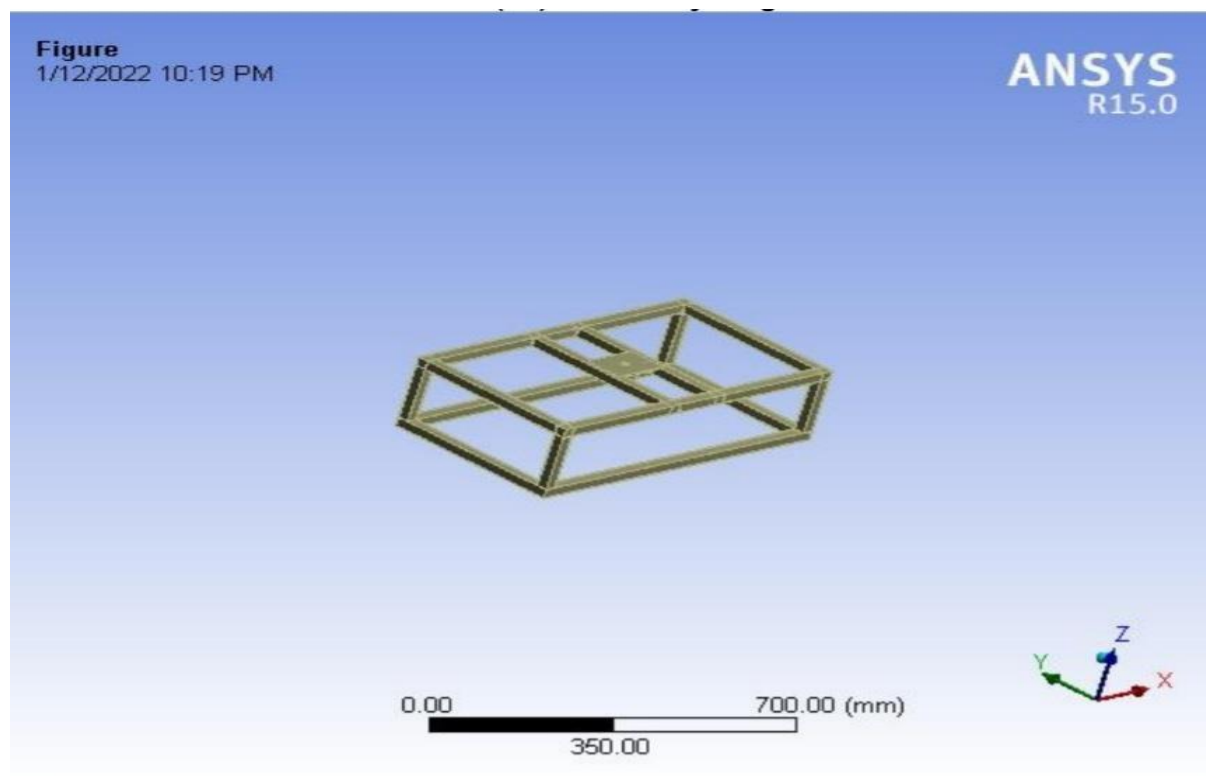
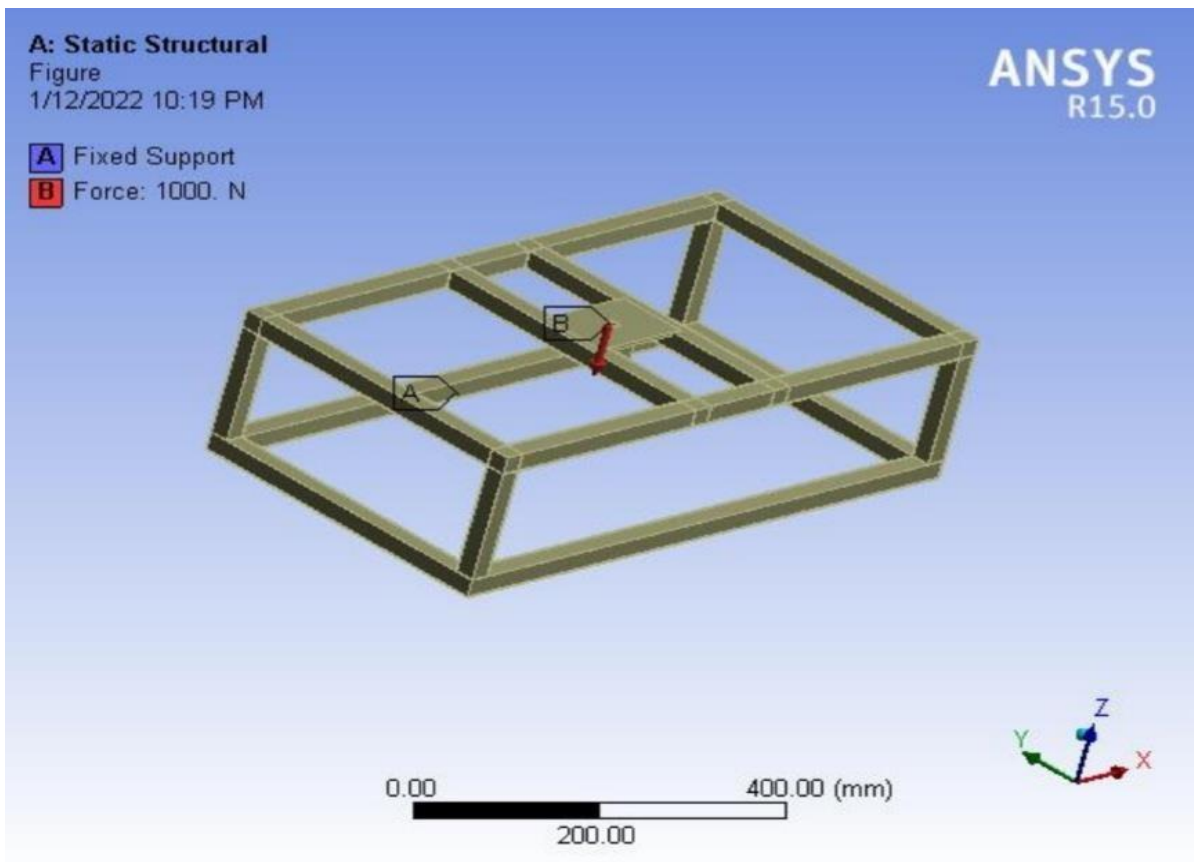
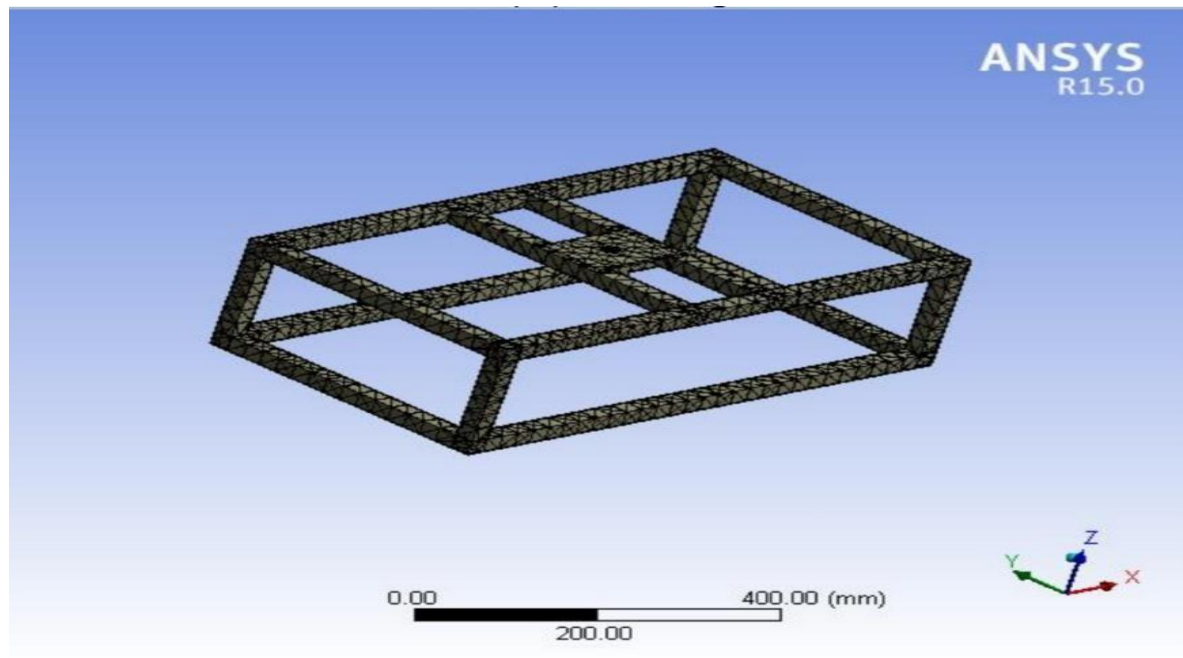


fig. 22





A: Static Structural

Figure

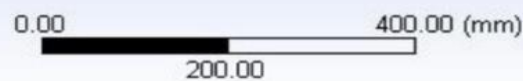
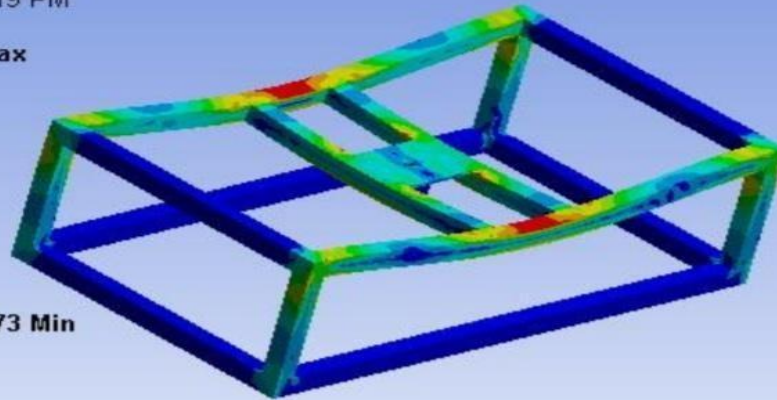
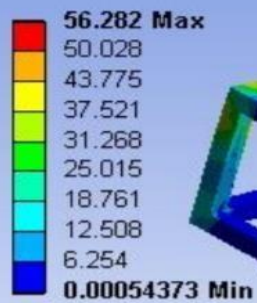
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Unit: MPa

Time: 1

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A: Static Structural

Figure

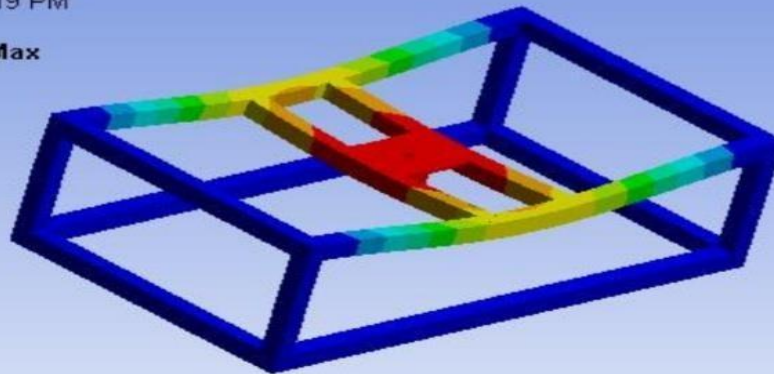
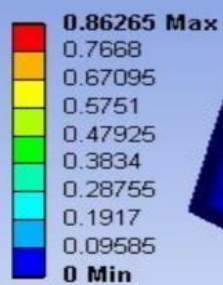
Type: Total Deformation

Unit: mm

Time: 1

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R15.0



IX. Conclusion :

Further modifications and working limitations will put this work in the main league of use. This concept saves time & energy which leads to efficient working. The constructional work or the infrastructural work demands efficient and user friendly machinery which will lead to more and more use of unidirectional dumper. We have been able to increase the easiness in unloading trolley. Problems occurred at the time of unloading the trolley in critical areas are eliminated. And thereby reducing overall time and fuel required for unloading the trailer.

X. Future Scope :

- Pneumatic cylinder can be used instead of Hydraulic cylinder to carry light weight load.
- Instead of one large cylinder, two small identical cylinder of same capacity can be used to lift higher loads. This helps to reduce the pump work.
- As the world progressing at faster rate we meet mover and mover huge construction which head to be dig big and big amount of the earth and thus more efficiently working equipment are to be required and hence the Development of Three Axis Modern Pneumatic trailer may be used more than the two way or one way. India is progressing at higher rate and hence infrastructural development is on its high. Hence the future of this project work seems promising. The project work can be modified further more on following basis:
 - Dual stage cylinders can be used.
 - This system can be used by using hydraulic system instead of pneumatic systems for higher loads.