

# Design and Fabrication of Loading Device for Tractor Trailer

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**Abstract:** The constructional features and the functioning aspects are included in the paper to get the complete insight of the topic. Tractor trailers are come in market for the onion auction. Before the onion auction the quality will be checked by agents. During the process of quality checking the onions are dropped from tractor trailer. Unloading of tractor trailer causes onions become scarred and become scaly. Out off 8 quintal onions there are 1 or 1/2 quintal onions are wasted. Labours are required to fill onions in the tractor trailer. Farmer paid money for the labours. As a solution to this we design and fabricate loading device for tractor trailer. This loading device is automatically lowered at some distance by using two hydraulic double acting cylinders. Hence agents easily checked the quality of onions. After checking the quality of onions the loading device automatically fills the tractor trailer. The loading device can pick up the load of 400 kg. Unskilled person can also operate this arrangement very easily as it does not requires any special training. Various models of tractors like Swaraj, Mahindra, Arjun, Sonalika can use this loading device attachment as accessory without changing its actual mechanism. This loading device is eliminates wastage of the onions and maintain the quality of the onions. This loader attachment is developed to minimize the labour work as well as to minimize a time. Our project aim is to reduce the work load on the farmers and save the time and money of farmer.

**Index Terms-** Bucket assemblies, Hydraulic system, Bucket capacity, Detail design.

## I. INTRODUCTION

India is the second largest onion growing country in the world. There is a lot of demand of Indian onion in the world. Maharashtra ranks first in onion production and famous for their caustic quality and available round the year. Tractor trailer is widely demanded in agriculture industry for transporting agro products from one place to another. In current scenario of constructional equipment like tractor front hydraulic bucket is used, but that type of bucket has more extra attachments required. The cost of this bucket is high and more complicated. One of the most popular implements for compact tractors is a front-end loader. A loader will allow you to dig, move soil or other bulk products, carry bags and other bulky items, lift pallets and even do light grading. Not all compact tractors are equipped with the necessary hydraulic connections for a loader, so be sure you check on hydraulics if adding a loader to an existing tractor.

The unloading of tractor trailer is very simple in early tractors because of hydraulic systems are used. But there is no any device for loading the materials from the backside of the tractor trailer. During quality checking of onions in onion market out off 8 quintal onions 1 or 1/2 quintal onions are wasted. The workers are required for fill the tractor trailer. It is time consuming and also pay money for the labours. Considering the above problems in tractor trailer there is need of the project work riser which is about loading device for tractor trailer.

## II. LITERATURE REVIEW

Sagar Kailas More, Susheel M. Magar and Pradip B. Dhole, in their paper expressed that, the rear loader attachment minimize the labour work and time. This attachment is developed to overcome the various limitations which other earth moving equipment have like larger size, heavier in mass generally in tones. Important benefit of this design is that, it allows mower desk to stay attached to the tractor while providing quick engagement-disengagement features. Unskilled person can also operate this arrangement very easily. It can pick up a load up to 120 kg to 150 kg. Its cost is much lower as compare to other accessories available in market [1].

Bheemrao m. Kamble focuses on solid modelling of the front end loader of tractor and its F.E analysis for strength Evaluation. Finite element analysis is the most powerful technique used to evaluate strength of the structures working under high loads [2].

Sujit Lomate, Siddaram Biradar, Ketan Dhumal and Amol Waychal, in their paper focuses on the evaluation method of bucket capacity and digging forces required to dig the terrain for light duty and heavy duty construction work. This method provides the prediction of digging forces and can be applied for autonomous operation of excavation task [3].

Ritenkumar B. Parekh, Kalpesh N. Shah and Krunal J. Shah in their paper tell about hydraulic drive system uses hydraulic fluid to transfer a power. Such systems are widely used because it offers high accuracy and high operating pressure. Normally cost of such system is high. To reduce cost and improve strength of hydraulic mechanism, analysis and optimization have been carried out on various mechanisms which are discussed in this review paper [4].

### III. PROBLEM STATEMENT

There is no any device for tractor trailer for loading the various materials. Filling the various materials in tractor trailer is not easy. It is time consuming and labours are also required, which is both slow and exhausting. The problem presents several engineering challenges and opportunities for the optimization of the device. The main engineering challenge consists of creating a design that uses two cylinders that achieves the necessary tilt the bucket, while maintaining lower cost to produce.

#### 3.1 Objectives

- The main objective of our project is to provide loading device (bucket) that is used in combination with hydraulic system of tractor trailer.
- Make use in agricultural as well as commercial.
- To reduce man power and time saving.
- Inexpensive to construct and economical to maintain.
- Efficient in operation.

#### 3.2 Scope

- Operating of the device is easy.
- Replacement of the parts is easy.
- Labour work is not required.
- Repairing of parts is easy.
- Construction cost is low.

#### 3.3 Methodology

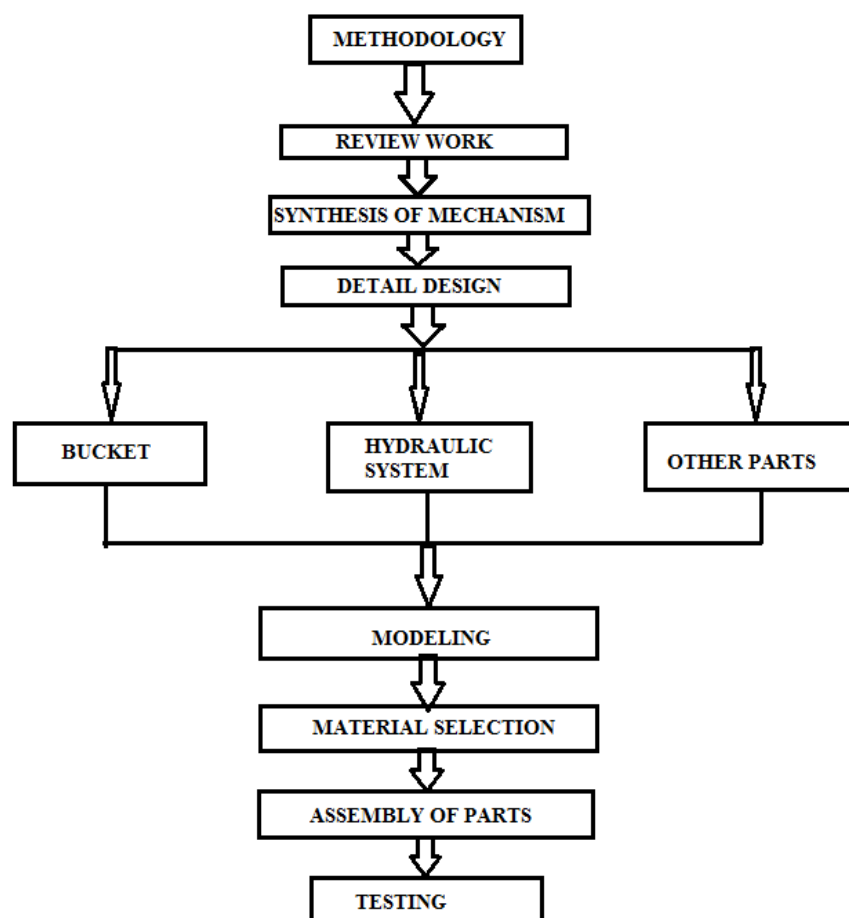


Fig.3.3.1: Methodology chart

## IV. ANALYTICAL DESIGN

### 4.1 Design of Bucket

Bucket is mechanism which is design for lifting or loading materials using hydraulic system of tractor trailer. The bucket is made up from the alloy steel (sheet metal). For choosing material for the bucket following factors are considered:

- Material cost and availability
- Material must be easily available.
- Processing must be considered. For example, bending, machining.
- The effect of environment on the part.

The material selected for experiment is alloy steel. Chemical composition of the alloy steel is given in the grade Structural Steel offers good ductility and shock resisting properties combined with resistance to wear.

Table 4.1.1: Material Selection

| Sr.no. | Designation | Condition  | Tensile strength<br>N/mm <sup>2</sup> | Yield strength<br>N/mm <sup>2</sup> | BHN |
|--------|-------------|--|---------------------------------------|-------------------------------------|-----|
| 1      | 20 Mn 2     | Sheets & strip<br>Softened<br>Hardened and<br>tempered | 480<br>550                            | 300                                 | 320 |

Now we have,

$$\rho = m/v$$

Where  $\rho$  = Density of a material (Kg/m<sup>3</sup>)

m = Mass of a material (Kg)

v = Volume of bucket (m<sup>3</sup>)

Let us consider the nominal load to be carried by bucket is 400 kg. This bucket is used to carry onion and density of onion is 640 Kg/m<sup>3</sup>.

L = length of bucket (mm)

W = width of bucket (mm) = L/2

H = Height of bucket (mm) = L/3

Plate thickness for the bucket is considered 3mm as it is available in market.

Table 4.1.2: Bucket parameters

| Sr. no. | Parameter | Dimension |
|---------|-----------|-----------|
| 1       | Length    | 1553.6mm  |
| 2       | Width     | 776.8mm   |
| 3       | Height    | 517.8mm   |
| 4       | Thickness | 3mm       |

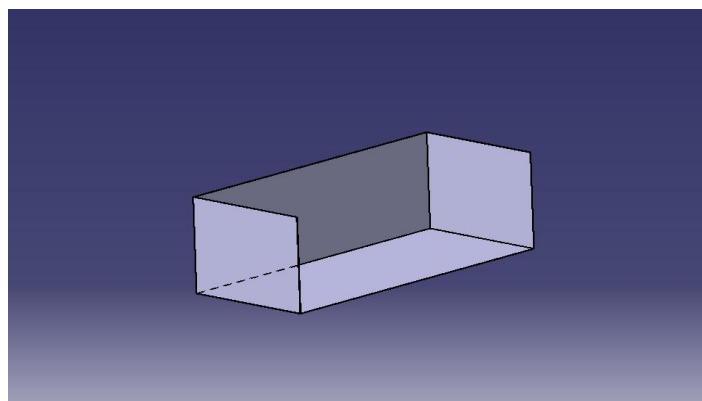


Fig.4.1.1: Cad model of bucket

## 4.2 Design of Hydraulic system

A hydraulic drive system is a drive or transmission system that uses pressurized hydraulic fluid to power hydraulic machinery. Hydraulic system is power transmission system in which transmission of power takes place through hydraulic oil. In this system we use tractor oil reservoir, Filter, 4/3 Direction Control Valve, two Actuator or double acting hydraulic cylinders. Using data tables for vane pumps, cylinders, oil reservoir and direction control valve, we design the hydraulic system for our mechanism.

For selection of cylinder we use formulae,

$$F_e = (\pi \times D^2) / 4 \times p \text{ for extension and}$$

$$F_R = (\pi \times (D^2 - d^2)) / 4 \times p \text{ for retraction}$$

Using above formulae we are select cylinder of model A2 is selected. It has bore diameter of 40mm and rod diameter of 16mm.

For the selection of other components of hydraulic system we required maximum pressure and discharge. It can be calculated using following formulae,

$$P_{\max} = F/A \text{ and } Q_{\max} = A \times V$$

Using above formulae  $P_{\max} = 31.22\text{bar}$  and  $Q_{\max} = 8.5 \text{ lpm}$ .

Capacity of the reservoir should be more than 3times the maximum discharge.

Therefore reservoir of model T1 is selected having capacity of 40lit.

## 4.3 Design of pipes

The design of pipe involves the determination of inside diameter of the pipe. The inside diameter of the pipe depends upon the quantity of the fluid to be delivered.

$$Q = \text{Area} \times \text{Velocity}$$

Using above formula we selected the pipe of diameter 0.03m for our design.

## V. ACTUAL ASSEMBLY OF LOADING DEVICE FOR TRACTOR TRAILER



Fig.5.1: Actual Assembly of Loading Device for Tractor Trailer

## CONCLUSION

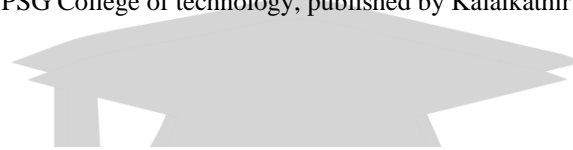
The problem presents several engineering challenges and opportunities for the optimization of the device. The main engineering challenge consists of creating a design that uses two cylinders that achieves the necessary tilt the bucket, while maintaining lower cost to produce. It is time saving and also no labours are required to fill the onions in tractor trailer. Analysis had been performed that will substantiate the feasibility and probable success of this project. The device has been thoroughly contemplated and

analyzed in its design, usefulness and functionality. The device is less costly. Our mechanism is installed back side of trailer. But in future scope we will use this mechanism for all doors of the trailer.

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## BIOGRAPHIES



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