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Modified design of 'Ghamela'

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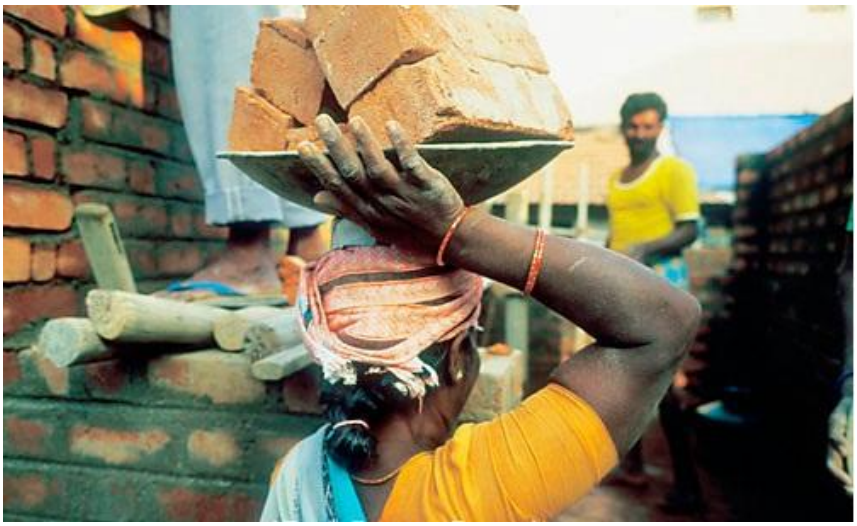
Abstract: *The objective is to reduce the human effort by using the principle of mechanics which leads to optimization of the manual labour work. This paper discusses about the mechanism which help in reducing the efforts of construction labour.*
Keywords: *Ghamela (tasla), load transfer, manual labour, human effort.*

I. Introduction

"Ghamela" also known as "tasla" is a traditional Indian labour tool which is used in construction sites to carry the bricks, cement, concrete and other materials on the head.

Ghamela is usually made up of galvanized iron, PVC and other plastic. It is basically carried over head with some weight on it.



As mentioned above the load present in ghamela will act directly upon a point. So the entire weight acts on the head. Normally carrying over head is an alternative way to reduce the burden on shoulders and back. But studies prove that loading on head is not less exerting than that of shoulders and back.

So the aim is to create a new design by which the load can be distributed to the shoulders instead of head by using a simple principle of mechanics "load transfer by structure".

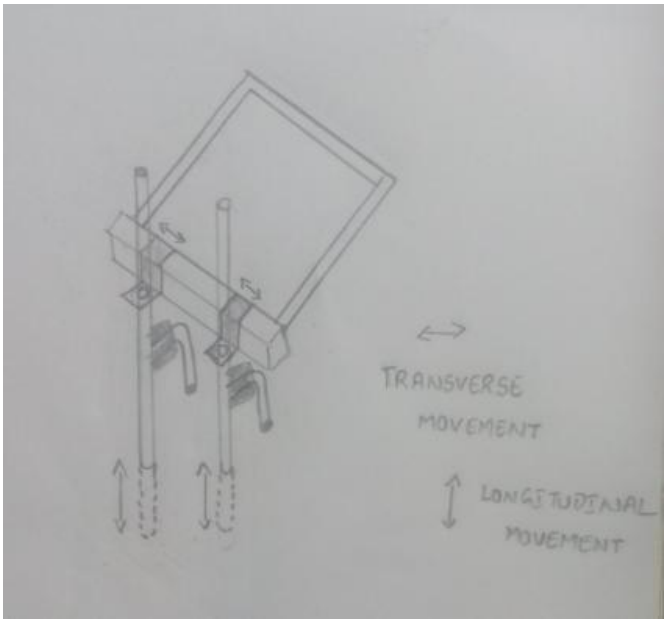
II. Design Methodology

Deciding Type of Material
⇓
2 Dimensional Sketch
⇓
Parts specifications
⇓
Optimization
⇓
New Design

Deciding type of material:

The material should with stand the load which should have strength more than or equal to that of previous model. It must be economical (cheap), effective and efficient.
By Considering All the Above Factors The Material Of The New Design Has Been Chosen Which Is "Wood".

2 Dimensional sketch:

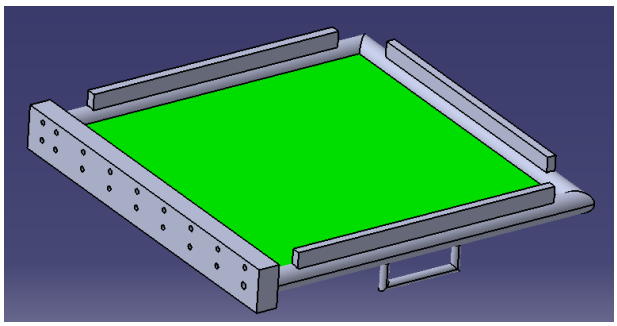


Iterations and optimization:
Several iterations for the type of material, and design have been performed to produce a optimized design. .
(*Like Wood Shrinks In Water So In Order To Avoid That, Protective Coatings Can Be Applied To It, The New Design Was Constructed With Least Number Of Members As Possible).*

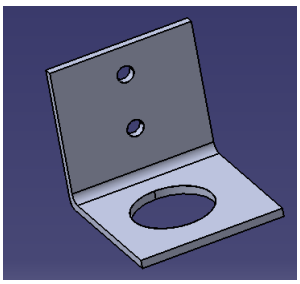
New design:
Parts
The design consist of mainly 4 parts
1. Roof
2. L clamps
3. Back
4. Handle

1. Roof: The roof consists of 4 members which are made up of wood. 3 members are of circular cross section having one inch thickness and 40cm length the 4^{th} member is of rectangular cross section whose length is 40cm width is 5.08cm (2inch) and 1 inch thickness. Face of the rectangular member is drilled with 2 holes of 6mm which are separated at 20mm distance apart at regular intervals. The holes are made to attach clamps to rectangular member .4 members are connected together with the help of nails. One wooden plate of 1mm

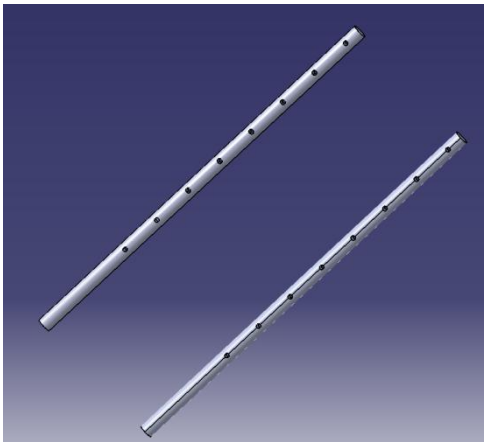
thickness is made to fit on these 4 members which make a platform for the material to be carried. 2 holding supports of 10mm thickness, 9cm length, and 4cm width are provided for holding the roof part with hands. The roof can also carry sand , cement and other materials by extending the height of the thin plates which are attached to the circular members.



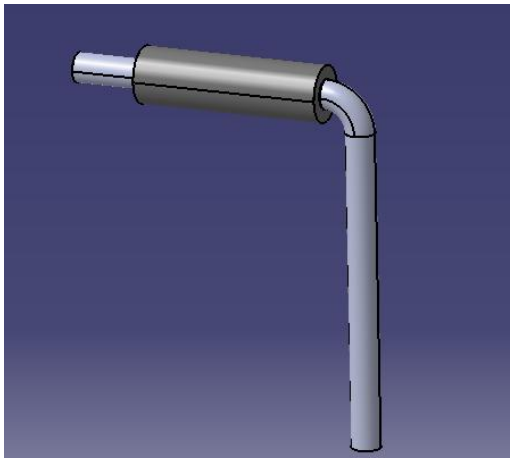
2. L Clamps: The L clamps are used to connect the roof and back part of the modified ghamela. The L clamps material should have more strength because it is subjected to more stresses so mild steel (EN8) has been used to design these L clamps. The one surface of the clamp is provided with one inch hole and the other surface is drilled with 6 mm holes which are separated by 20mm distance. The clamps help in transverse adjustment of the modified ghamela. Two 6mm bolts are made to pass through the holes present in clamp and rectangular member of the roof and both are locked with the help of nut. if the width of the ghamela need to be changed then the bolt and nut are fixed to the other holes present on the rectangular member .so, by this way the transverse movement can be adjusted irrespective of the personality of the user. 2 L clamps are used



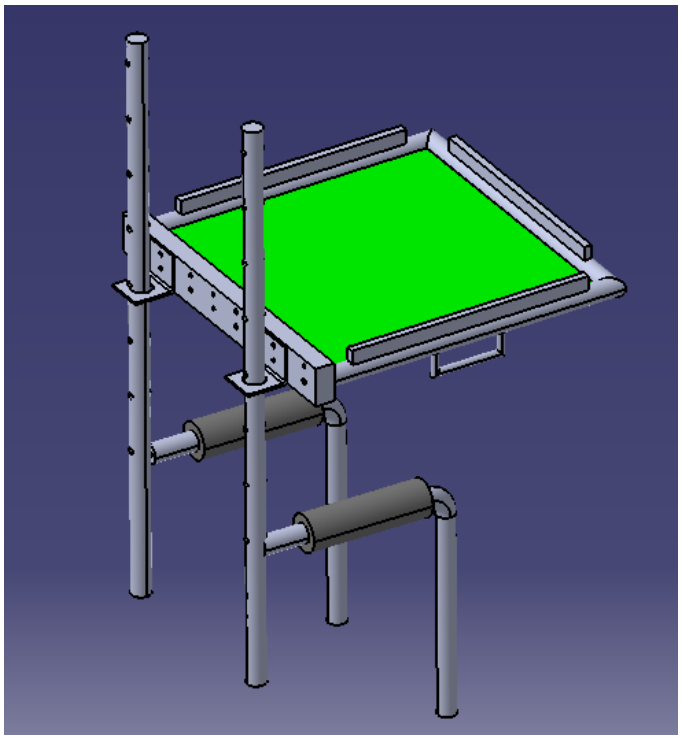
3. Back: The back consists of 2 members. 2 vertical wooden members of 75cm height, circular cross section with 1 inch thickness are used. The 2 vertical members are made to pass through the one inch holes present on the L clamp thus by this way the back part is attached with roof .The 2 vertical members are drilled with 8mm holes at regular intervals of 5 cm. The height of the modified ghamela can be adjusted by passing a 8mm bolt through the hole which is present on the vertical member (*suppose you need to adjust the height of ghamela at 3rd hole from the top then the vertical members are passed through the 2one inch holes of the clamps and are stopped just above the 3rd hole now 8mm bolts are passed through the 3rd hole and are locked by the nut. this restricts the motion of the back part further*), by this way the height of the ghamela can be adjusted according to person who is using it. This is one of the most important feature of the modified ghamela.

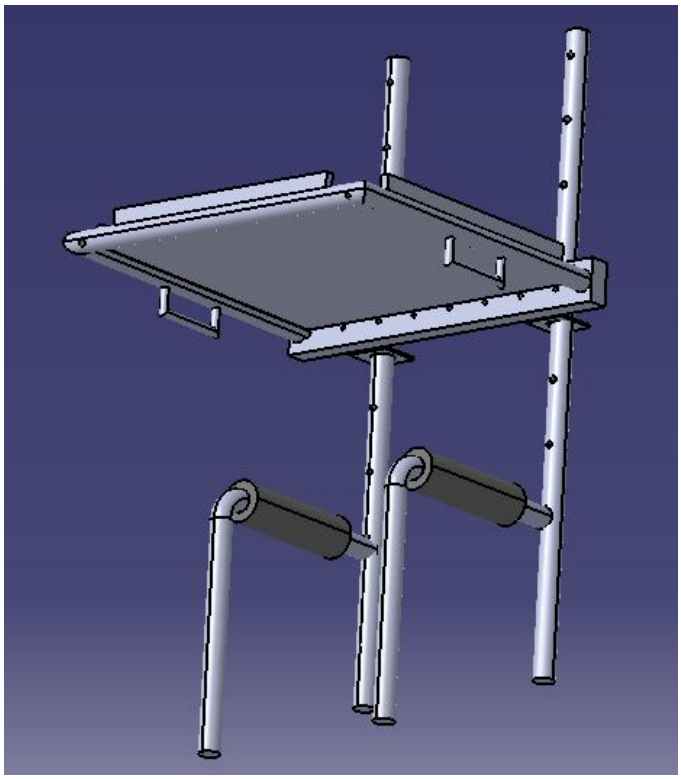


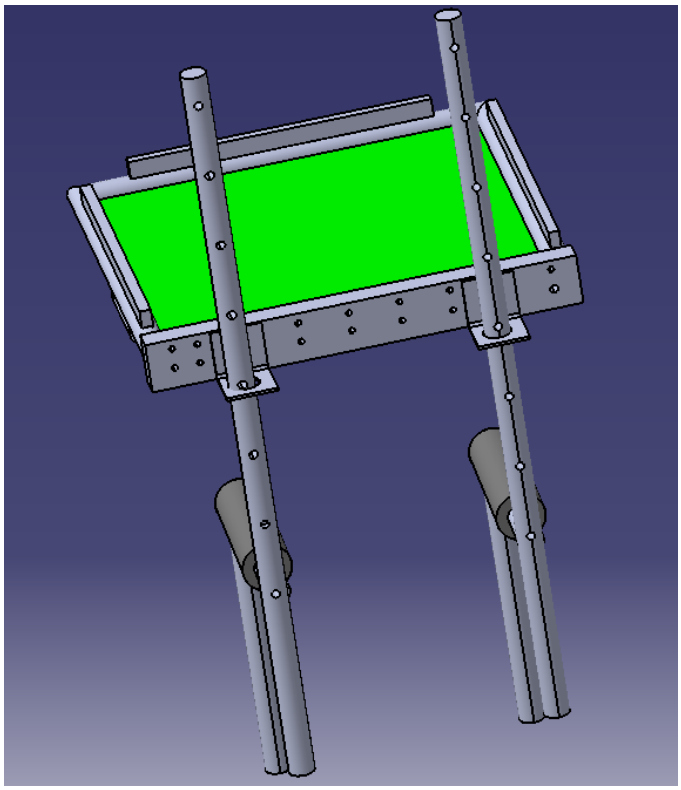
4. Handle: Handle is made up of wood which is of circular cross section which is of one inch. The handle is bend at angle of 90 degrees one end length of the handle is 20cm and other length is of 30cm. The length 20 cm rests on the shoulders of the person who carries the ghamela in order to make it comfortable for carrying the 20cm length end is provided with a cushion support made up of foam. The handle is attached to the back part of the modified ghamela with the help of the nails.



5. The Final Assembled View: All the above mentioned parts are assembled with the help of SOLIDWORKS and CATIA software. The final design is obtained.
The different views of the design have been presented in the following paper.



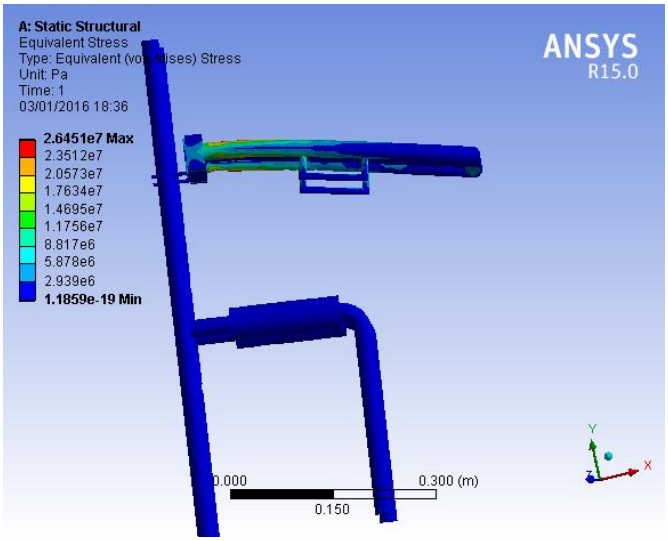




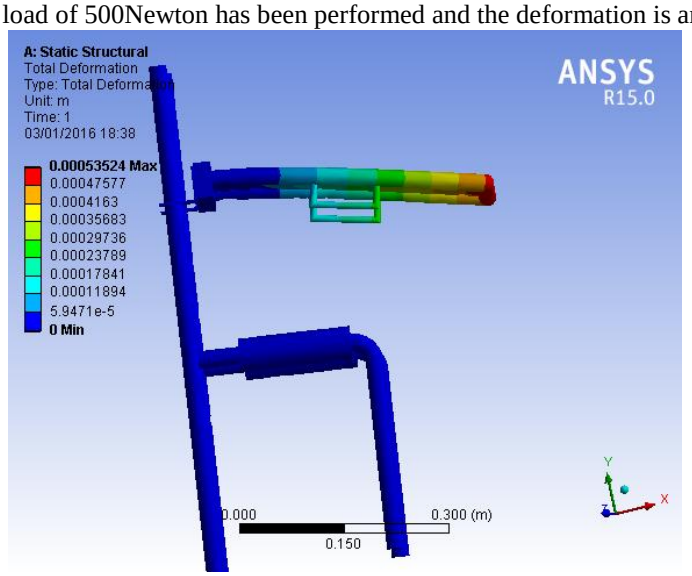
III. Analysis:

The analysis of the modified ghamela is done on ANSYS bench work. Basically the material (bricks, cement, sand etc) that need to be carried will be placed on the wooden plate which is located on 4 members of the roof part. So, 500Newton load is applied on the wooden plate and a stress of 26Mpa is obtained. The maximum stress that can be applied on the wood material is 40Mpa.

Factor of safety: 40Mpa/26Mpa = 1.53



The deformation for the load of 500Newton has been performed and the deformation is around 0.0005 mm.



Hence by the following results we can conclude that the modified ghamela undergoes very negligible deformation and it is safe**.**

IV. Cost Report:

Material	cost
1. Wood (3mts approx., 1 inch thickness)	250 INR
2. L clamps (2 NO)	50 INR
3. Nails (15 NO)	10 INR
4. Cushion foam (2 NO)	10 INR
5. Nut and bolts 6mm (4NO) and 8mm(2NO)	50 INR
TOTAL	**370 INR**

V. Difference Between Modified And Old Ghamela

Old ghamela	Modified ghamela
1. Load directly acts up on head	1. Load is distributed to members and then acts upon shoulders
2. Weighs around 3-4 kg (galvanized ghamela)	2. Weighs 2 kg
3. Cost 400- 450 INR	3. Cost 350-400 INR
4. Capacity – max10-12 kg	4. Capacity – 20 kg

VI. Conclusion:

The modified ghamela which is less in weight, more efficient and more economical than normal ghamela has been designed further more it reduces the effort on the head by transferring the load to the members which in turn transfer them to the shoulders. Hence the primary objective of reducing the human effort of construction labour has been accomplished.

Acknowledgment:

I hereby declare that all the details which have been provided in this paper are legit as per my knowledge

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