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"DESIGN AND ANALYSIS OF HYDRAULIC SCISSORS LIFT FOR BIKE BY USING ANSYS"

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ABSTRACT

This project is mainly focused on force acting on the hydraulic scissor lift when it is extended and contracted. Generally, a hydraulic scissor lift is used for lifting and holding heavy weight components. Material selection plays a key role in designing a machine and also influence on several factor such as durability, reliability, strength, resistance which finally leads to increase the life of scissor lift. The design is performed by considering hydraulic scissor lift as a portable, compact and much suitable for medium type of load application. Drafting & drawing of hydraulic system scissor lift is done using Catia with suitable modeling and imported to Ansys work bench for meshing and analysis. Hence, the static analysis of the scissor lift includes Total deformation load, Equivalent stress, was done in Ansys and all responsible parameters were analyzed in order to check the compatibility of the design value. The computational values of three different materials such as aluminium, structure steel and stainless steel are compared for best results.

KEYWORDS: *Hydraulic scissor lift, Catia, Ansys work bench, Total deformation load, Equivalent stress, static analysis*

I. INTRODUCTION

Any machine part cannot be moved to a desired position with application of less amount of external force. For placing a component in required location, the motion of component follows commonly horizontal or vertical direction. Many machines such as aerial lift, boom lifts, scissor lift, man lift, tele handler, towable lift are used to move machinery and manpower in different directions based on the requirement. A scissor lift is a portable, easily extended and compressed, safe operating machine used for transportation of medium sized components to its expected position. A scissor lift is machine which moves in vertical direction using criss-cross 'X' pattern scissor arms. The required elevation of the lift is achieved based on the number of criss-cross 'X' pattern scissor arms attached. The scissor lift mechanism is based on linked arms in a criss-cross 'X' pattern which can be folded and extended in exact direction similar to a pantograph.

The upward motion is achieved by the application of pressure to the outside of the lowest set of supports, elongating the crossing pattern, and propelling the work platform vertically upwards. The platform may also have an extending 'bridge' to allow closer access to the work area.

1.1 Types of Scissor lift

The scissor lifts can be classified as follows:

- Hydraulic lifts

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- Pneumatic lifts
- Mechanical lifts

Hydraulic scissor lifts are very powerful tool for applying a ton of force on the platform plate of component which is equally distributed on scissor arms.

II METHODOLOGY

Deflection in scissors lifts can be defined as the change in elevation of all parts to the original size of entire assembly i.e from the floor to the top of platform deck, whenever loads are applied to or removed from the lift. Each component within the scissors lift has the potential to store or release energy when loaded and unloaded. Deflection takes place in all parts of scissor lift i.e Scissors Legs, Platform Structure, Base Frame, Pinned Joints**.** To reduce stresses and deflection in scissor lift the load should transfer equally between the two scissors arm pair. Base frames should be attached to the surface on which they are mounted.

2.1 Single Acting Hydraulic Cylinder

Single acting cylinders use hydraulic oil for a power stroke in one direction only. Some external force acting on the piston rod causes its return. Most applications require a single acting cylinder with the spring pushing the piston and rod to the in stroked position.

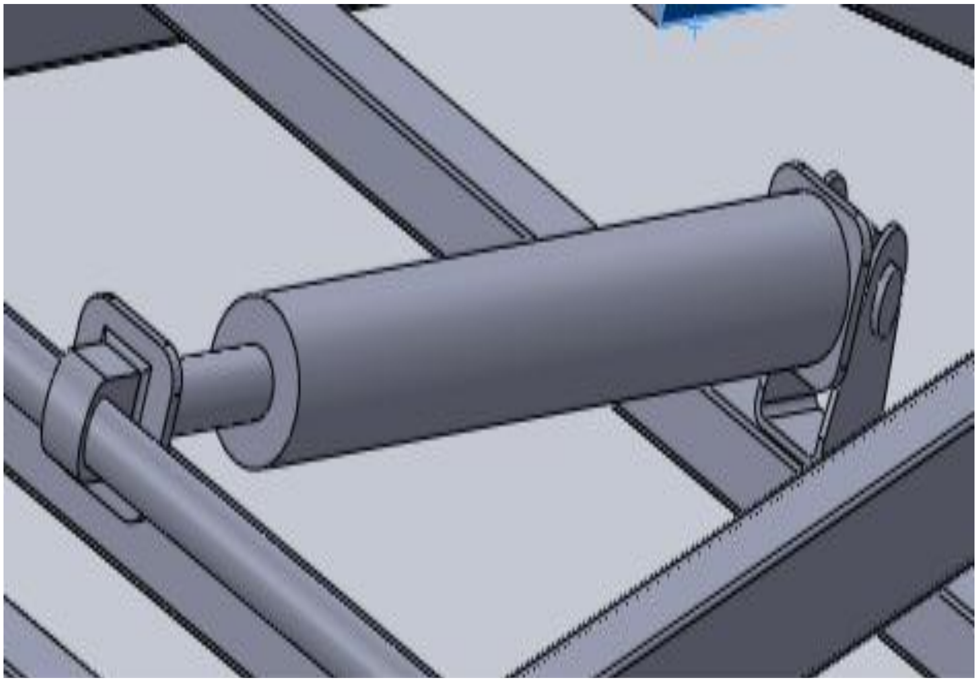

Fig -1: Hydraulic cylinder

2.2 Material Selection

Material selection plays a very important role in machine design. Two metals are considered for the analysis of scissor lift is mild steel & aluminum and stainless steel.

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2.3 Stainless Steel Mechanical properties

Table- 1

Material Field Variable	**Value**	**Units**
Density	7750	Kg/m^3
Young's modulus	1.93E+05	Mpa
Poisson Ratio	0.31	
Shear modulus	76664	Mpa
Bulk Modulus	1.6937E+05	Mpa
Tensile Yield Strength	207	Mpa
Compressive Yield Strength	207	Mpa
Tensile Ultimate Strength	586	Mpa
Compressive Ultimate Strength	0	Mpa

2.4 Structure Steel Mechanical properties S460

Table 2

Material Field Variable	**Value**	**Units**
Density	7850	Kg/m^3
Young's modulus	2E+05	Mpa
Poisson Ratio	0.30	
Shear modulus	76923	Mpa
Bulk Modulus	1.6667E+05	Mpa
Tensile Yield Strength	250	Mpa
Compressive Yield Strength	250	Mpa
Tensile Ultimate Strength	460	Mpa
Compressive Ultimate Strength	0	Mpa

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2.5 Aluminium Alloy Properties Al (6061)

Table 3

Material Field Variable	Value	Units
Density	2770	Kg/m^3
Young's modulus	2.3E+05	Mpa
Poisson Ratio	0.33	
Shear modulus	26692	Mpa
Bulk Modulus	69608	Mpa
Tensile Yield Strength	280	Mpa
Compressive Yield Strength	280	Mpa
Tensile Ultimate Strength	310	Mpa
Compressive Ultimate Strength	0	Mpa

III. FINITE ELEMENT METHOD

By using catia ver 5.0 , modeling of scissor lift was done and then it was imported to Ansys14.0 for the analysis of scissor lift. The goal of meshing in ANSYS Workbench is to provide robust, easy to use meshing tools that will simplify the mesh generation process. In this hydraulic scissor lift automation meshing is applied and complete analysis of scissor lift was done.

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IV MODELING

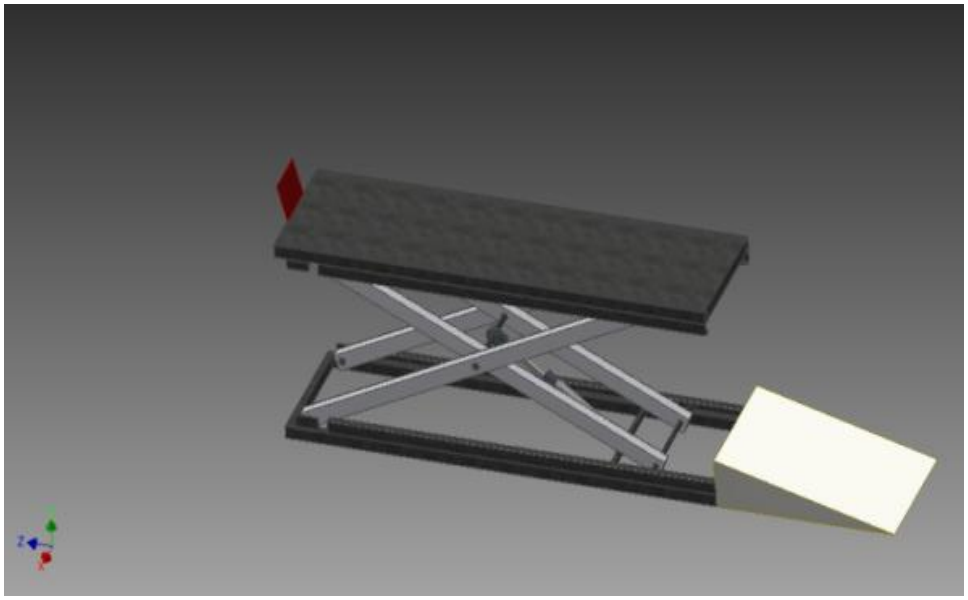

Fig.2

Fig.3

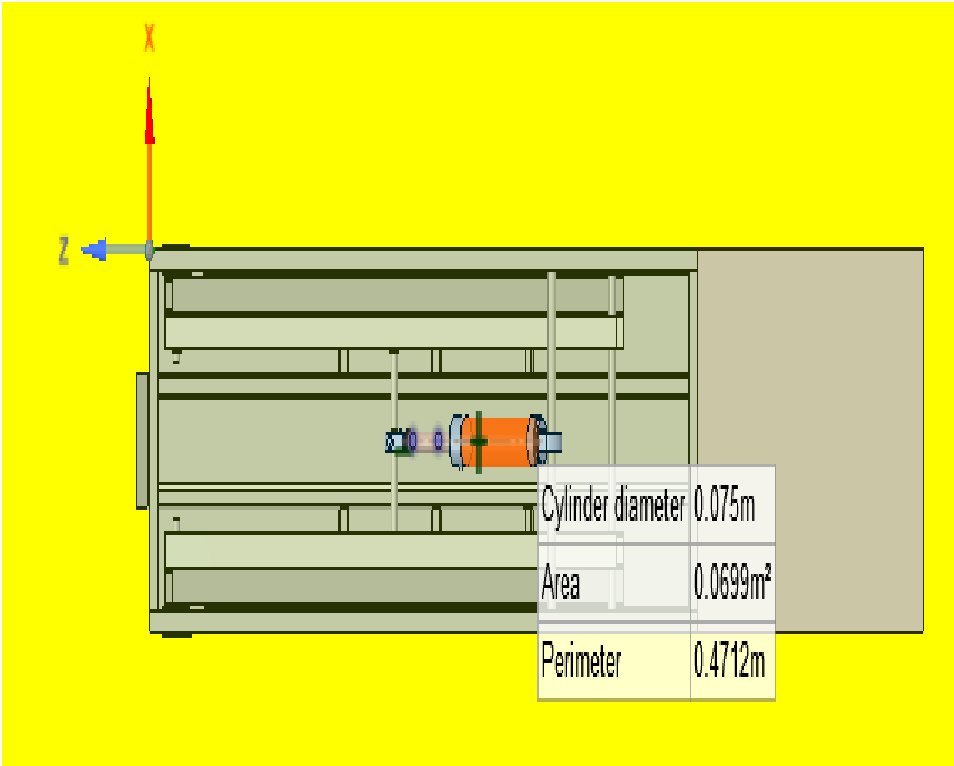

Fig.4

4.1 Bike lift Specification

Table.4

S.No	Particulars	Dimensions
01	Length	2000 mm
02	Width	560 mm
03	Closed Height	160 mm
04	Total Height	914 mm
05	Lifting Capacity	250 kg
06	Table Size (feet X feet)	6.5 x 1.8

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4.2 Simulation

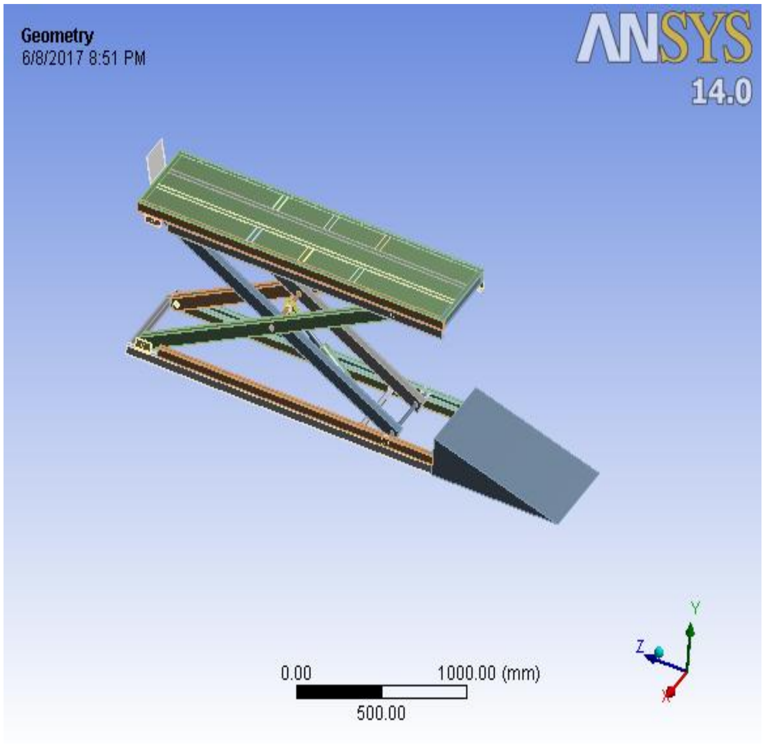

Fig.5

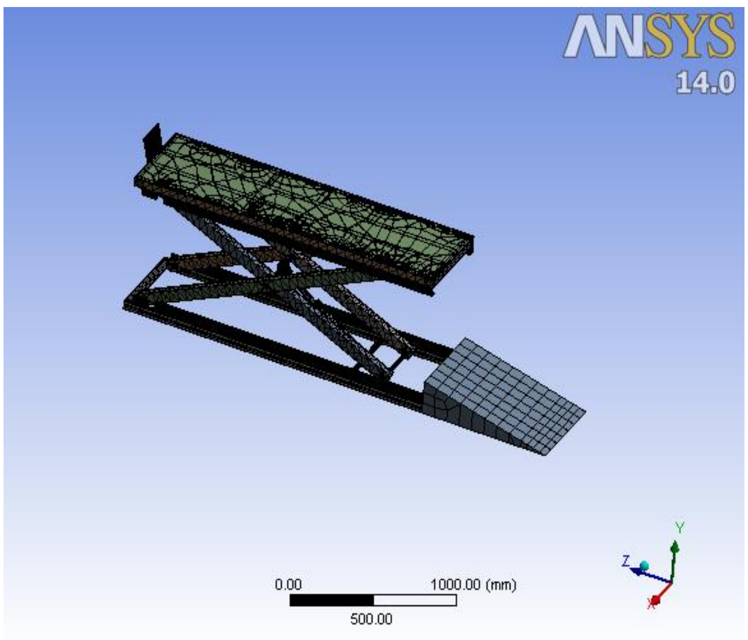

Fig.6

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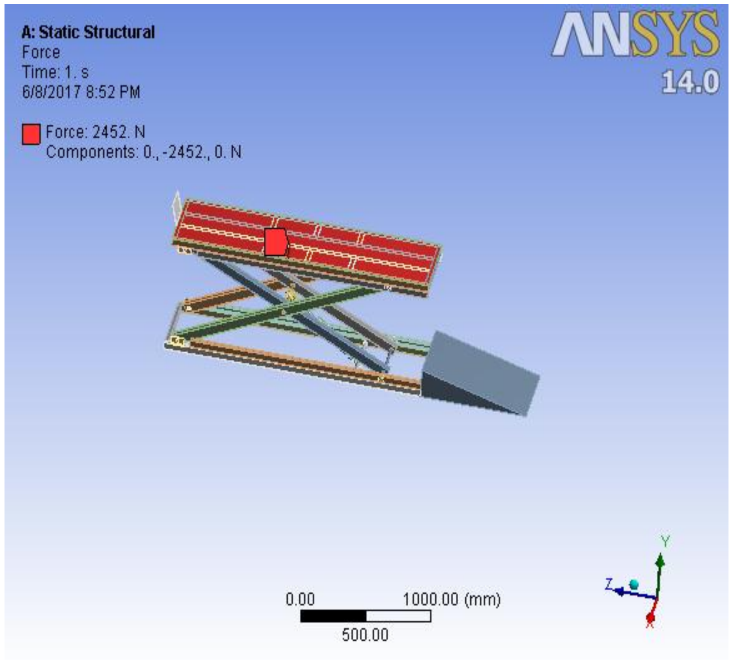

Fig.7

4.2.1 Structure Steel Materials

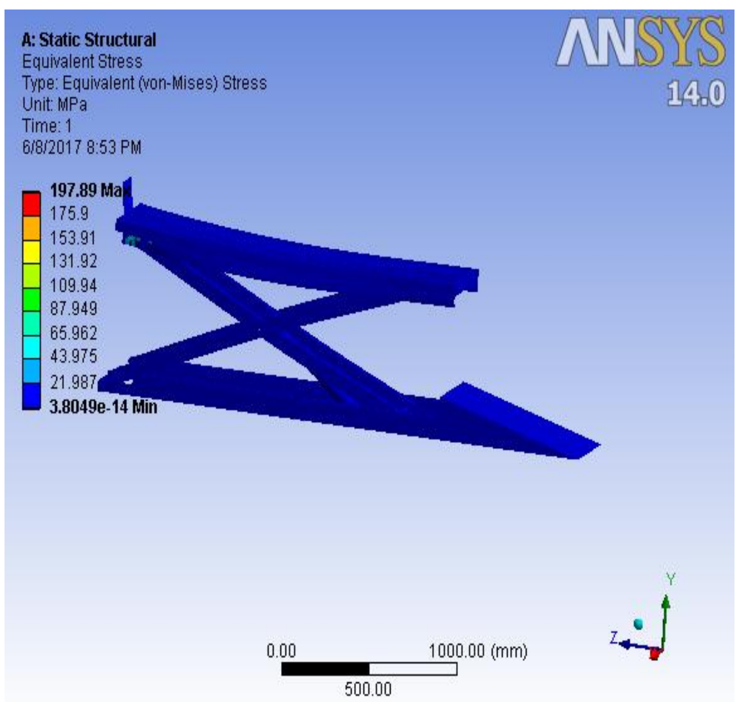

Fig.8

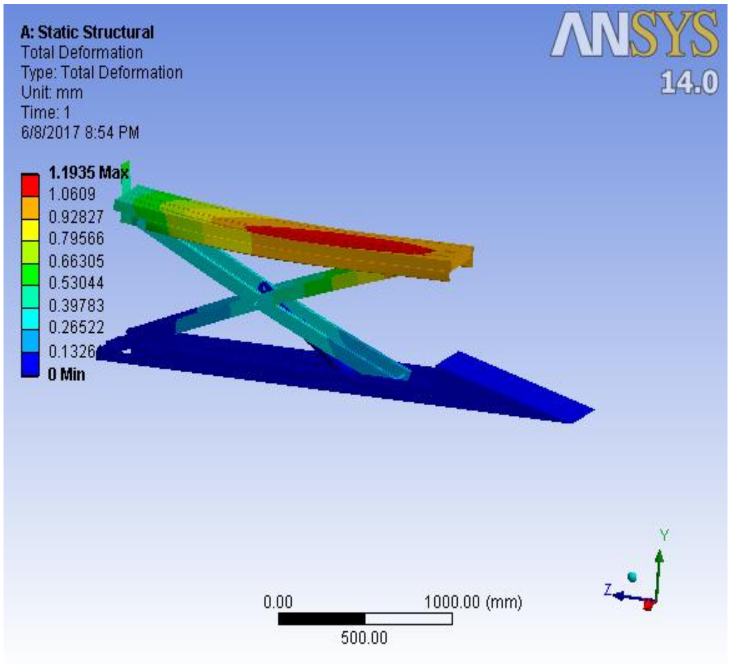

Fig.9

4.2.2 Stainless Steel Materials

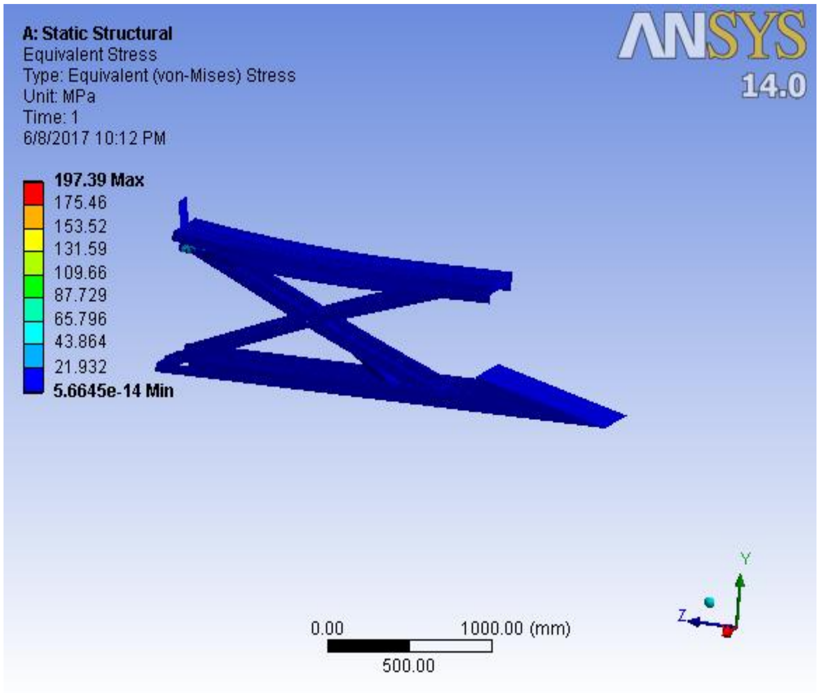

Fig.10

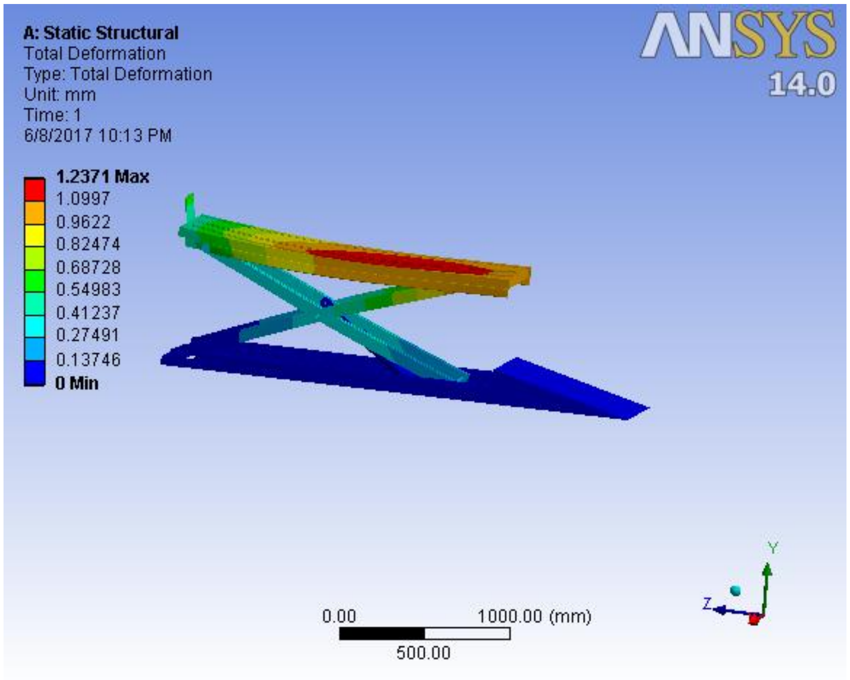

Fig.11

4.2.3 Aluminium, Materials

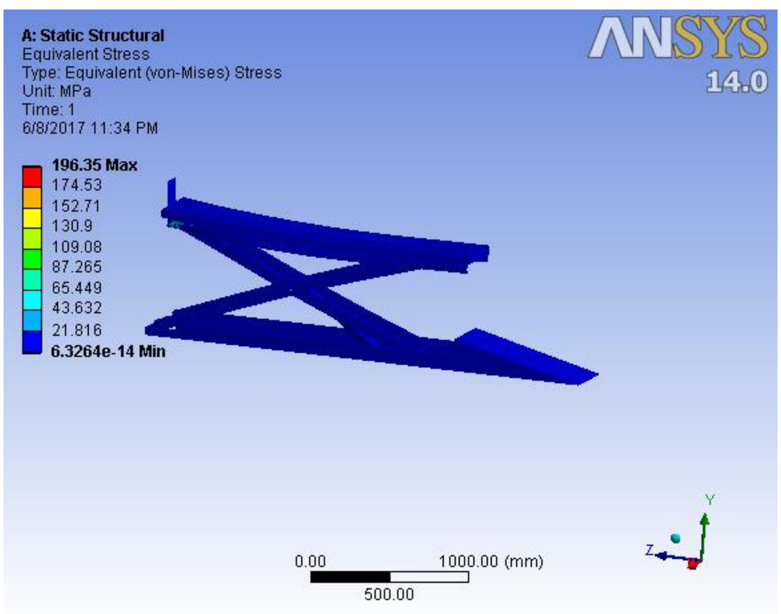

Fig.12

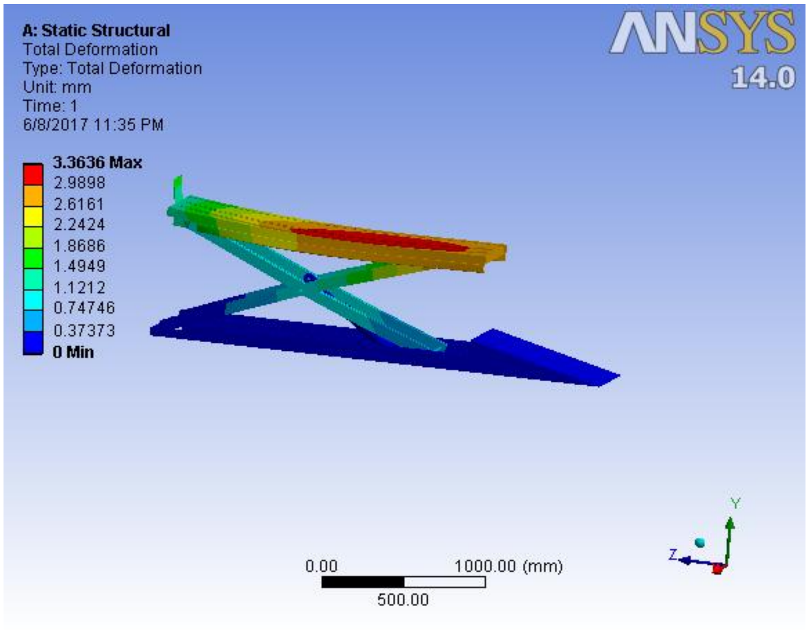

Fig.13

V RESULT & DISCUSSION

The maximum deformations induced in Aluminium hydraulic lift is 3.36mm, which is in safe limits (1% of total span). Hence based on rigidity the design is safe, but if we compare deformations induced in Stainless Steel 1.23 mm. If we compare corresponding deformations in structure steel (S 460) it is 1.19 mm which has less deformation. The equivalent stress induced for three materials is almost same i.e. 196.35 Mpa, 197.39 Mpa, 197.89 Mpa which is less than the allowable stress (380Mpa).Hence the design is safe based on strength. On optimization it is clear that Structure steel (S 460) lift shows good results as compared to other two lift, hence Structure steel lift is suggested for manufacturing to said industry.

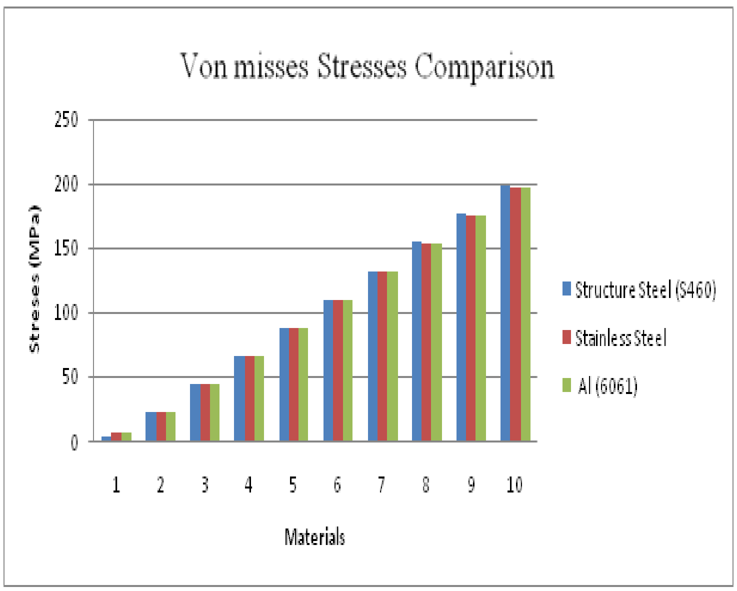

Fig.14

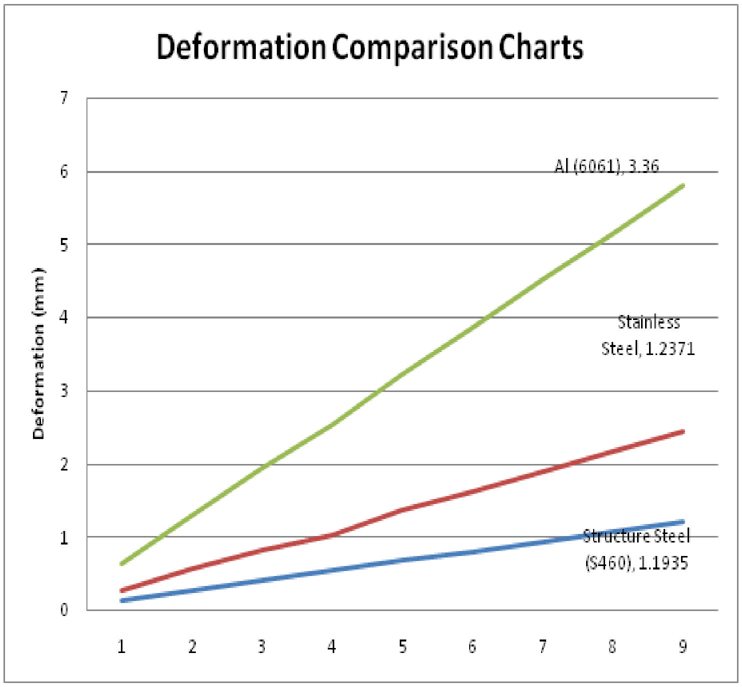

Fig.15

VI. CONCLUSION

The design and fabrication of a portable work platform elevated by a hydraulic cylinder was carried out meeting the required design standards. The portable work platform is operated by hydraulic cylinder which is operated by a motor.
The scissor lift can be design for high load also if a suitable high capacity hydraulic cylinder is used. The hydraulic scissor lift is simple in use and does not required routine maintenance. It can also lift heavier loads. The main constraint of this device is its high initial cost, but has a low operating cost. The shearing tool should be heat treated to have high strength. Savings resulting from the use of this device will make it pay for itself
with in short period of time and it can be a great companion in any engineering industry dealing with rusted and unused metals.

VII. FUTURE SCOPE

This device affords plenty of scope for modifications for further improvements and operational efficiency, which should make it commercially available and attractive. Hence, its wide application in industries, hydraulic pressure system, for lifting of vehicle in garages, maintenance of huge machines, and for staking purpose. Thus, it is recommended for the engineering industry and for commercial production.

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