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DESIGN MODIFICATION OF RAM OF HYDRAULIC SHEARING MACHINE

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ABSTRACT:

A hydraulic shearing machine is a machine using a hydraulic cylinder to generate a compressive force. Ram and cylinder are the main components of the hydraulic shearing machine. In this project ram of hydraulic shearing machine ram are designed by the design procedure. Ram are analyzed to improve its performance and quality for hydraulic shearing machine. The ram of hydraulic shearing machine are modeled by using modeling software CREO. Stress analysis has been applied on ram of hydraulic shearing machine by using analyzing software ANSYS.

Keywords: *Hydraulic Shearing Machine, Creo, Ansys.*

I. INTRODUCTION:

Among the several types of machines available for shearing metals sheets or plates, hydraulic mechanism is considered as cost effective and less power consuming option. Depending on the industrial requirements, a shearing machine is designed, so that it would stay easy to obtain metal sheets in a shape and size that matches the demand. The hydraulic plate shearing machine is useful in handling large sheets or plates or bars of any type of metal. The important attractions in the functioning of this machine are its compact shape, durability, and it is safe to work with.

When the metal is inserted into hydraulic machines, it is secured by clamps so it does not shift under high pressure. To ensure that the cut is smooth and even for a 90 degree cut, a squaring arm or back gauge must be used. Minute burrs may be formed by the edge of the cut metal; these must be removed by grinding. If you use hydraulic shears, be careful of the little marks left by the cutting blades and holding clamps while working. You will need to remove them or otherwise account for them.

To find the shear force for a cut we can go back to the basic mechanics of materials (with one adjustment factor). [1]

$$F = 0.7twUTS$$

Where,

F = force needed to shear

t = thickness of sheet

w = width of sheet

UTS = Ultimate Shear Strength of material

II. TRADITIONAL MECHANICAL CALCULATION OF RAM:

Material selected for Ram is Mild Steel (MS).

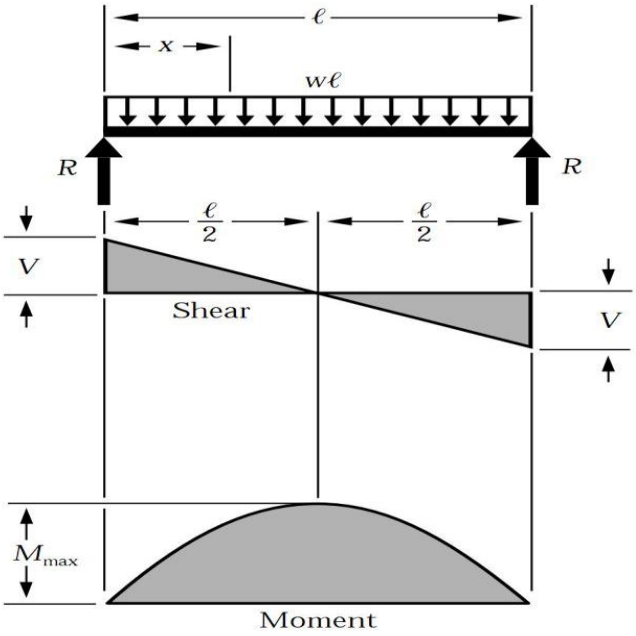

Fig.1.Simple Beam with UDL[2]

A. Ram Reaction[3]:Ram are usually supported on walls piers or columns which provide the necessary equilibrium. Maintaining the Integrity of the Specifications.

$$R = \frac{wl}{2}$$

Where, w=Uniform load, N/mm

l=Length of beam, mm

B. Maximum Bending Moment[4]:Algebric sum of moment to the left or right side of the section is called bending moment at the section. A bending moment is the reaction induced in a structural element when an external force or moment is applied to the element causing the element to bend. Unit of B.M. is N.mm.

$$M_{max}\text{(at center)} = \frac{wl^2}{8}\ \text{Nm}$$

C. Maximum Deflection[5]:Deflection is the degree to which a structural element is displaced under a load. It may refer to an angle or a distance. Cantilever beams have one end fixed, so that the slope and deflection at that end must be zero.

$$\delta_{max}\text{(at center)} = \frac{5wl^4}{384EI}\ \text{mm}$$

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III. STRESS ANALYSIS OF EXISTING RAM IN FINITE ELEMENT METHOD:

Creating a finite element model: CREO 3.0 are used to creating a model. The element type is set to solid 45; Material is Mild Steel; Material property; modulus of elasticity 205GPa, poisons ratio 0.29, factor of safety 1.2, yield strength 370 MPa, density 7861 kgm^{-3}; tensile strength 440MPa. The meshed model shown in fig 2.

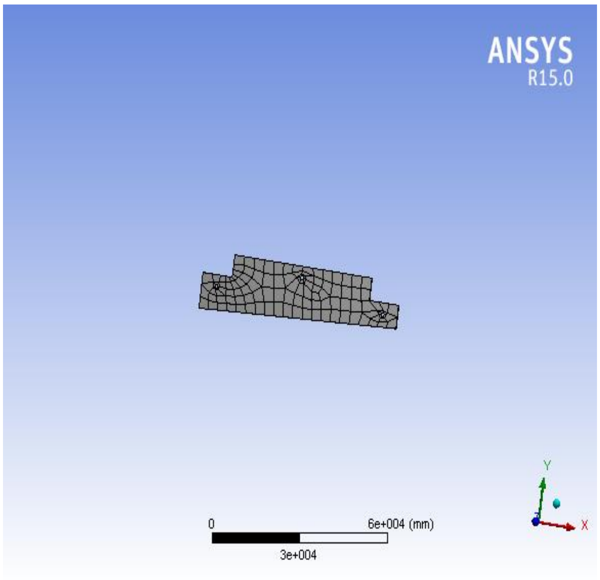

Fig.2. Meshed model of Existing Ram

Calculation and Result: The result is viewed and analyzed through post-processor. Stress and Deformation situation on modes are shown in table 1.

Parameter	Minimum	Maximum
Equivalent stress(Pa)	6.43×10^2	7.44×10^4
Directional Deformation(mm)	-59.608	33.729
Total Deformation(mm)	47097	47480

Table.1. Analysis result

Equivalent stress analysis are shown in fig.3.

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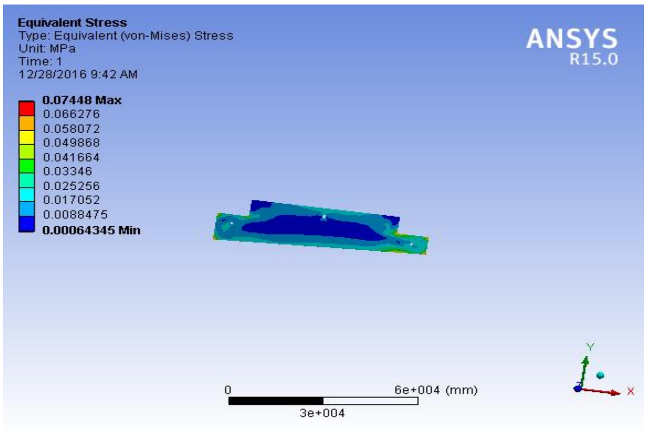

Fig.3. Equivalent Stress

Directional deformation are shown in fig.4, and total deformation are shown in fig.5.

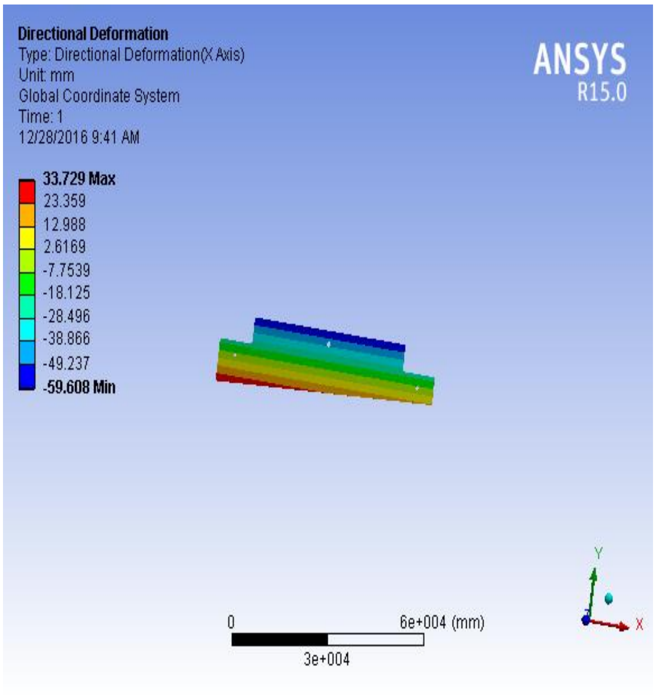

Fig.4. Directional Deformation

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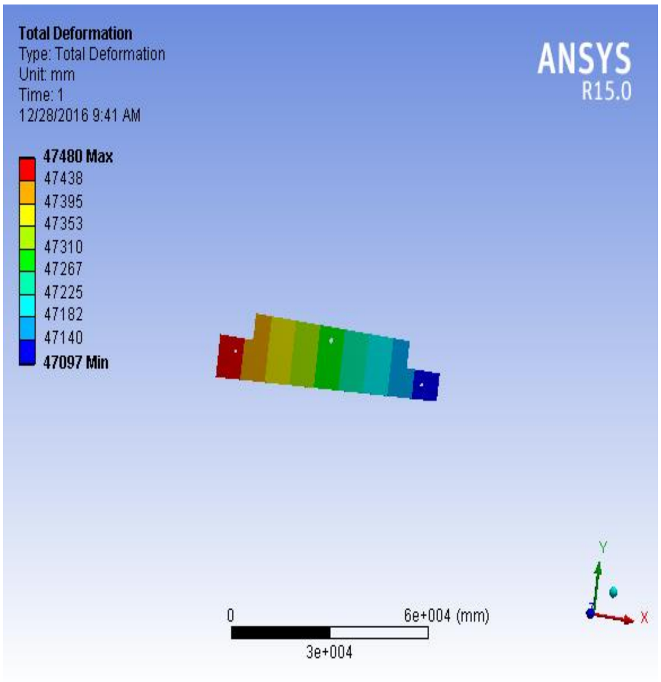

Fig.5. Total Deformation

IV. STRESS ANALYSIS OF MODIFIED RAM IN FINITE ELEMENT METHOD:

Creating a finite element model: CREO 3.0 are used to creating a model. The element type is set to solid 45; Material is Mild Steel; Material property; modulus of elasticity 205GPa, poisons ratio 0.29, factor of safety 1.2, yield strength 370 MPa, density 7861 kgm^{-3}; tensile strength 440MPa. The meshed model shown in fig 2.

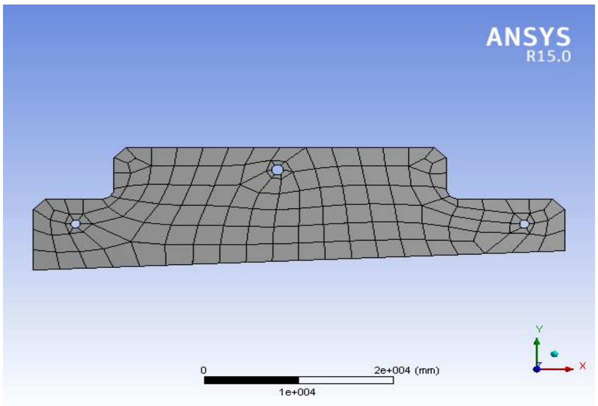

Fig.2. Meshed model of Existing Ram

Calculation and Result: The result is viewed and analyzed through post-processor. Stress and Deformation situation on modes are shown in table 1.

Parameter	Minimum	Maximum
Equivalent stress(Pa)	6.43×10^{2}	7.44×10^{4}
Directional Deformation(mm)	-59.608	33.729
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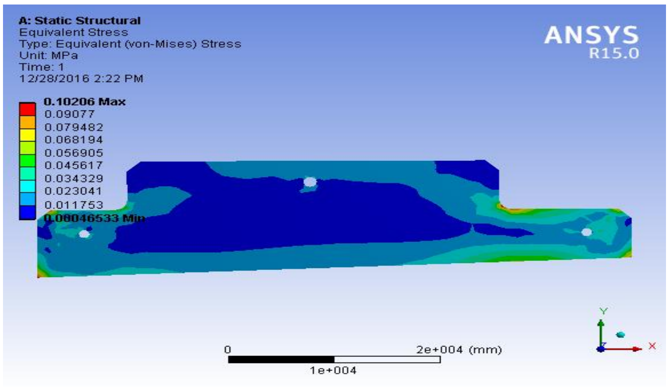

Fig.3. Equivalent Stress

Directional deformation are shown in fig.4, and total deformation are shown in fig.5.

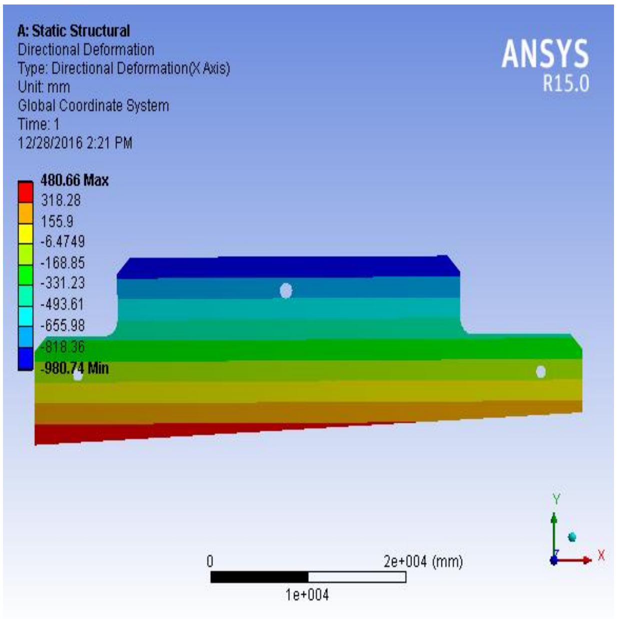

Fig.4. Directional Deformation

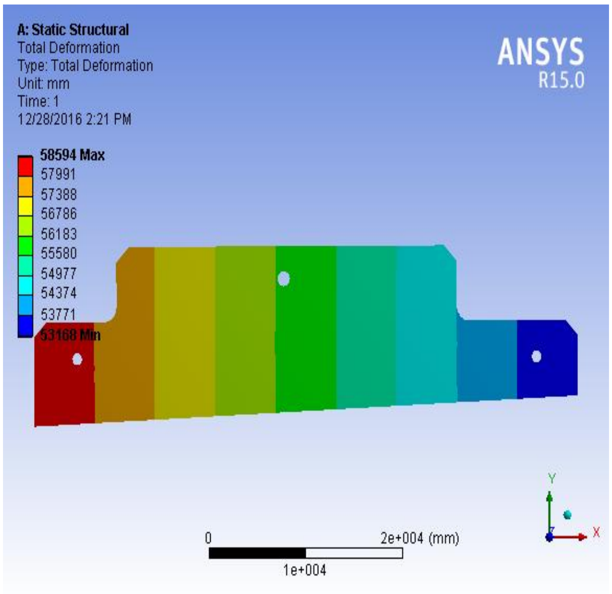

Fig.5. Total Deformation

V. CONCLUSION:

Use the ANSYS software to do the finite element analysis for the ram. In the analysis stress and deformation value within the acceptable range. Factor of safety of the material is 1.9. For the existing Ram, the maximum equivalent stress are 7.44×10^{4} Pa. The maximum directional deformation are 33.729 mm and total deformation are 47480 mm. For the modified Ram, the maximum equivalent stress are 1.02×10^{5} Pa. The maximum directional deformation are 480.66 mm and total deformation are 58595 mm.

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