

# Design and Modification of Hydraulic Press

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**Abstract** - An urgent and realistic need in designing structures, e.g., top platen, movable platen, column and bottom platen is to find an optimal design for minimizing weight and deflection, maximizing safety, minimizing the cost of products, etc. The simplest idea for optimizing a structure is to modify the sizes of structural members, i.e. by use of sizing optimization method.

**Index Terms** - Deformation, Von-mises stress, Hydraulic press, Top platen.

## I. INTRODUCTION

The function of a press is to transfer one or more forces and movements to a tool or die with the purpose of forming or blanking a work piece. In a specialized production line, in view of economic production, the output is the most important issue, while maintaining the required part quality. The purpose of a universal production line, in contrast, is to offer flexibility and use a larger variety of dies covering as wide a part spectrum as possible. Achievement of the maximum possible uptime is a determining factor in the design of any press, with the objective of reducing unproductive or downtime to a minimum – for example necessary for changing dies, maintenance or tryout. The general layout of press machine is shown in figure. <sup>[1], [2]</sup>

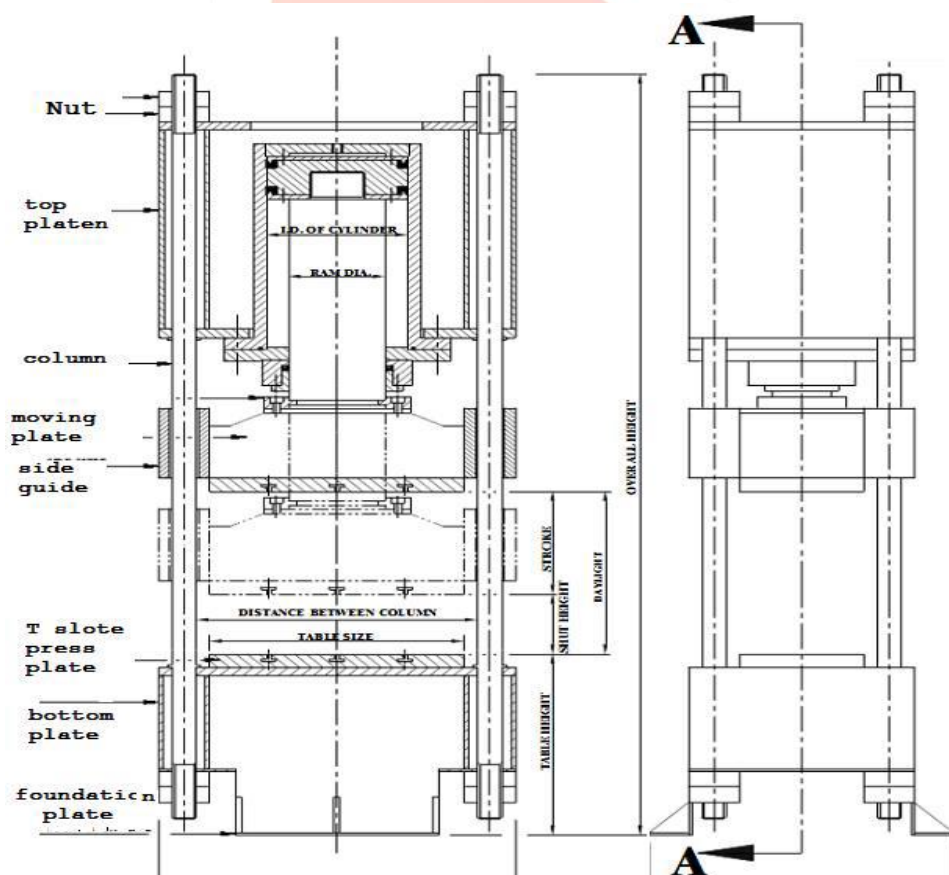


Fig 1 Layout of press machine

## II. FEA ANALYSIS OF EXISTING COMPONENT SPECIFICATION OF PRESS MACHINE

SR NO	SPECIFICATION	CAPACITY
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1	Type	300 Ton 4 Column Hydraulic Press
2	Application	Metal Forming
3	Rated Nominal Pressure:	3000000 N
4	Weight of the press machine:	15000 KN
5	Motor Power(W)	22 KW
6	Power source:	hydraulic
8	Ejecting Speed	Eject 50 mm/s return 150 mm/s
9	Material	STRUCTURAL STEEL

Table:1 Specification Of Press Machine

**Analysis of Top Platen**

Top platen is a steel cast structure located upper side of a vertical press, and withstand compressive and bending load developed by hydraulic cylinder.

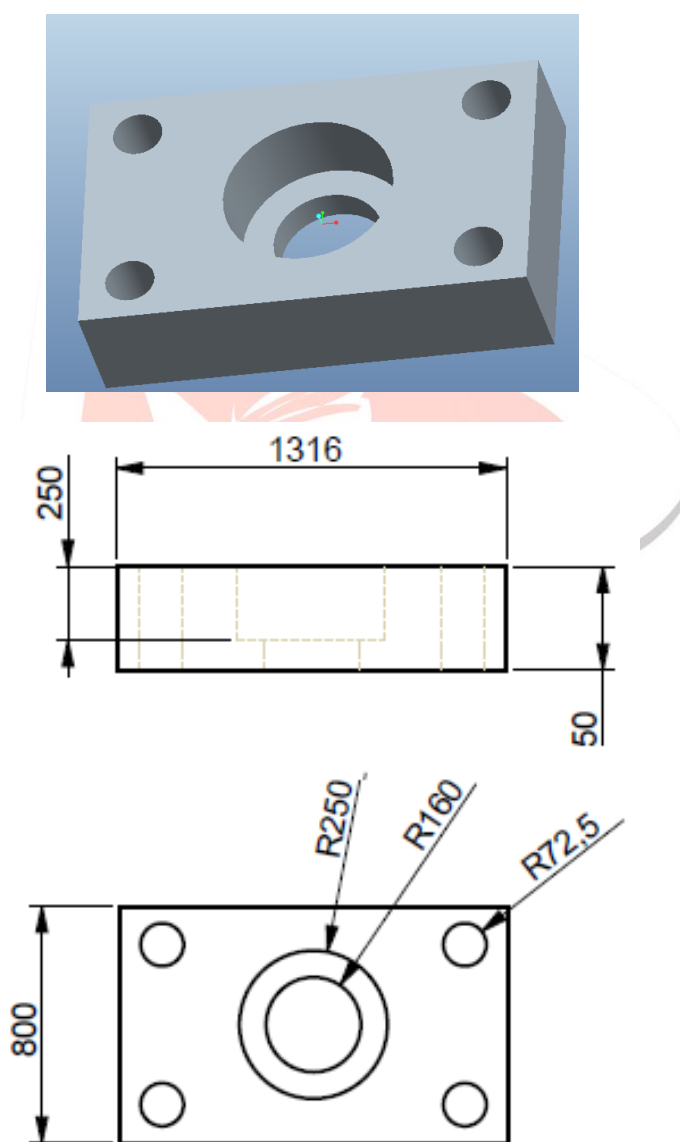


Fig 2 Drawing view of top plate

As shown in figure 3, force 3000 KN of cylinder is acting on the top plate. Plate is fixed at four nuts. So diameter of nut is 225 mm and force is acting on 430 diameter at bottom part of top platen.

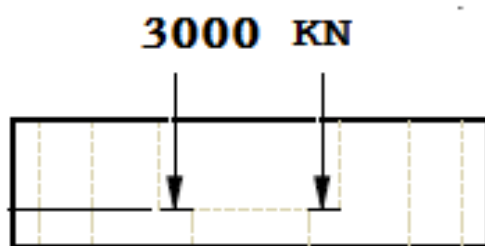


Fig 3 Force acting on plate

**FEA of Top Platen**

As shown in figure 3, plate is fixed at four nut having diameter of 225 mm.

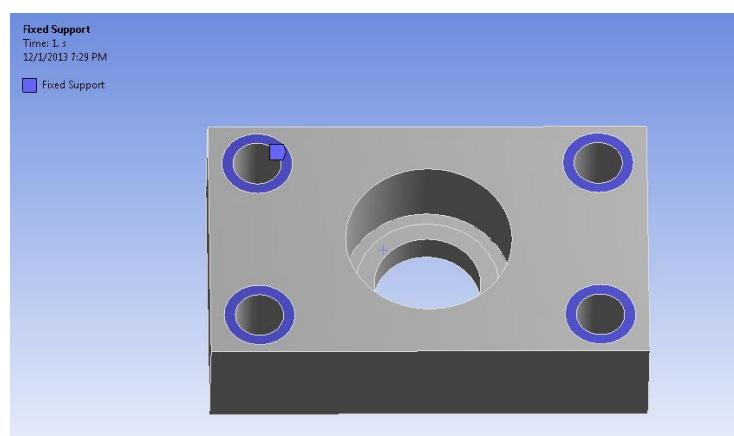


Fig 4 Fixed support of top platen

As shown in figure 5, force of 3000000 N is acting on diameter of 430 mm at bottom part.

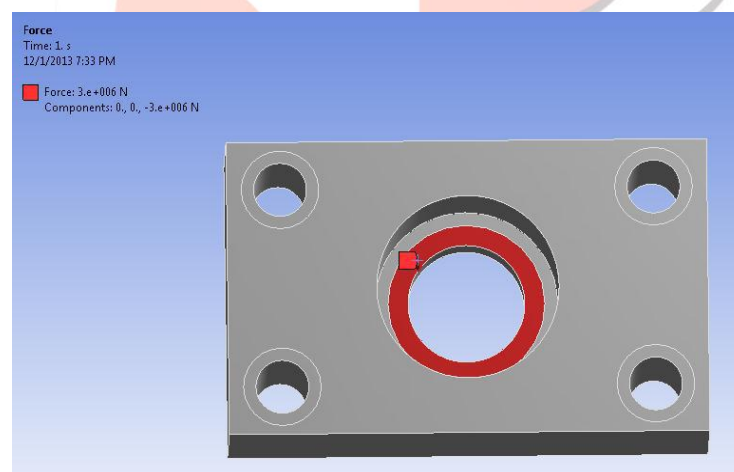


Fig 5 Force acting on top plate

Now show figure.6 is represent von-Mises stress. Maximum von- Mises stress is induced at the fixed support is approximate 120 Mpa

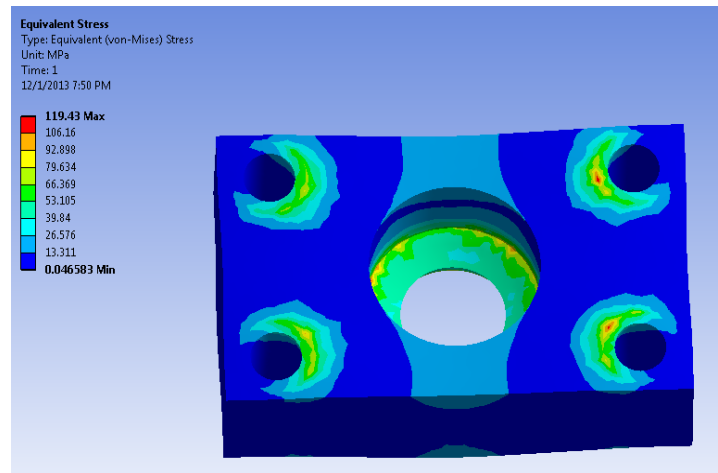


Fig 6 Von-Mises stress

The properties of structural steel are:

Tensile yield stress: 250 Mpa

Ultimate tensile stress: 460 Mpa

Poisson ratio: 0.3

Young modulus: 200000<sup>[3]</sup>

So as per material specification induced stress is safe.

In the figure 7 shows deflection of top platen is approximate 0.18 mm.

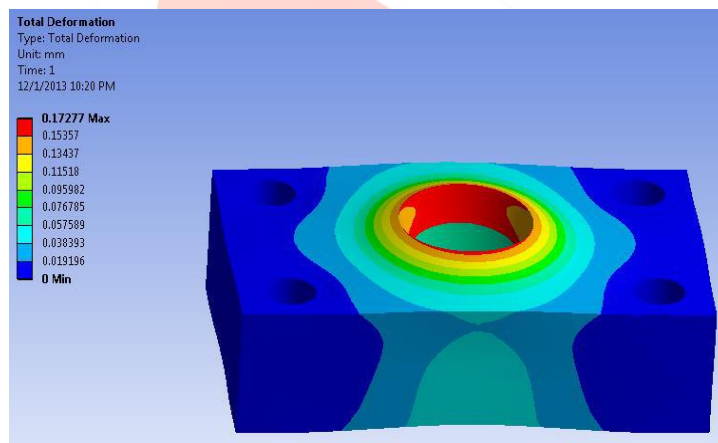
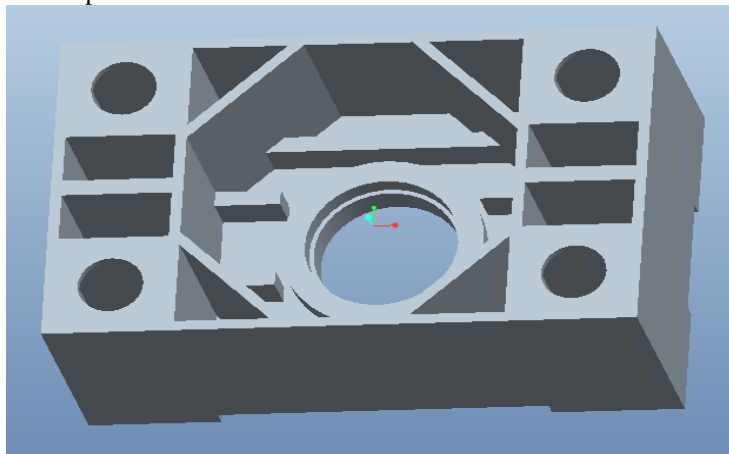


Fig 7 Deflection of top platen

### III. OPTIMIZATION OF MODIFIED PRESS MACHINE COMPONENTS

#### *Modified Dimension of Bottom Platen*

Now modified dimensions for sizing optimization as shown in figure 8. Here box is made of 25 mm thickness of plate, 50 mm of horizontal plate and 80 mm of bottom plate thickness.



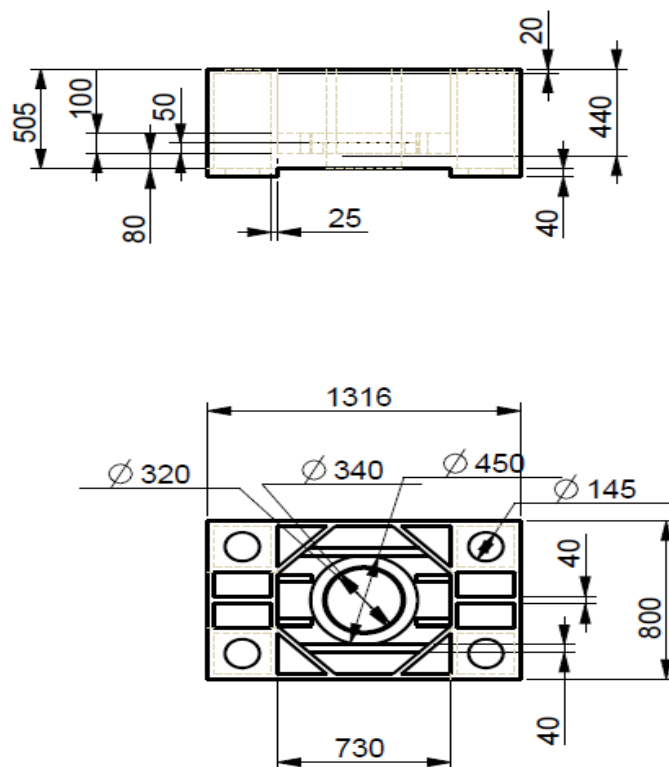


Fig 8 Drawing view of modified bottom platen

#### IV. FEA OF MODIFIED DIMENSION BOTTOM PLATEN

Now shown in figure 9 the fixed support and forces applied on bottom plate. Fixed support is apply at that portion is because nut from that portion pass and force apply of cylinder on it of 3000KN.

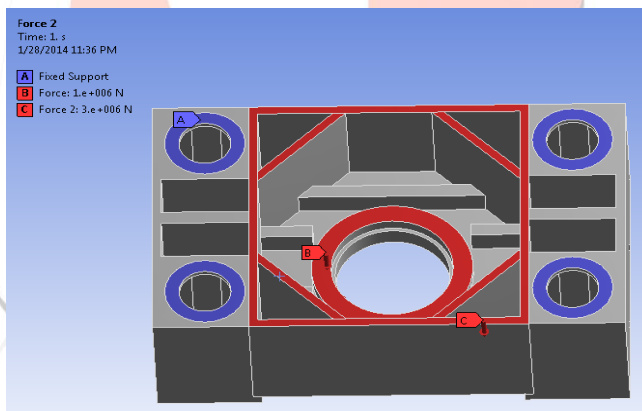


Fig 9 Fixed support and load application modified bottom platen

As shown in figure 10 the equivalent stress is approximate 144 Mpa which is within than safe limit and shown in figure 11 the total deflection is about 0.21 MM.

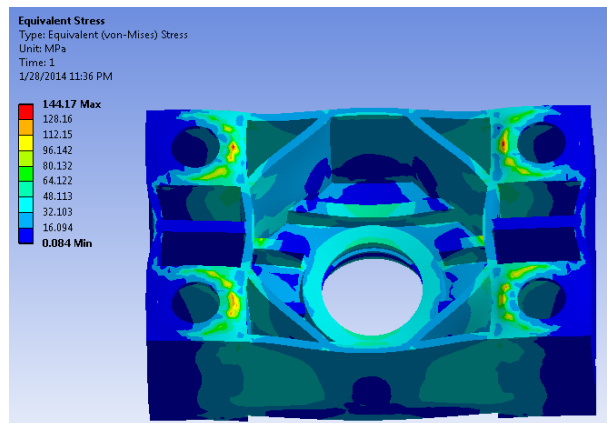


Fig 10 Von-mises stress of bottom platen

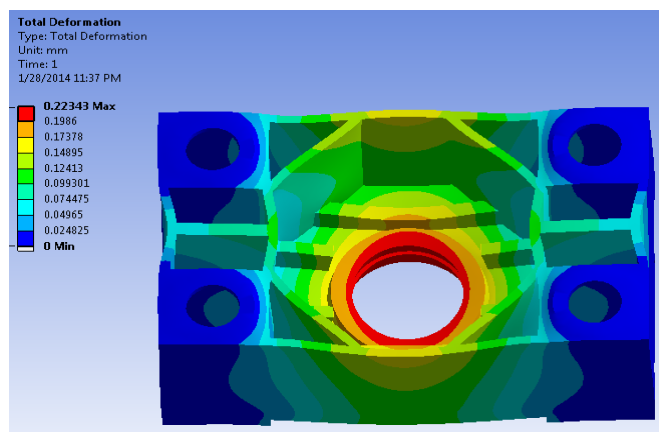


Fig 11 Total deflection of bottom platen

## V. CONCLUSION

Table 2 Comparison Of Bottom Platen

Sr No	Parameter	Old Bottom Platen	Modified Bottom Platen
1	Von-mises Stress	104 Mpa	144.17 Mpa
2	Total deflection	0.055 mm	0.17 mm
3	Weight	2263 Kg	1303.1 Kg

For the sizing optimization of bottom platen more than thirty analysis are carried out by using different orientation and size of rib. Out of thirty analysis only seven analysis of bottom platen are mention over here. And finally, bottom platen are shown. By comparing we get that it's weight reduce from 2263 kg to 1303.1 kg It's von mises is 144.17MPa but it is safe because maximum value is 250MPa.

## REFERENCES

- [1] <http://www.jindalhydraulics.com/hydraulic-presses.html>
- [2] Q.S.KHAN, "Introduction to hydraulic presses & press body" volume-1, tanveer publications.
- [3] [http://en.wikipedia.org/wiki/Ultimate\\_tensile\\_strength](http://en.wikipedia.org/wiki/Ultimate_tensile_strength)