Design, Analysis and Optimization of Plate Bending Machine

Vaibhav Bankar[1] Akash Gurve[2]
[1]Assistant Professor [2]M. Tech Student
[1,2]Department of Mechanical Engineering
[1,2]VIT Nagpur

Abstract— In Plate bending machine, the generation of force, its transmission and amplification are achieved using fluid. The liquid system exhibits the characteristics of solid and provides a positive and rigid medium of power transmission and amplification. In a easy application, a smaller piston transfers fluid under high pressure to a cylinder having a comparatively larger piston area, thereby amplifying the force. Thus resulting in easy transmissibility of large amount of energy with unlimited force amplification. It also has a very low inertia effect. The aim of the project is to modify the major component of one cylinder four post hydraulic press so that rigidity and strength is increased by using minimum material. The function of the major components like frame, bottom plate, bed, top box is to absorb forces to provide precise slide guidance and to support the drive system and other auxiliary unit. The structural design of any component depends on the pressing force this determines the rigidity. The machine currently under use does not have high rigidity and needs to be redesigned.

Key words: Plate bending machine, FEA, Machine design

I. INTRODUCTION

Fabrication of sheet metal plays an important role in the metal manufacturing world (Cloutier, 2000). Sheet metal is used for production of varied materials ranging from tools, to hinges, automobiles etc. Few application of Sheet metal fabrication is deep drawing, stamping, forming, and hydro forming, to high-energy-rate forming (HERF) to create designs (Cloutier, 2000). Unique, intricating and elegant shapes may be folded from a single plane sheet of material thereby not causing stretching, tearing or cutting, if one incorporates curved folds into the desired shapes (Martin et al., 2008). Rolling of sheet metal also known as shape rolling is the bending continually along a linear axis.

When usually dealing with such types of presses, press-body is of C Shaped. When free space required from three directions of press table for loading and unloading of pressed component then this type of presses are designed. As main cylinder placed eccentrically to central axis of press-body, it applies eccentric load on press-body hence heavier press body is required in comparison to same capacity of other type of press. These types of presses are also called as single press.

II. OBJECTIVE

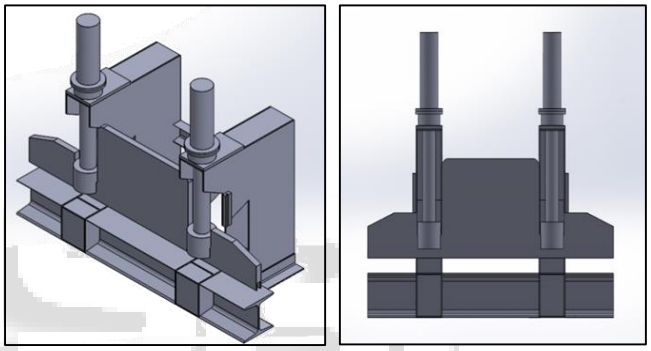
The aim of the project is to modify the major component of one cylinder four post hydraulic press so that rigidity and strength is increased by using minimum material. The function of the major components like frame, bottom plate, bed, top box is to absorb forces to provide precise slide guidance and to support the drive system and other auxiliary unit. The structural design of any component depends on the pressing force this determines the rigidity. The machine currently under use does not have high rigidity and needs to be redesigned.

III. METHODOLOGY

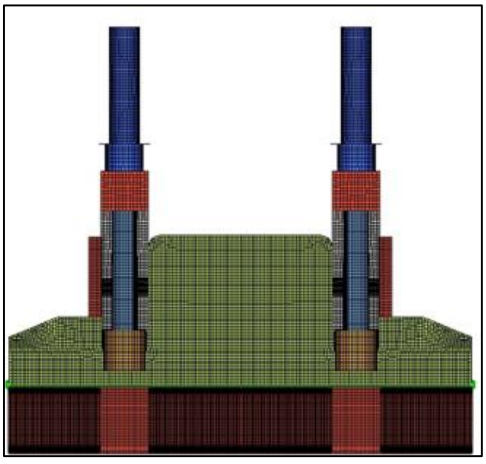
1) Data collection from site.
2) CAD modelling of existing system.
3) Finite Element Modelling.
4) Analysis of the press machine in FEA.
5) Optimization of design.
6) Results discussion.
7) Conclusion.

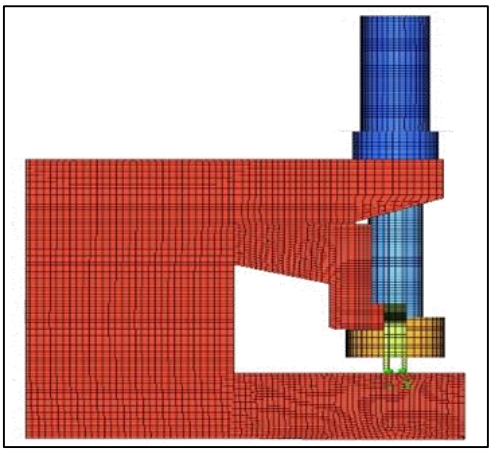
IV. CAD MODEL

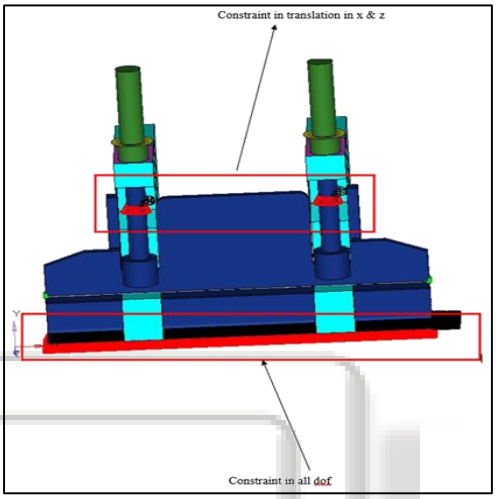
A. Existing Cad Model of Press Machine Rod:

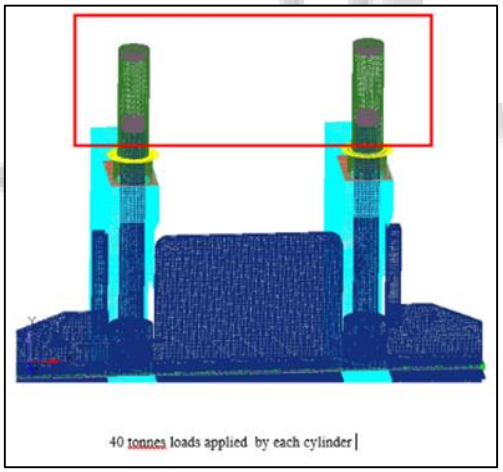


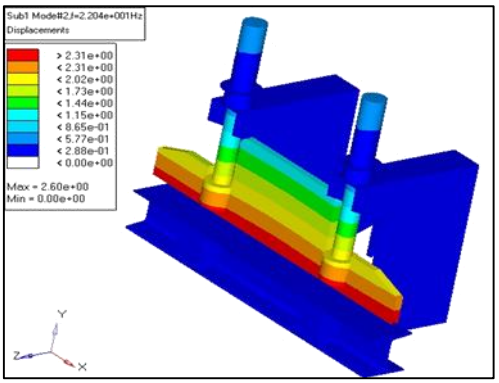
B. Existing Press Machine Finite Element Model and Boundary Condition:

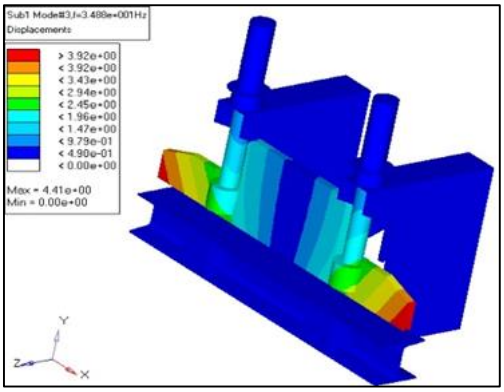


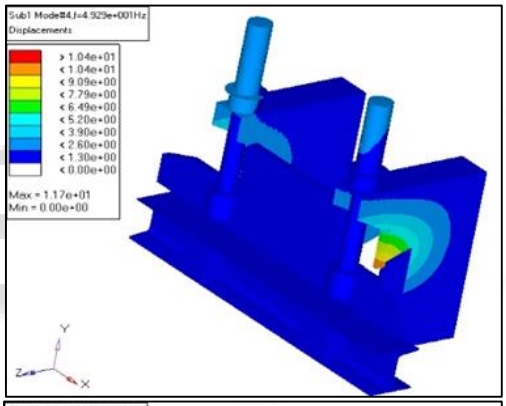


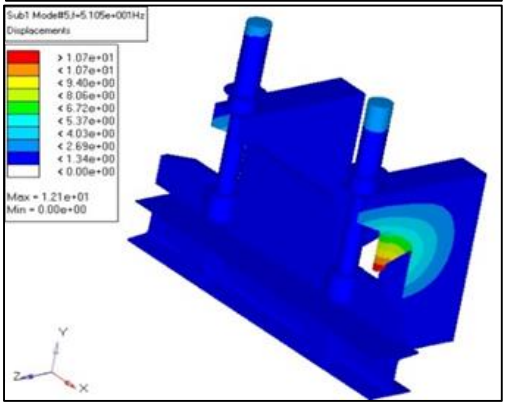




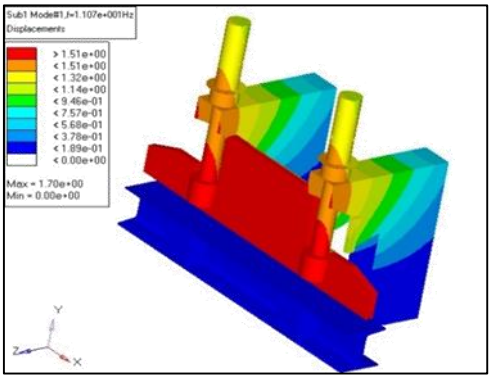


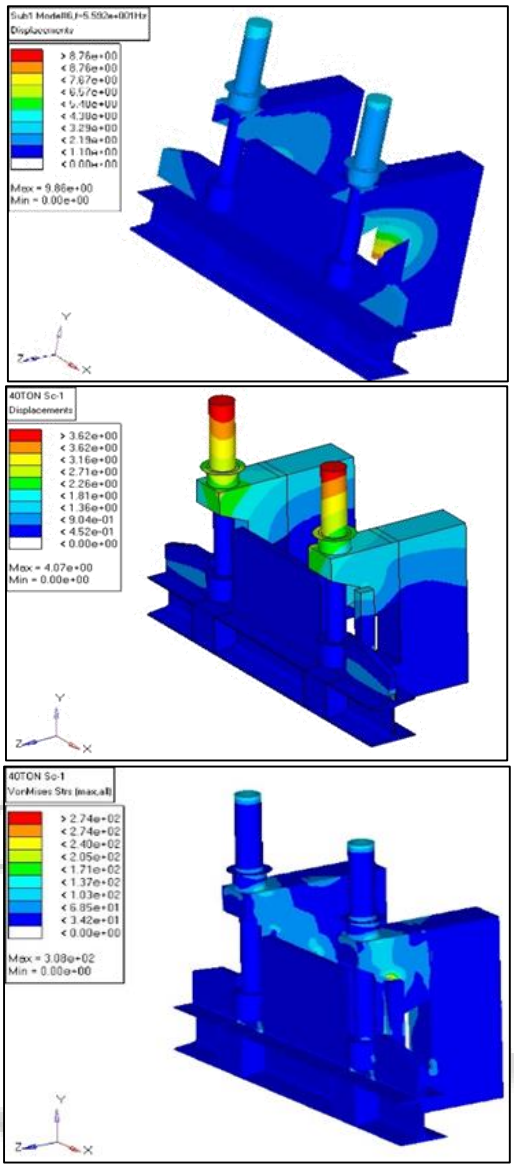






C. Existing Design Finite Element Analysis and Results:





V. CONCLUSION

In modal analysis we obtained natural frequencies and mode shapes. Displacement, stresses and strains obtained by performing static analysis of existing model. For existing model stresses were outside the safe limit. Thus it is important to redesign the structure of the bending machine to reduce the induced stress within the elastic limit. This will be covered in the next publication.

REFERENCES

[1] Muni Prabaharan and V.Amarnath, "Structural Optimization of 5Ton Hydraulic Press and Scrap Baling Press for Cost Reduction by Topology"
[2] B.PARTHIBAN1, P.EAZHUMALI 2, S.KARTHI 2, P.KALIMUTHU, "Design and analysis of c type hydraulic press structure and cylinder.
[3] Ankit H Parmar, Kinnarraj P Zala, Ankit R Patel, "Design and Modification of Foremost Element of Hydraulic Press Machine."
[4] Malachy sumaila and Akii okonigbon akaehomen Ibhadode. (2011) "Design and manufacture of a 30-ton hydraulic press"
[5] Drake, K.R. Fone, D. and Smith, T.W.P. (2012) "A simple hydraulic model for the hydrodynamic loading on a heaving horizontal cylinder with a small damage opening at its keel"
[6] Fulland, M. Kullmer, G. Richard, H.A and Sander, M. (2008) "Analysis of fatigue crack propagation in the frame of a hydraulic press"

