DESIGN AND ANALYSIS OF SIDE PLATE OF HYDRAULIC PRESS BRAKE USING ANSYS 10.0

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ABSTRACT

This research work illustrates the application of CAD/CAE technoloies for the design and analysis of process equipment of Hydraulic Press Brake. An attempt has been made to justify said tools by means of a live case study of design and analysis of a Hydraulic Press Brake at Weldor company in Rajkot.
The important aspect/details related to Hydraulic Press Brake, and the important design considerations and theory for Hydraulic Press Brake used are presented. Calculation for tonnage required, Design of critical parts as Side Plate, Upper beam of Hydraulic Press Brake using FEA ANSYS 10.00 is carried out. It includes Solid Modeling in Pro-E wild fire 3.0 and FEA in ANSYS 10.00. The conclusion is made based on result and discussion.

PROBLEM DEFINITION

Weldor Hydraulic Press Brakes are designed and developed through years of experience in Sheet Metal Working Machineries. Weldor Hydraulic Press Brakes are developed by keeping latest technology in mind. Both cylinders are mounted at back side of Hydraulic Press Brake and are synchronized for parallelism between ram and table, by providing mechanical links connected with cylinder. The heavy duty steel construction frame is so designed to absorb heavy shocks of overload. All welding edges are properly machined for weld joints. The electric control panel is fixed on side wall at conventional place for easy reach of operator. It includes push button pendant and foot switch. Standard 'V Block & 'V Punch and manually operated back gauge system which is front operated are supplied as standard accessories.

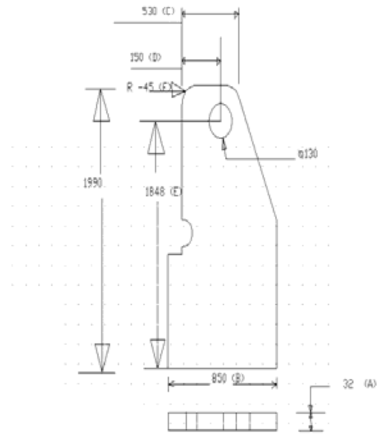
As per the basic model the deflection in side Plate was 1.2179 mm. So practically this is high. There were two main problems that occur when a plate was bent. The problems occurred are explained below

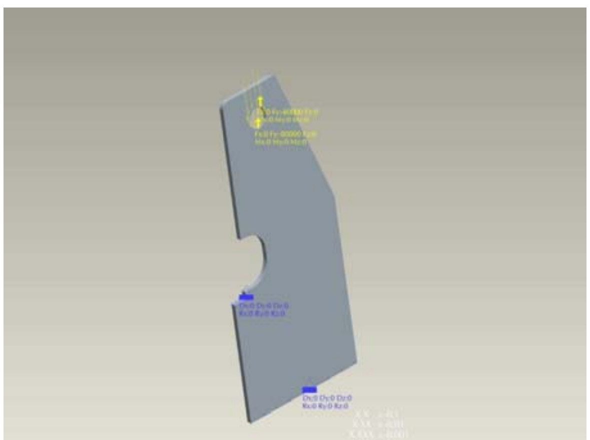
Consistency in bending was not there during process so this is the main problem asked by the company. As during bending process $\pm 1^{0}$ tolerance may be allowed in some of the process. So there is criterion to reduce the displacement and so to get consistency in process i.e. optimizing available design.

(1) As it can be say that because of this kind of fluctuation in process the chances of fatigue of side plate may increase.

(2) Currently, FEM Simulations is an advanced method to predict problems without wasting money in faulty series or unnecessary prototyping. As any mathematical model of a real-world phenomenon it has potential risk. There is always the ossibility that in one particular case the model gives wrong results. The purpose in thi s model is to decrease this possibility as much as possible.

Detailed Dimensions of Side Plate:-





Solid model of lower beam

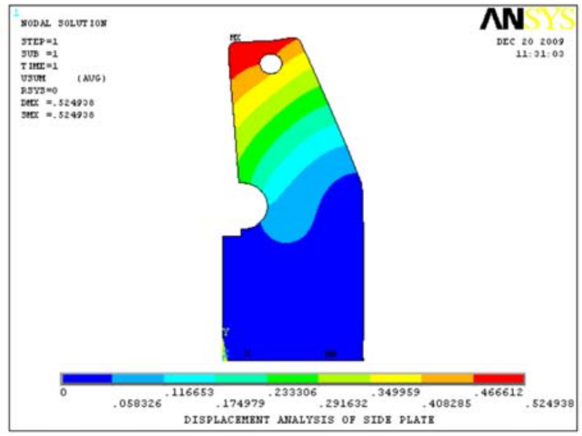
MATERIAL PROPERTYMaterial :- Plain Carbon Steel (C = 0.20 to 0.30)Ultimate Tensile Strength :- 470 N/mm2....Ultimate Shear Strength :- 350 N/mm2

Yield Strength :- 154 N/mm2

Hardness BHN :- 140

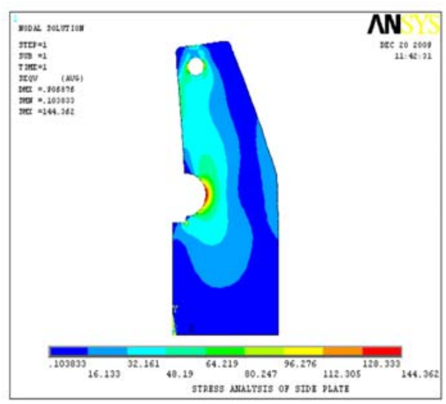
DISPLACEMENT ANALYSIS – MODEL No. – 01

(Hole Dimension Changed Horizontally From 150 mm to 250 mm)



Displacement Analysis is performed and observed from above figure that displacement is reduced from 1.223899 mm to 0.5249 mm But its still Beyond the permissible limit. i.e. it should be lower than 0.5 mm so there is need to done some more modification in following case.

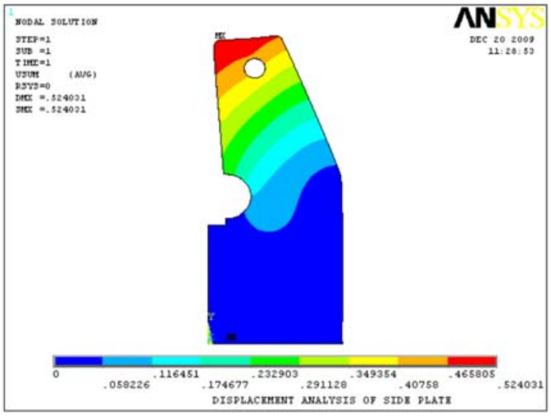
VON MISES STRESS ANALYSIS - MODEL 01



Von Misses Stress Analysis is performed and observed from above figure that Stress is 144
KN/mm2 which is within the permissible limit of 154 KN/mm2. Hence as far as Von-Misses stress analysis is concern this is valid

DISPLACEMENT ANALYSIS
MODEL No. – 02

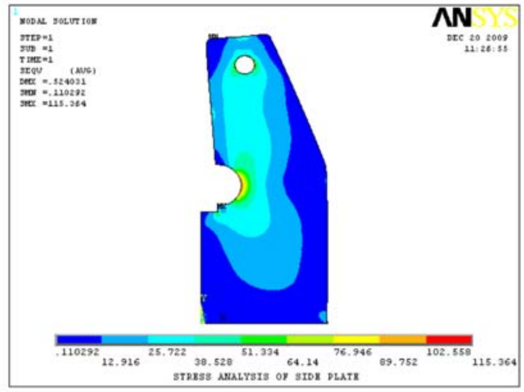
(Hole Dimension Changed Horizontally From 150 mm to 250 mm &
Vertically From 1848 mm to 1798 mm)



Displacement Analysis is performed and observed from above figure that displacement is reduced from 0.5249 mm to 0.5240 mm But its still Beyond the permissible limit i.e. it should be lower than 0.5 mm so there is need to done some more modification in following case.

VON MISES STRESS ANALYSIS –

MODEL 02



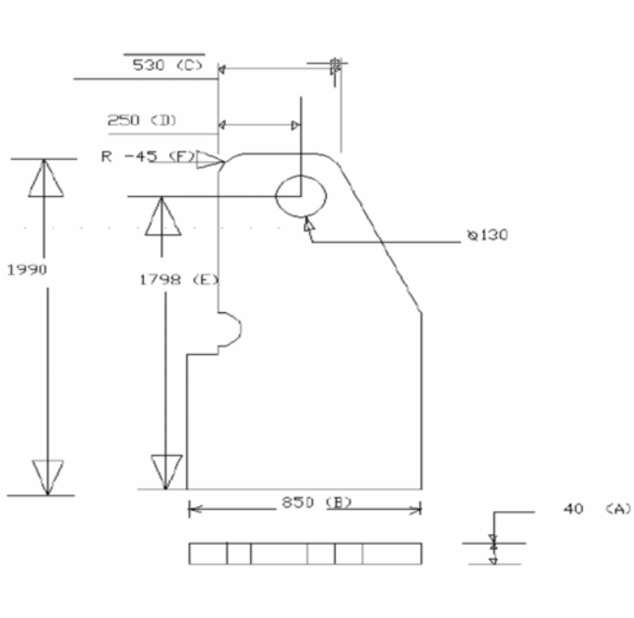
Von Misses Stress Analysis is performed and observed from above figure that Stress is 115 KN/mm2 which is within the permissible limit of 154 KN/mm2. Hence as far as Von-Misses stress analysis is concern this is valid

VON MISSES STRESS AND DISPLACEMENT ARE GIVEN IN THE TABLE

Von misses stress within limit. i. e. Model No – 05

The displacement & Von Misses are compares and the model is adopted having displacements & Von misses stress within limit. i. e. Model No – 05								
Mo D L e no	Changed Dimension	A	C	D	E	F	Max Disp (mm)	Von Misses Stress (KN /mm2)
1	Hole Dimension Changed Horizontally	----	---	250	---	----	0.5249	145
2	Hole Dimension Changed Horizontally & Vertically	----	----	250	1798	--	0.5240	115
3	Left Top Corner Fillet Reduced To Zero	----	-----	---	---	00	0.5305	115
4	Thickness Increased	40	-----	---	---	---	1.8600	296
5	Thickness Increased And hole shift horizontally and vertically	40	-----	250	1798	----	0.4165	92
6	Upper width Increased	----	580	----	-----	-----	1.5400	237

Modified Side Plate



CONCLUSION

Solid models of lower beam, side plate, and assembly of side plate and lower beam are developed
using Pro- E. The same models are analysed using Pro- mechanica. The displacement of side plate
is 1.223 mm which is greater than permissible limit 0.5 mm Hence various dimension of side plate are modified and solid models are developed (1 to 6) In Pro – E. All models are analysed using Ansys 10.00 and results i. e. Von misses stress and displacement are obtained and compared. The Model No :- 05 (thickness 40 mm, horizontal shift 150 mm and vertical shift 50 mm) has Von-Misses stress and displacement within permissible limit. Hence it is adopted.

REFERENCES

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