Optimization of Rotavator Blade towards Enhancing the Blade Life and Higher Crop Productionby Using CAD Tool

Ankush D. Bhishnurkar[1], Dr. Ashok G. Matani[2]

1Assistant Professor, Mechanical Engineering, G. H. Raisoni Institute of Engineering & Management, Jalgaon [MS] India
2Associate Professor, Mechanical Engineering, Government College of Engineering, Amravati [MS] India – 444606

Email: **1**anky4589@gmail.com**, 2**drashokmatani@gmail.com

Abstract:

The development of Rotavator blades is an on-going process and new blades, particularly in the Asian subcontinent and Japan, where the Rotavator is widely used. The direction of rotation affects the manner because of its design in which soil failure occurs during the rotary tillage operation. Increase in fossil fuel prices leads to higher level of Agricultural land preparation cost which directly leads to increase in the cost of food. Farmers are more interested to improve cost to benefit ratio by reduce the land preparation cost and increase the yield. Now a day it is possible by using Rotary tiller or Rotavator for seedbed preparation. In a Rotavator Blades are the main parts which are engaged with soil to prepare the seedbed for sowing. Rotavator is a widely used machine for tillage operation in Indian farming because of its superior ability to mix, flatten and pulverize soil. This paper describes the design analysis of blade through computational method.

Keywords: Blade Life, Deformation, Optimization, Rotavator Blade, Structural Analysis.

Objectives

1. To prepare a geometric solid model of Rotavator Blade by using CAD-software.
2. To generate a CAD analysis report of rotary tillage tool components.
3. To modify existing geometric solid model of Rotavator Blade.
4. To generate a CAD analysis report of modified Rotavator Blade.

Results and Discussions

The analysis results of left hand in graphical mode have shown in figures below. As in case of tillage tools, deformation is related to tool wear but stress plays a major role which results in wear of the tool. In this analysis, because of variations in tool shape the stress variation is obtained. The resultant for deformations, von-mises stress, maximum principal stress, tensile stress and shear stressis shown in figure below for LH Rotavator blade.

Figures below shows the 3D model and stresses for rotavator blade for thickness of 7mm.

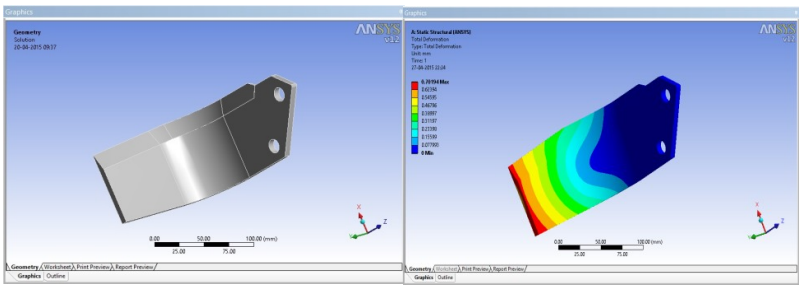

Fig-1.: 3D-Model of 7mm Blade

Fig.-2: Deformation of 7mm Blade

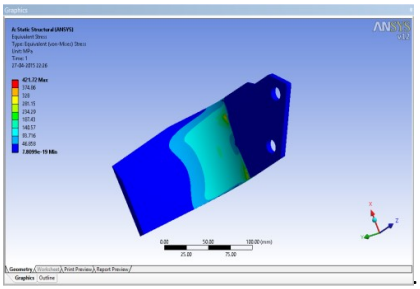

Fig.3: Von-Mises Stress

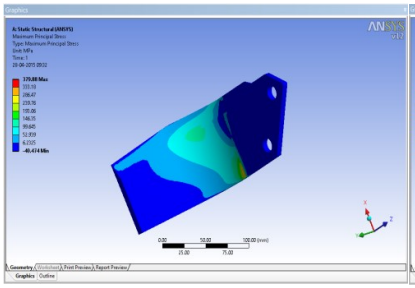

Fig.4: Maximum Principal Stress

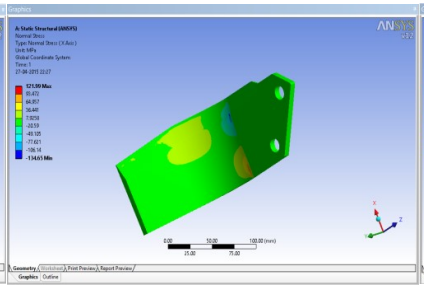

Fig.5: Tensile Stress

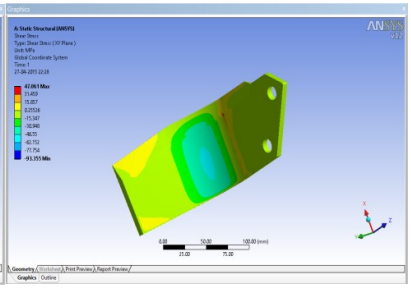

Fig.6:Shear Stress

Figures below(Fig. 7 to Fig 12) shows the 3D model and stresses for rotavator blade for thickness of 9mm.

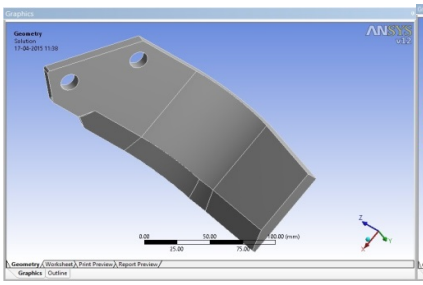

Fig.7: 3D-Model of 9mm Blade

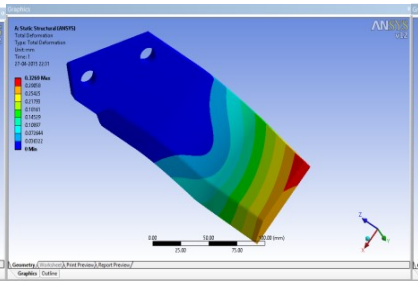

Fig.8: Deformation of 9mm Blade

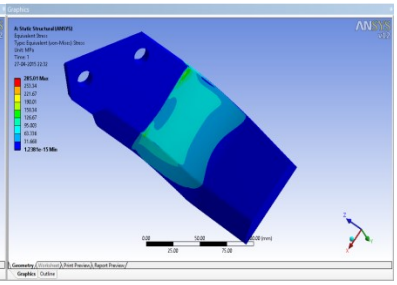

Fig.9: Von-Mises Stress

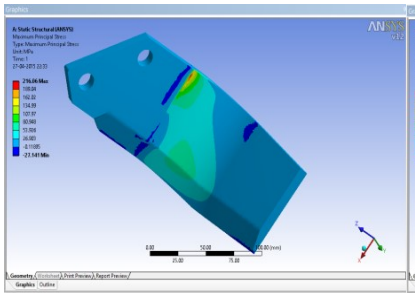

Fig.10: Maximum Principal Stress

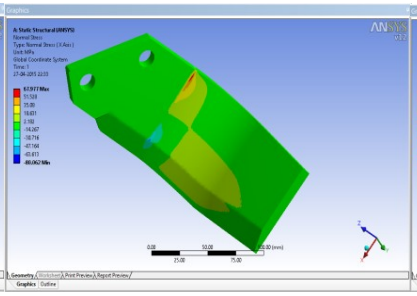

Fig.11: Tensile Stress

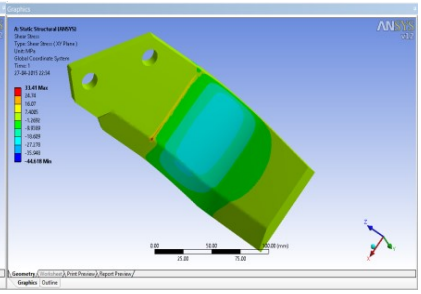

Fig.12: Shear Stress

Table 1: Comparison of Results for 7mm and 9mm Rotavator Blade

Sr. No.	Factor	7mm Blade	9mm Blade
1	Maximum Deformations	0.7mm	0.33 mm
2	Maximum Von-Mises Stress	421.72 MPa	285 MPa
3	Maximum Principal Stress	380 MPa	216 MPa

4	Maximum Tensile Stress	122 MPa	68 MPa
5	Maximum Shear Stress	47.06 MPa	33.4 MPa

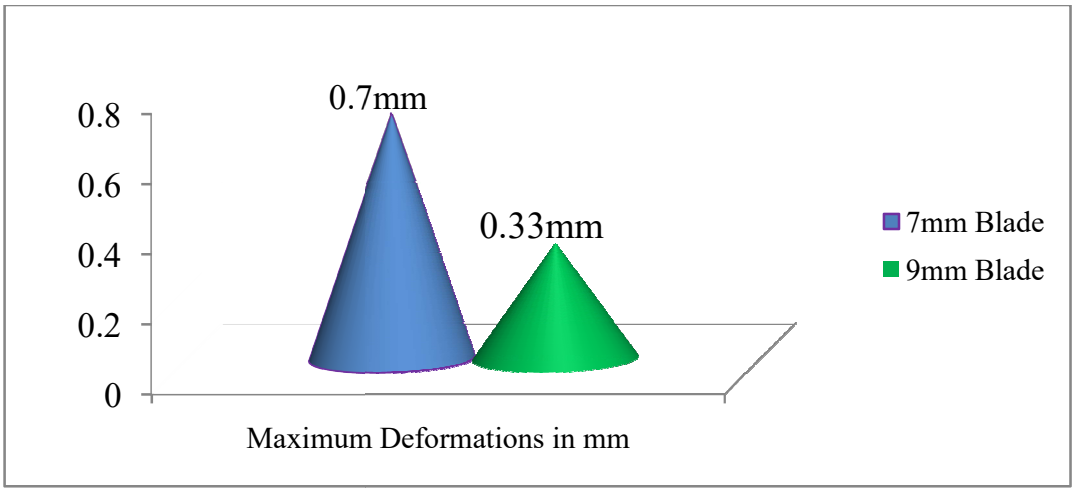

Fig.13. Comparison of Deformation in 7mm and 9mm Blade

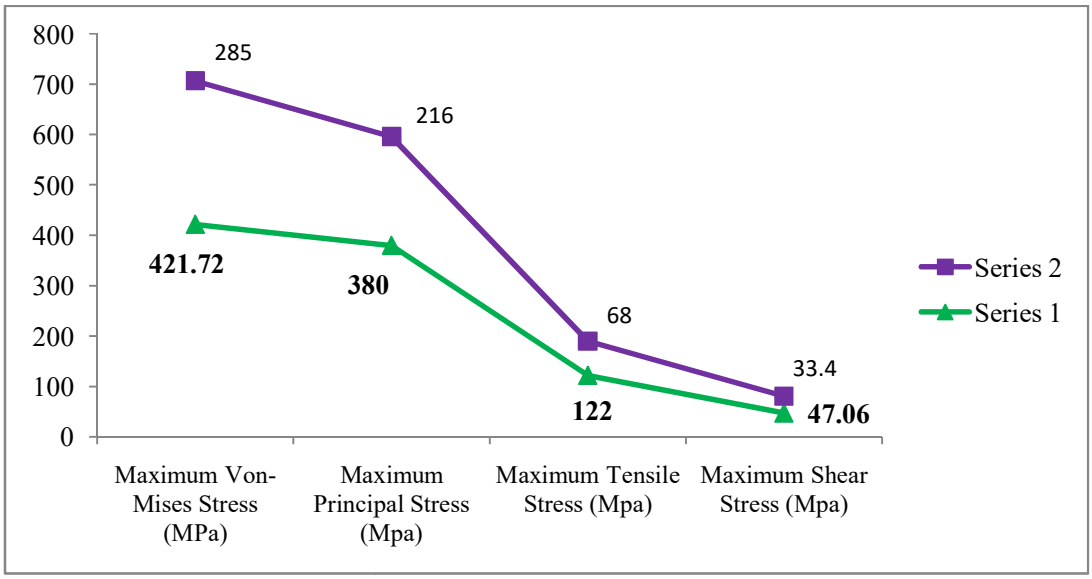

Fig.14: Comparison of Stresses in 7mm and 9mm Blade

Conclusions

From the results of structural analysis for 45HP tractor shows that all the parameters *viz.* von-mises stress, maximum principal stress, tensile stress and shear stress drastically reduces for the modification is design for thickness of 7mm to 9mm. More laboratory and field testing is required for the detailed analysis results.