Research Article CODEN: IJPAKY Impact Factor: 4.226 ISSN: 2319-507X
Triveni R. Petale, IJPRET, 2016; Volume 4 (11): 20-29 IJPRET

INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

A PATH FOR HORIZING YOUR INNOVATIVE WORK

DESIGN AND ANALYSIS OF AUTOMOBILE DIRT SHIELD

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Accepted Date: 16/06/2016; Published Date: 01/07/2016

Abstract: - While moving on roads water and other elements can attack your vehicle from all angles. Mostly it attacks at the bottom part of the vehicle. Due to this it may damage or corrode the brake assembly etc. So to ensure that the quality of your engine and brake we can keep them covered using a splash shields. The paper mainly focusing on the dirt shield of TATA Safari. The vehicle has the high power and torque. This will lead to more chances to lower parts failures due to stone and other particle while working. CAD and CAE tools are used to check the failures of dirt shield and comparison of various materials are done to predict the more suitable material for dirt shield.

Keywords: Materials, Tata Safari, CAD, CAE

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How to Cite This Article:

Triveni R. Petale, IJPRET, 2016; Volume 4 (11): 20-29

PAPER-QR CODE

INTRODUCTION

Not very well known but still important part of an automobile, are the wheel arch liners and the splash shields. The parts serve on the one hand for reduction of the transmission into the vehicle interior of the running noises generated during traveling of the vehicle through the wheel rotating on a surface. On the other hand the parts serve as spray protection against particles highly accelerated during travel, due to the rotating wheel, such as sand or gravel, and for protection against water or mud. Wheel arch liners and splash shields also bring about, in their function as spray protection, for example a protection of the bodywork or of the engine bay from paintwork damage or corrosion and from contamination by highly accelerated particles and/or water or mud. Further, the parts also serve as covering over openings, such as for example ventilation openings, which in the rearward side region of the vehicle open into the vehicle bumpers.

1.1 Brake Drum Wear Conditions

Most of the following wear conditions that affect a brake drum require that you replace the drum. Refer to Table below for possible causes of, and corrective actions for, the following wear conditions.

1.2 Normal Wear

Brake drums wear evenly under normal operating conditions. Use fleet history, if available, to determine the approximate wear rate of tractor drums. Normal wear is the most common reason to remove a brake drum from service.

1.3 Deep or Excessive Wear

It is important to inspect a brake drum for the following excessive wear conditions, which is required to replace the drum.

1.4 Deep, Uniform Wear

Deep, uniform wear at the edge of the drum where the lining rub path starts can result from brake drag, brake imbalance and dirt embedded in the brake lining.

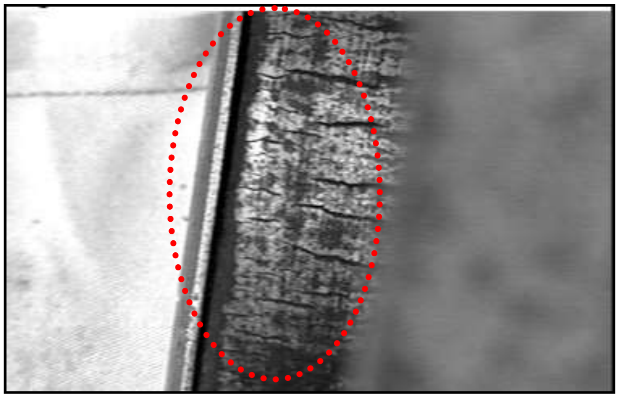


Figure 1.1 Deep wear

Figure 1.2 Uniform wear

1.5 Deep Wear on One Side of the Drum Only

Deep wear only on one side of the drum indicates that the drum is not concentric with the bearing center line of the hub. No evidence of hot spotting may be evident

Figure 1.3 Deep Wear on One Side of the Drum Only

2.0 CAD MODEL OF EXISTING ASSEMBLY AND DIRT SHIELD

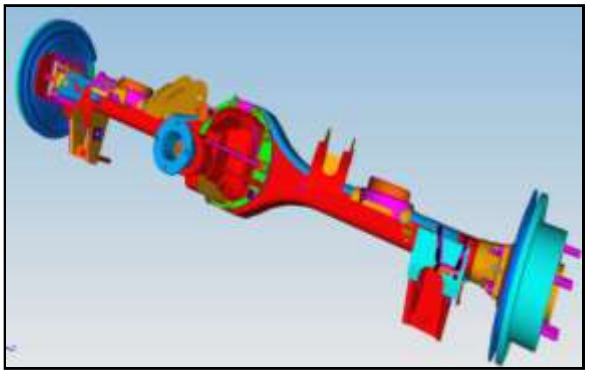


Figure 2.1 Rear Axle Assemblies

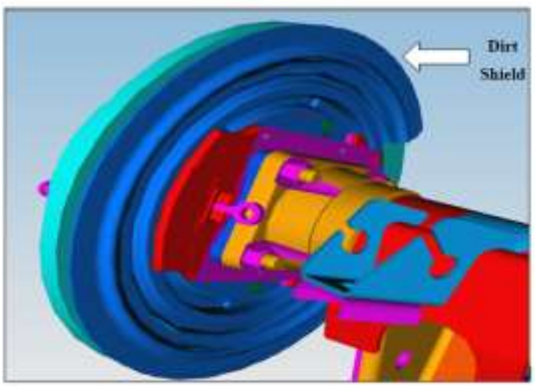


Figure 2.2 Placement of dirt shield

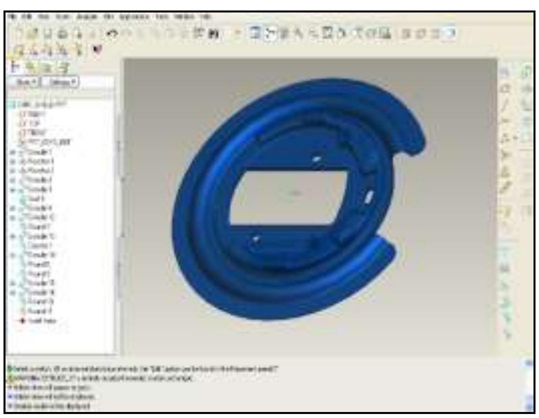


Figure 2.3. CAD model of dirt shield

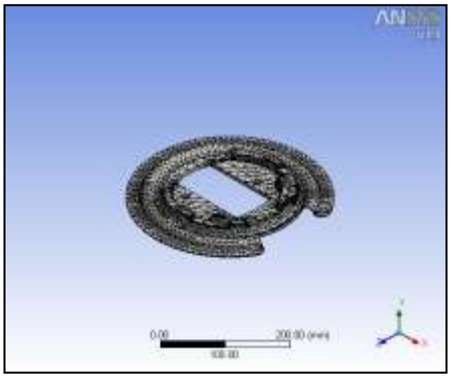


Figure 2.4 Finite element meshed model

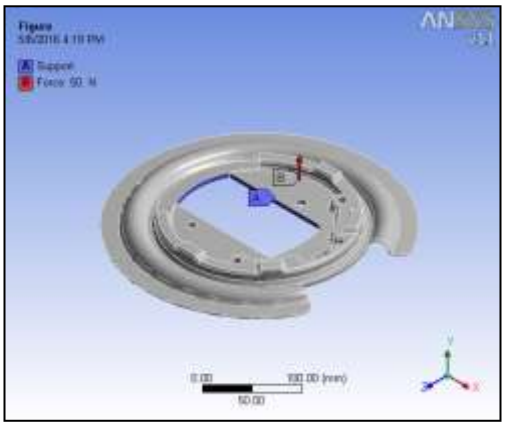
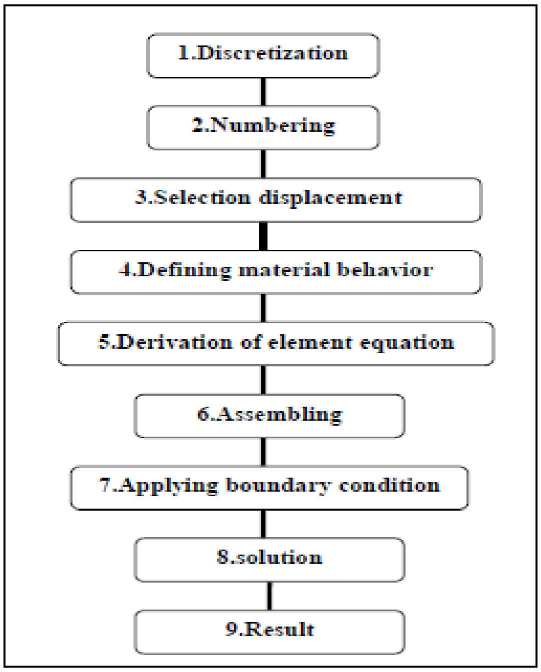


Figure 2.5 Applied boundary conditions

3.0 STEPS IN FEA



3.1 Preprocessing

The preprocessing step is, quite generally, described as defining the model and includes

- Define the geometric domain of the problem.
- Define the element type(s) to be used.
- Define the material properties of the elements.
- Define the geometric properties of the elements (length, area, and the like).
- Define the element connectivity (mesh the model).
- Define the physical constraints (boundary conditions).
- Define the loadings.

3.2 Analysis (Solver)

During the solution phase, finite element software assembles the governing algebraic equations in matrix form and computes the unknown values of the primary field variable(s). The computed values are then used by back substitution to compute additional, derived variables, such as reaction forces, element stresses, and heat flow. For static, linear problems, a wave front solver, based on Gauss elimination, is commonly used.

3.3 Visualization (Post processing)

- Sort element stresses in order of magnitude.
- Check equilibrium.
- Calculate factors of safety.
- Plot deformed structural shape.
- Animate dynamic model behavior.
- Produce color-coded temperature plots.

4.0 SAMPLE RESULTS OF ANSYS

4.1 ANSYS Results for Mild Steel Alloy

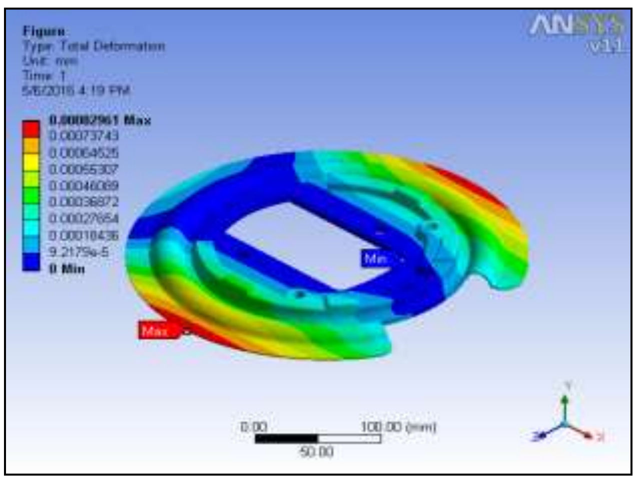


Figure 4.1 Total Deformation in Mild Steel Alloy

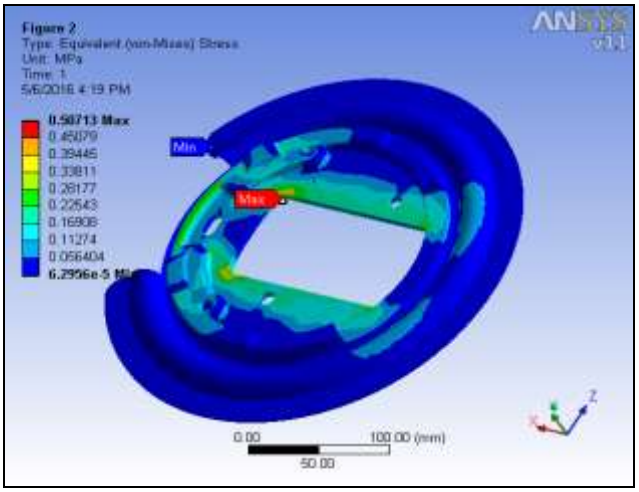


Figure 4.2 Equivalent stress in Mild Steel Alloy

5.0 RESULTS OF ANSYS FOR DIFFERENT MATERIALS

	Mild Steel	Hardox 400	AlSi	E-Glass Epoxy	HS Carbon Epoxy
Results					
Frequency Range for 6 different modes (Hz.)	701.17	710.87	701.22	694.56	1352.8
	711.17	721.25	712.28	704.47	1366.6
	759.01	770.79	764.82	751.86	1434.9
	786.21	798.11	790.81	778.8	1492
	968.74	984.2	977.98	959.61	1816.5
	1055.6	1071	1058.5	1045.7	1999.2
Total Deformation	8.296 e-4 mm	8.0 e-4 mm	2.3 e-3 mm	3.3 e-3 mm	1.08e-3 mm
Equivalent Stress	0.50713 MPa	0.51534 MPa	0.54286 MPa	0.50713 MPa	0.36637 MPa

6.0 CONCLUSION

Complete study about design and analysis of dirt shield is done. CAD model of the existing dirt shield is designed with the available dimensions on CAD software ProE and FE meshed model were developed for getting accurate results on which FEM analysis on ANSYS workbench is performed. Keeping all the boundary conditions constant like ambient temperature, force, type of support etc. Dirt shield is then tested for five different materials such as Mild steel, Hardox 400, AlSi, E-Glass Epoxy, and HS Carbon Epoxy. It is found that out of these five materials HS

Carbon Epoxy is the suitable material, as the results of total deformation, equivalent stress and frequency range appears to be best in comparison with other material.

Then the force analysis is performed for every material. The force is taken as 50N. HS Carbon Epoxy shows lowest deformation and lowest equivalent stress i.e. 1.0817e-003 mm and 0.36637 MPa.

For the natural frequency vibration/modal analysis six different positions i.e. modes are taken, for which the frequency range is found out. The HS Carbon Epoxy shows higher frequency range than the existing material Mild steel and the other four materials. Which indicates the HS Carbon Epoxy can be used with higher rpm with low vibrations.

As for both, force and natural frequency vibration/modal analysis, HS Carbon Epoxy shows the best results and its comparatively less mass; it is suggested material for the dirt shield manufacturing.

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