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CAD MODELLING AND THERMAL ANALYSIS OF TRACTION GEARBOX HOUSING FOR PAVER MACHINE

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Abstract— A Paver Machine (paver finisher, asphalt finisher, paving machine) is a piece of construction equipment used to lay asphalt on roads, bridges, parking lots and other such places. It lays the asphalt flat and providing minor compaction before it is rolled by a roller.

This research addresses responses of gear box to static and thermal analysis. The entire analysis is done for Paver Machine. The method used is finite element modeling and analysis for which the inputs are obtained from gear box model analysis. The responses to static and thermal analysis of gear box caused by interference and overheating of oil are determined. Components and, particularly areas which are much affected by the different loads and behavior oil are identified. The method is identified for optimization of gear box for increase efficiency and life of it. Finally, conclusions based on the results and recommendations which can be extensions of this research are also presented.

Keywords- Paver Machine, Optimization, FEM, Gear Box

I. INTRODUCTION

Figure 1 Paver Machine

A Paver Machine (paver finisher, asphalt finisher, paving machine) is a piece of construction equipment used to lay asphalt on roads, bridges, parking lots and other such places. It lays the asphalt flat and providing minor compaction before it is rolled by a roller.

In these Paver Machine having required different functionally such as fraction forward and reverse and conveyor left to right movement. A Paver Machine having a used three type of gear boxes for operation.

(i) Distributor or Differential Gear Box
(ii) Transit or Traction Gear Box
(iii) Gear Box for Conveyor

A Paver Machine is run by engine and performing different operation for lay asphalt on road, they have required different motion control device and hydraulic system. All gear boxes are coupled with engine for different function. The traction gear box is attached with engine by using 3 set pumps for different function. Main pump is used for the forward reverse movement of Paver. Second pump is used for up and down movement of the screed and hopper. Third pump is used for conveyor and screed.

SPECIFICATION OF PAVER

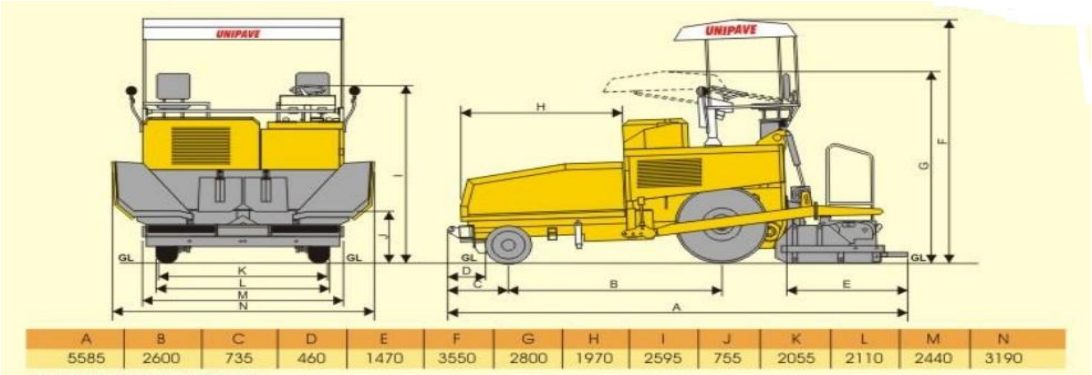

Figure2 Detail Schematics Drawing of Unipave HAP-045

Table 1.1Specification of Paver

Model	Unipave HAP-045
Transmission	Mechanical
Front Wheel	Solid rubber tyre 2 Nos.550 Dia. X175 mm
Rear Wheel	2 Nos. Pneumatic tyre Size : 11.00 x 20
Standard Accessories	Canvas Canopy, Working Lights, Travenlig Lights, Tool Kit with Jack & Horn
Prime Mover	Kirlosker make water-cooled electric start Diesel Engine Mthodel 4RT 1040 70BHP at 2000 rpm BS3 or equivalen-tarrangement. All the gears are of alloy steel & are hardened and ground and are working in oil bar
Screed	2.5 meters basic width, hydraulically extendable up to 4.5
Material Laying	Bitumen, Wetmix & DLC

II. CAD MODELING OF TRACTION GEARBOX HOUSING (ESP-05)

INTRODUCTION

Solid Works 2011 is 3D mechanical design system built with adaptive technology and solid modeling capabilities.

The Solid Works 2011 software includes features for 3D modeling, information management, collaboration, and technical support with DSS you can:

1. Create 3D models and 2D manufacturing drawings.
2. Create adaptive features, parts, and subassemblies.
3. Manage thousands of parts and large assemblies.
4. Use third-party applications, with an Application Program Interface (API).
5. Use VBA to access the Autodesk Inventor API. Create programs to automate repetitive tasks. On the Help menu, choose Programmer Help.
6. Import SAT, STEP, and AutoCAD and Autodesk Mechanical Desktop (DWG) files for use in Autodesk Inventor. Export Autodesk Inventor file to AutoCAD, Autodesk Mechanical Desktop, and IGES formats.
7. Collaborate with multiple designers in the modeling process.
8. Link to web tools to access industry resources, share data, and communicate with colleagues.
9. Use the integrated Design Support System (DSS) for help as you work.

WORKING WITH ASSEMBLIES

- Turn off visibility of nonessential components. Access the parts we need and update graphics faster.
- Use design representations. Create design representations that highlight specific design problems or assembly subsystems, and apply them when opening the assembly model.
- Turn off part adaptivity. After we size components, turn off adaptivity to speed up solutions and prevent accidental changes.
- Assign different colors to components. Select colors from the Color list on the Standard toolbar.
- Use the browser to find components. Point to component in the browser to highlight in the graphics window.

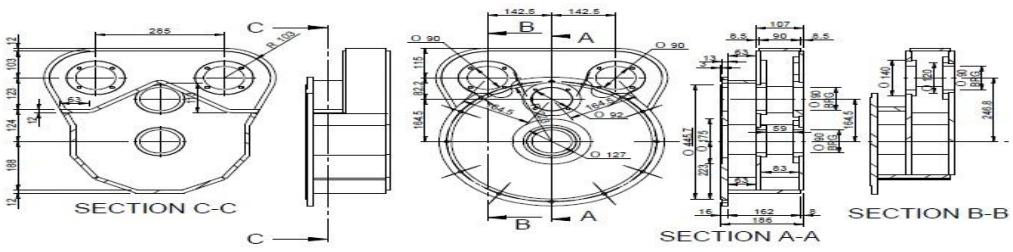

Figure 3 Detail of view of Traction Gearbox Housing

- Use color to identify components groups. Using attributes, find components in specific subsystems or from specific vendors and color-code them in named representations.

Using part features creates all components of Traction Gearbox Housing (ESP-05). All assemblies are created using various components (part) by constrained there relative motion.

Final model of Traction Gearbox Housing (ESP-05) by assembling above all sub-assemblies.

All sub-assemblies and assembly is shown in the following section.

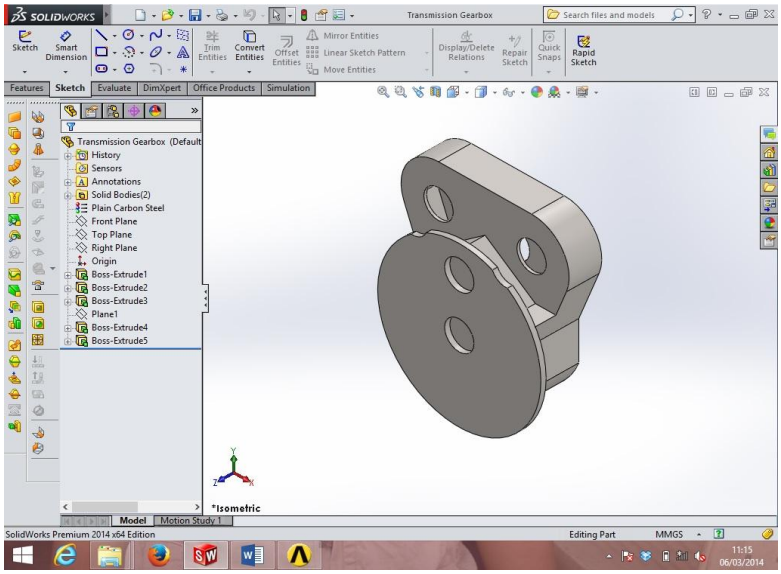

Figure 4 3D Model of Traction Gearbox Housing

TRACTION GEARBOX HOUSING (ESP-05)

Figure 5 Real Snap of Traction Gearbox Housing (ESP-05)

Figure 6 Traction Gearbox Housing (ESP-05) in Welding Process

As shown Figure 5 and 6 real snap of Traction Gearbox Housing (ESP-05) which made by different M.S plate which having thickness 8.5mm. Company is made Traction Gearbox Housing by cutting different M.S. plate on shaping machine and it was arranged such shape of different gear on Gearbox then it was welded.

III. THERMAL STRESS ANALYSIS OF TRACTION GEARBOX HOUSING (ESP-05)

ANALYSIS OF GEARBOX HOUSING

BASIC STEPS OF FEA ANALYSIS

(1) Pre-processing: defining the problem

The major steps in pre-processing are

(i) Define key points/lines/areas/volumes,

(ii) Define element type and material/geometric properties,

(iii) Mesh lines/areas/ volumes as required. The amount of detail required will depend on the dimensionality of the analysis, i.e., 1D, 2D, axisymmetric, and 3D.

(2) Solution: assigning loads, constraints, and solving

Here, it is necessary to specify the loads (point or pressure), constraints (translational and rotational), and finally solve the resulting set of equations.

(3) Post processing: further processing and viewing of the results

In this stage one may wish to see

(i) Lists of nodal displacements,

(ii) Element forces and moments,

(iii) Deflection plots, and

(iv) Stress contour diagrams or temperature maps.

STEP-1 PRE-PROCESSING

1) First Prepare Assembly in Solidworks 2011 and Save as this assembly as .IGES for Exporting into Ansys Workbench Environment. Import .IGES Model in ANSYS Workbench Simulation Module.

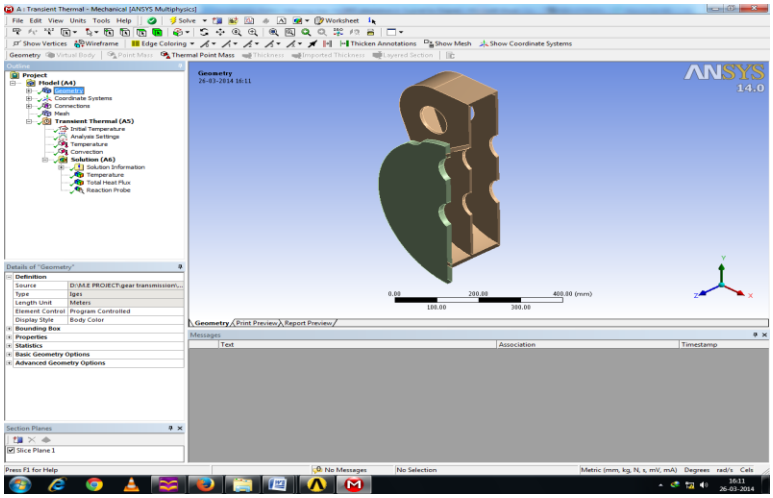

Figure 7Geometry of Gear Box Housing using thermal analysis

2) Check the Geometry for Meshing.
3) Apply Material for Each Component.
4) Create fine mesh.
No. of Nodes: - 314329
No. of Elements: - 158559

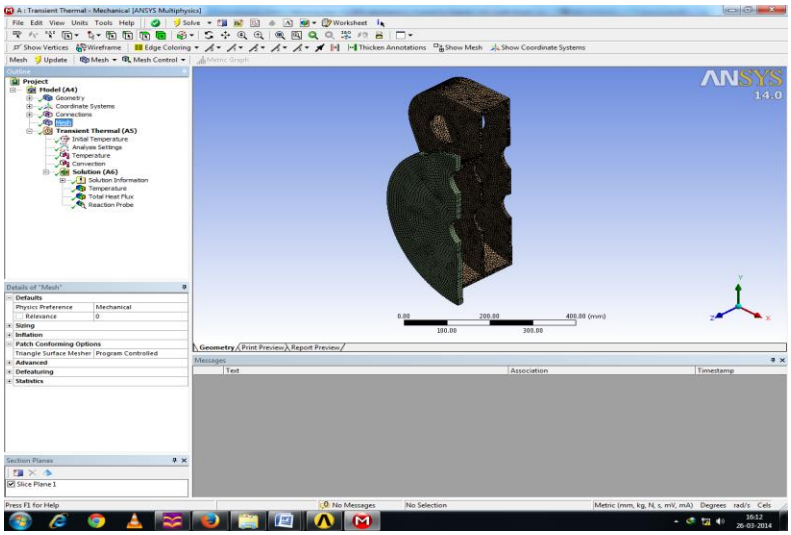

Figure 8 Meshing of Gearbox Housing using thermal analysis

5) Define Boundary condition

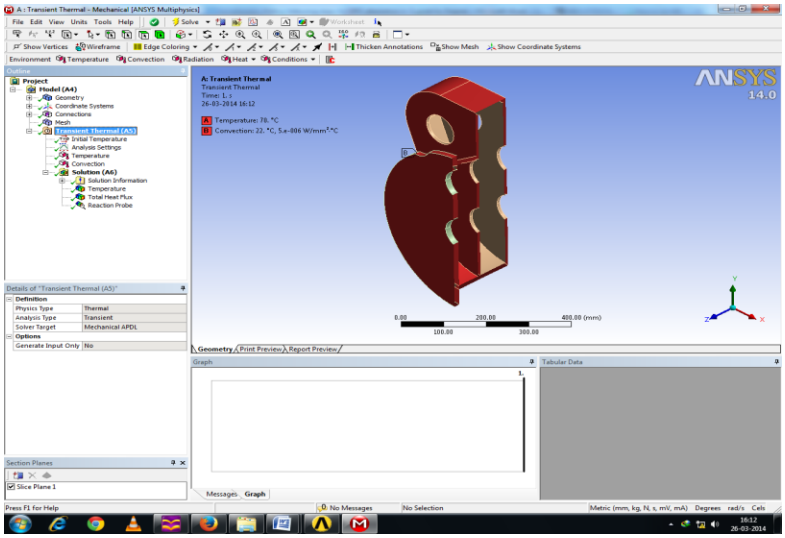

Figure 9 Boundary condition of Gearbox Housing using thermal analysis

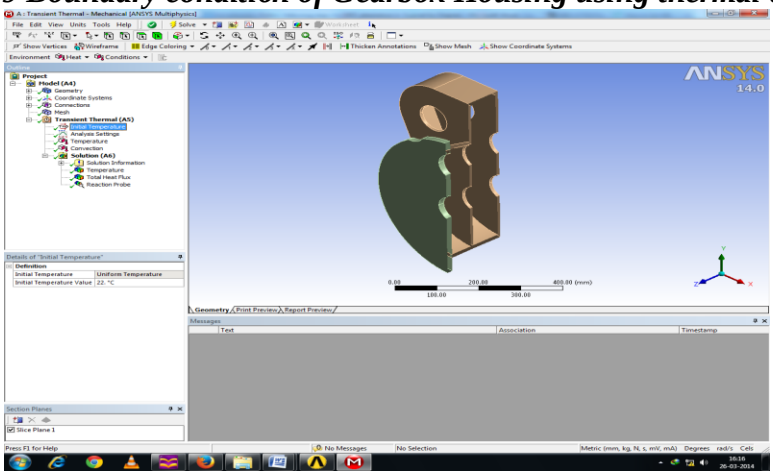

Figure 10 Initial temperature of Gearbox Housing using thermal analysis

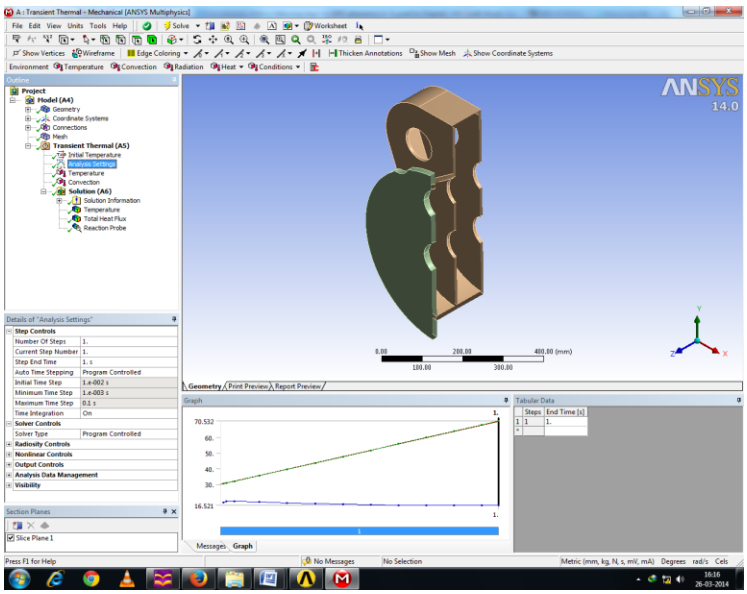

Figure 11 Analysis setting of Gearbox Housing using thermal analysis

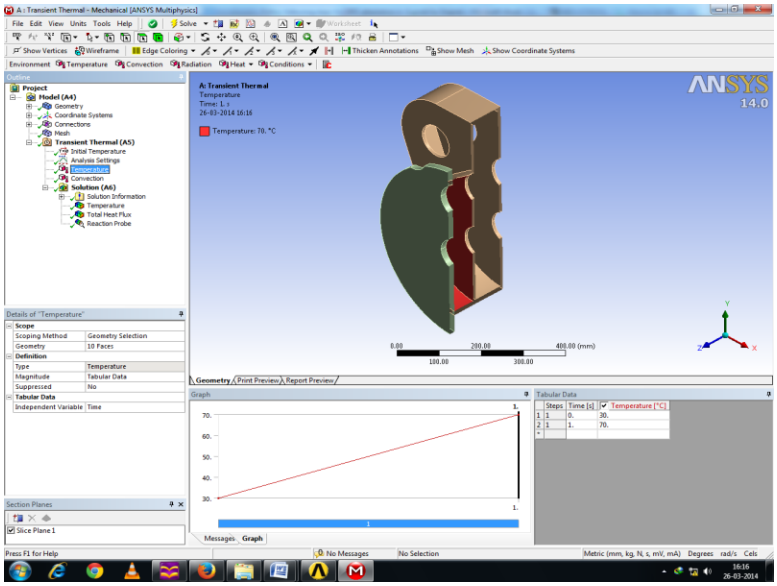

Figure 12 Detail of boundary condition-1 of Gearbox Housing using thermal analysis

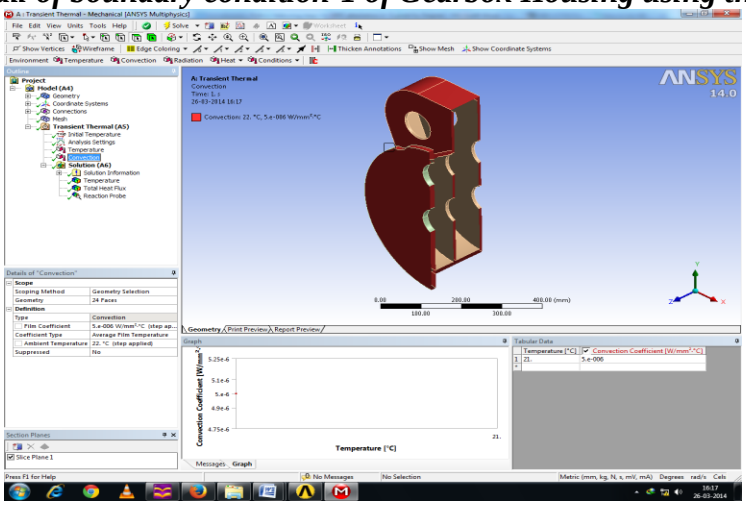

Figure 13 Detail of boundary condition-2 of Gearbox Housing using thermal analysis

Results of Analysis

Temperature distribution with respect to time in transient thermal analysis

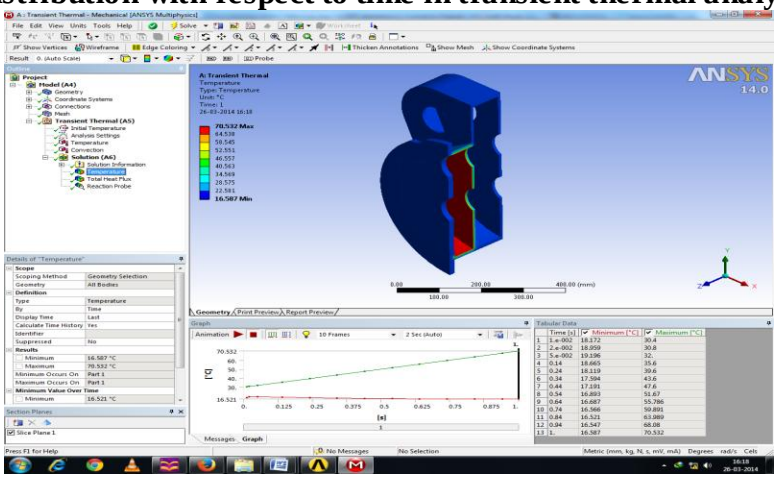

Figure 14 Temperature distribution with respect to time in transient thermal analysis of Gearbox Housing

Total heat flux with respect to time in transient thermal analysis

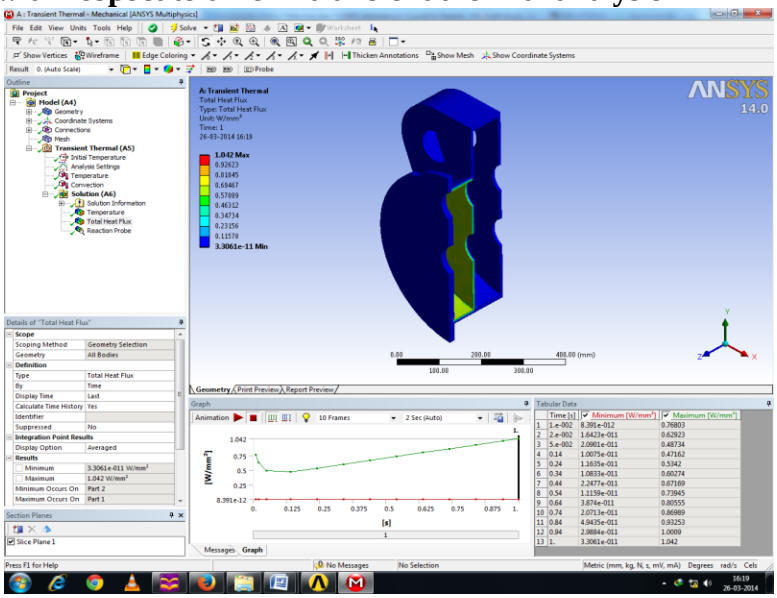

Figure 15 Total heat flux with respect to time in transient thermal analysis of Gearbox Housing

Reaction probe with respect to time in transient thermal analysis

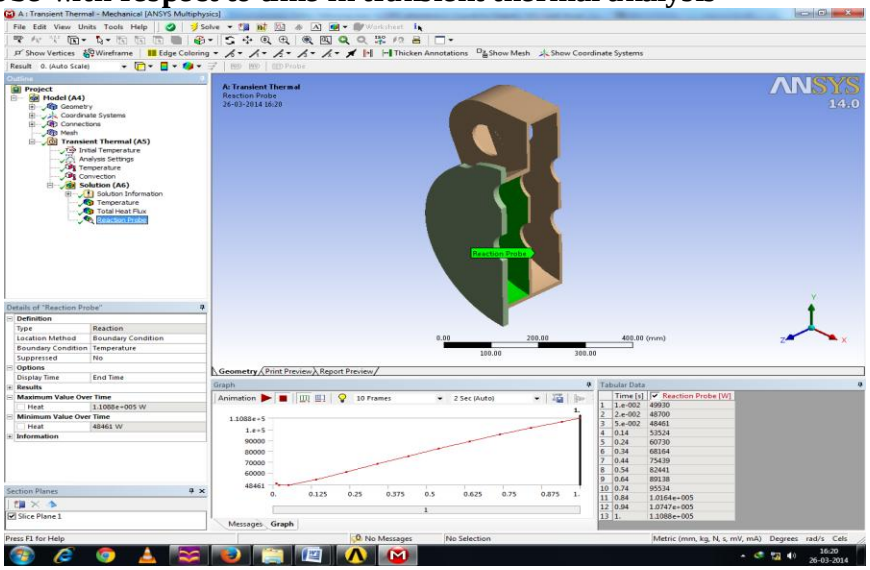

Figure 16 Reaction probe with respect to time in transient thermal analysis of Gearbox Housing

IV. CONCLUSION

In this study, the responses of Paver Machine are determined under static and thermal, input parameter identified.

From the results obtained in the analysis, the following can be concluded:

- To study basic application and specification of Paver Machine.
- To identified problem in gear box of Paver Machine such as interference of gear and overheating of oil which used for smooth running of gears.
- To represent CAD model of gearbox housing.
- To stimulate thermal analysis of gearbox housing in 1second time and check result such like temperature, temperature flux etc.

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