International Journal of Advanced Technology in Engineering and Science www.ijates.com
Volume No.03, Issue No. 01, January 2015 ISSN (online): 2348 – 7550

DESIGN AND ANALYSIS OF CONNECTING ROD USING DIFFERENT MATERIALS

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ABSTRACT

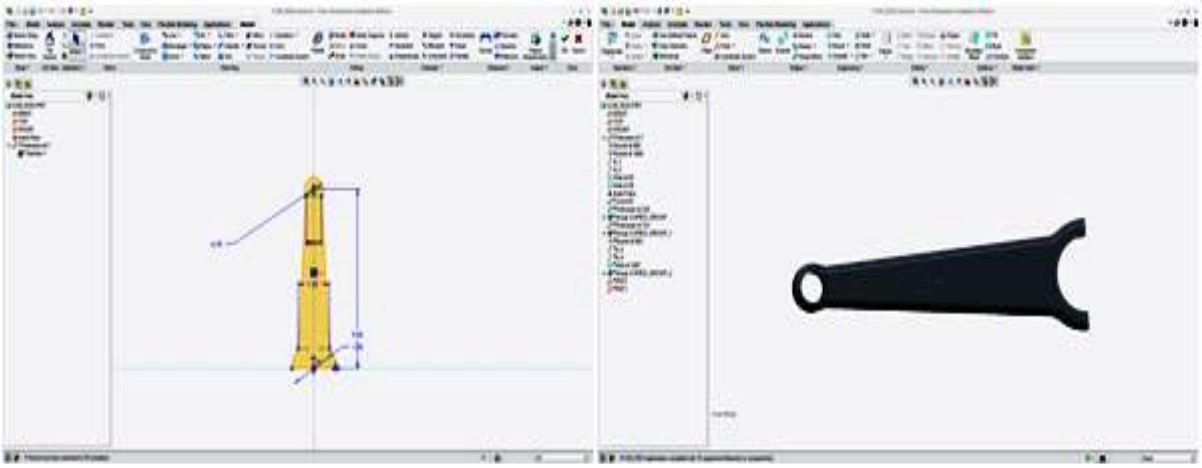
The automobile engine connecting rod is a high volume production vital element. Every vehicle that uses an internal combustion engine requires at least one connecting rod .From the viewpoint of functionality, connects the rods must have the maximum possible rigidity at the less weight. The major stress induced in the connecting rod is a combination of axial and bending stress in process. The axial stresses are caused due to cylinder gas stress and the inertia force arising in account is due to reciprocal action (both tensile as well as compressed), where as bowing stresses are occured due to the diffusive effects. The result of which is, the maximal stresses are developed at the fillet section of the big and the small end.

I. INTRODUCTION TO CONNECTING ROD

The notational link between rods that function in internal combustion engines are exposed to high cyclic loads consists of influential tensile and abridge loads. They must be capable of transmitting axial tension and abridge loads, as well as assist bending stresses caused by the thrust and pull on the piston and by the centrifugal force of the rotating crankshaft. The Figure presents schematic illustrations of a connecting rod and its location and function in an engine.

II. PROBLEM STATEMENT

The design of the Connecting rod starts with the definition of the connecting rod geometry using 3D CAD program. This 3D CAD competitive model is then carried to FEA software programand analyses under the forecast service conditions before anything is made. That steps up the model and testing process, and reduces the lead time to create new Connecting rod designs, and produces a better output. The idea behind finite analysis is to divide a model into a constant finite number of elements. The system software generates and forecasts the complete stiffness of the total rod. evaluating the data is possible forecast how the connecting rod will behave in a real loading condition and allows the engineer to see where the stresses and how the connecting rod will behave for loading condition. The mathematical model of optimization is entrenched firstly, and the FEA is carried out by using the ANSYS programmable software. Based on the analysis of optimal result, the stress concentrates on the model has become evaluate, which provides a better hint for rebuilt of connecting rod.



Analysis of Connecting Rod

MATERIAL ALUMINUM ALLOY

Model > Geometry > Figure

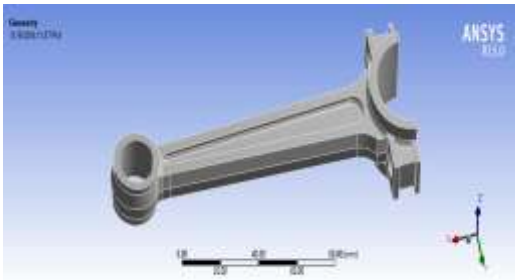


Figure: 1 Geometry Model of Connecting Rod

Model > Geometry

Mesh

Model > Mesh > Figure

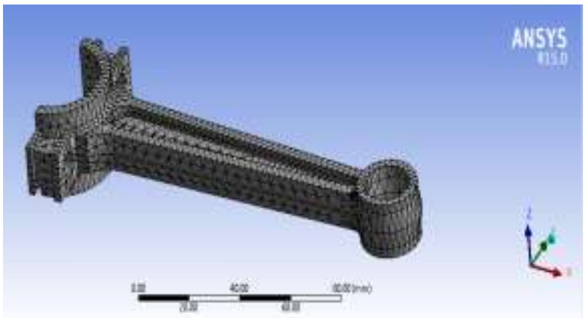


Figure: 2 Meshed Model of Connecting Rod

Model> Static Structural> Force

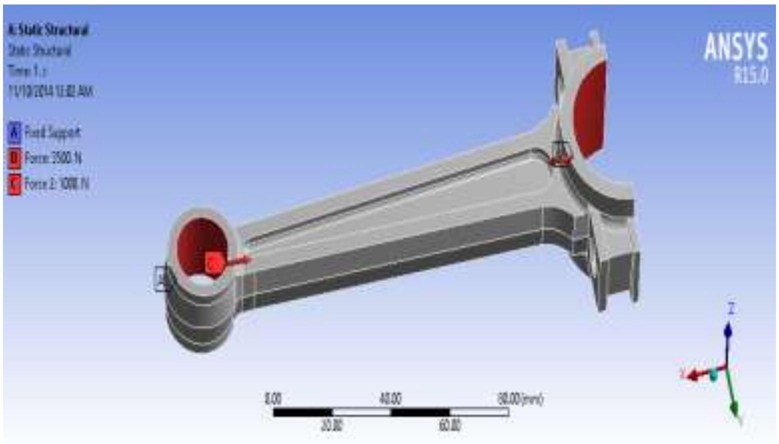


Figure: 3 Loading condition

Model (A4) > Static Structural (A5) > Loads

Model> Solution> Total Deformation > Figure

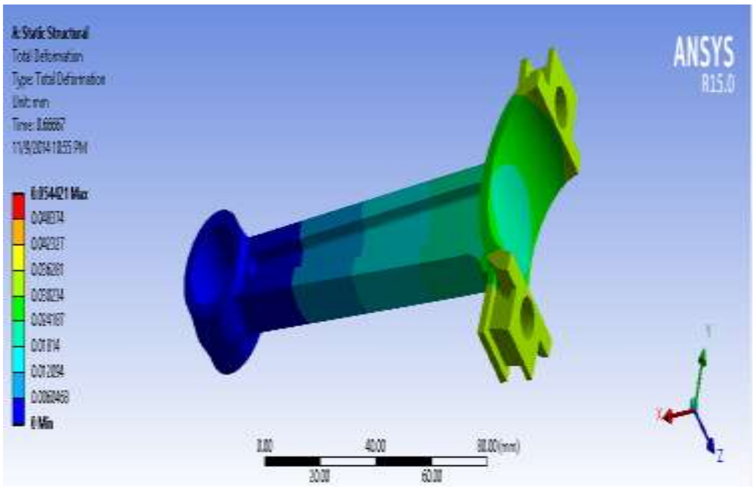


Figure: 4 Total Deformation on the connecting rod

Model> Solution> Equivalent Elastic Strain > Figure

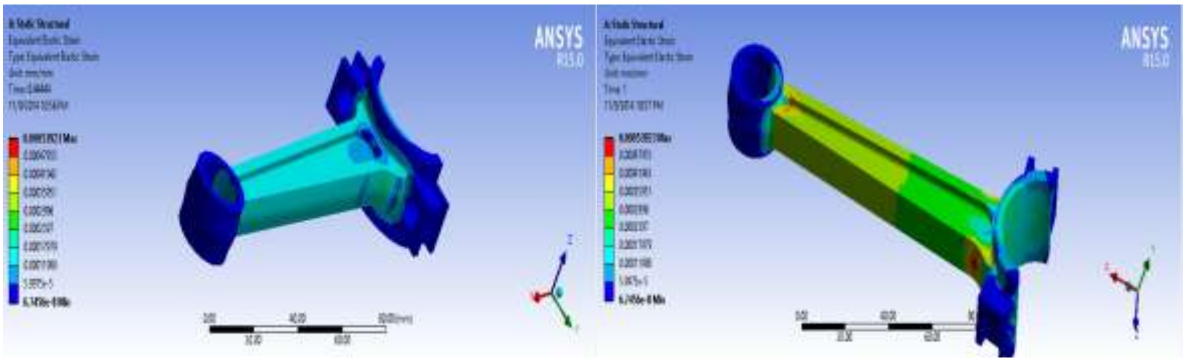


Figure: 5 Equivalent Elastic Strain on the Connecting Rod

Model> Solution> Equivalent Stress> Figure

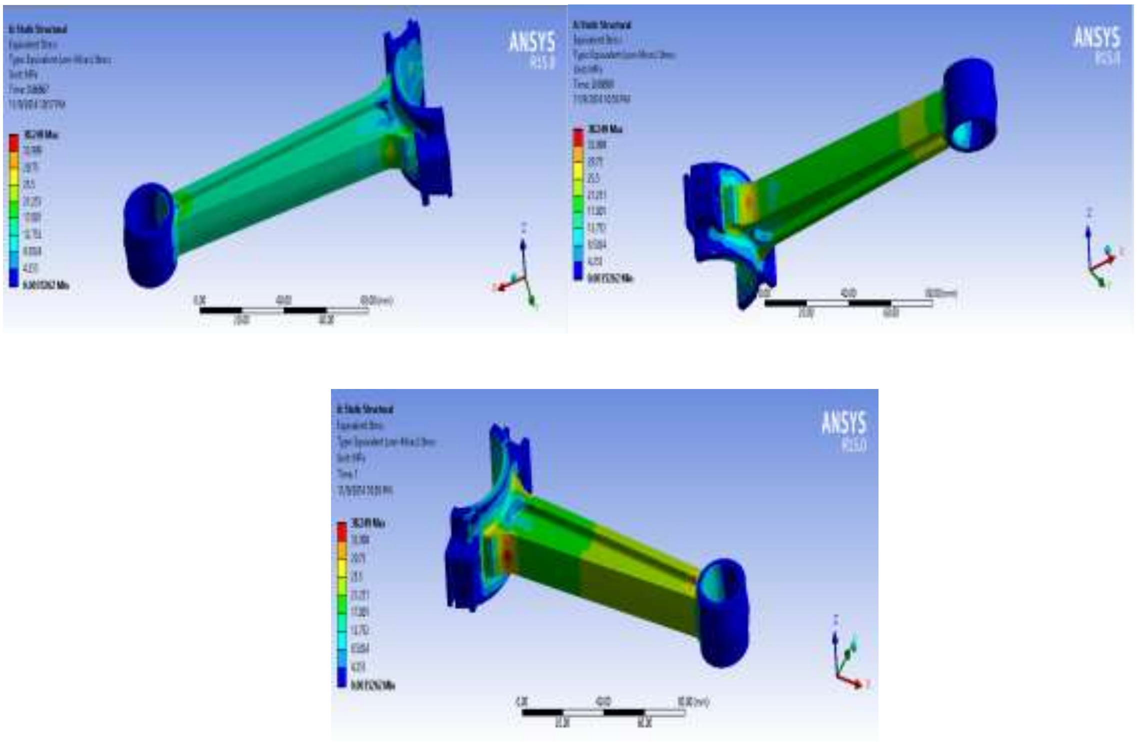


Fig: 6 Equivalent Stresses on the Connecting Rod

Material Data

Aluminum Alloy

TABLE 1

Aluminum Alloy > Constants

Density	2.77e-006 kg mm^-3
Coefficient of Thermal Expansion	2.3e-005 C^-1
Specific Heat	8.75e+005 mJ kg^-1 C^-1

TABLE 2

Aluminum Alloy > Compressive Ultimate Strength

Compressive Ultimate Strength MPa
0

TABLE 3

Aluminum Alloy > Compressive Yield Strength

Compressive Yield Strength MPa
280

TABLE 4

Aluminum Alloy > Tensile Yield Strength

Tensile Yield Strength MPa
280

TABLE 5

Aluminum Alloy > Tensile Ultimate Strength

Tensile Ultimate Strength MPa
310

Case II: material Titanium Alloy

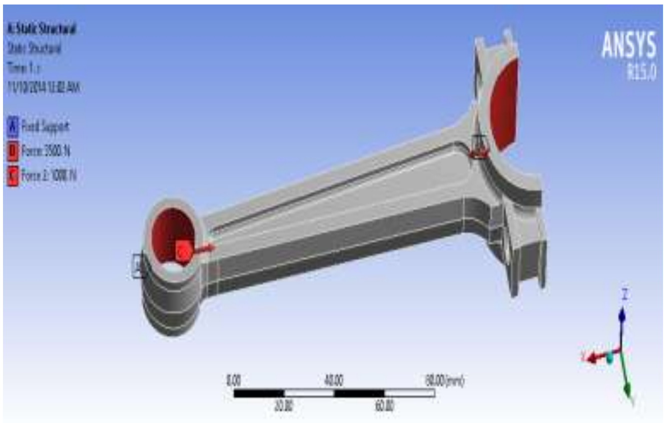
TABLE 6

Model> material

Material	
Assignment	Titanium Alloy
Nonlinear Effects	Yes
Thermal Strain Effects	Yes
Bounding Box	
Length X	159. mm
Length Y	60. mm
Length Z	28. mm
Properties	
Volume	32904 mm³
Mass	0.15202 kg
Centroid X	64.431 mm
Centroid Y	5.5004e-003 mm
Centroid Z	1.0703e-003 mm
Moment of Inertia Ip1	20.637 kg·mm²
Moment of Inertia Ip2	365.1 kg·mm²
Moment of Inertia Ip3	378.66 kg·mm²
Statistics	
Nodes	17822
Elements	9898

Temperature ^{0}C	Young's Modulus MPa	Poisson's Ratio	Bulk Modulus MPa	Shear Modulus MPa
22	96000	0.36	1.1429e+005	35294

Model> Static Structural> Force

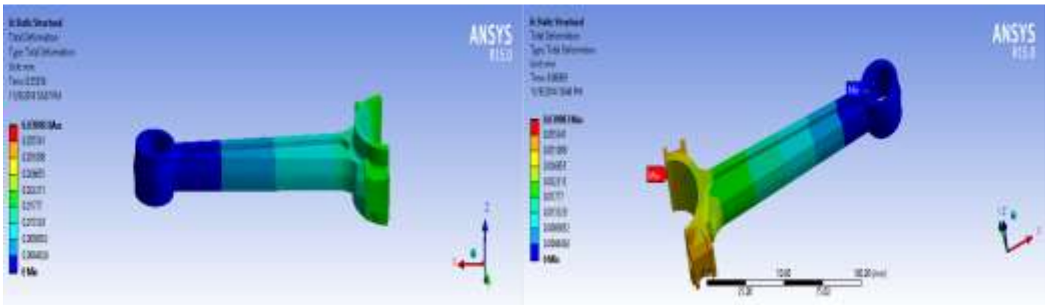


Loading Condition

Model > Static Structural> Loads

Definition			
Type	Fixed Support	Force	
Suppressed	No		
Define By		Vector	
Magnitude		3500. N (ramped)	1000. N (ramped)
Direction		Defined	

Model> Static Structural> Solution> Total Deformation > Figure



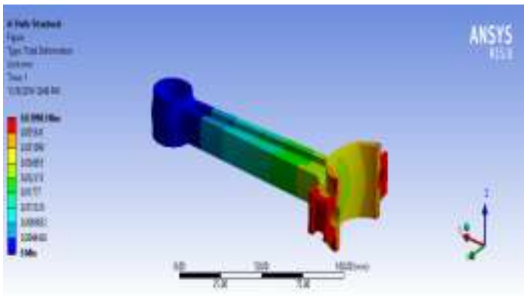


Figure: 7 Total Deformation on the connecting rod

Model> Static Structural> Solution > Equivalent Elastic strain >Figur

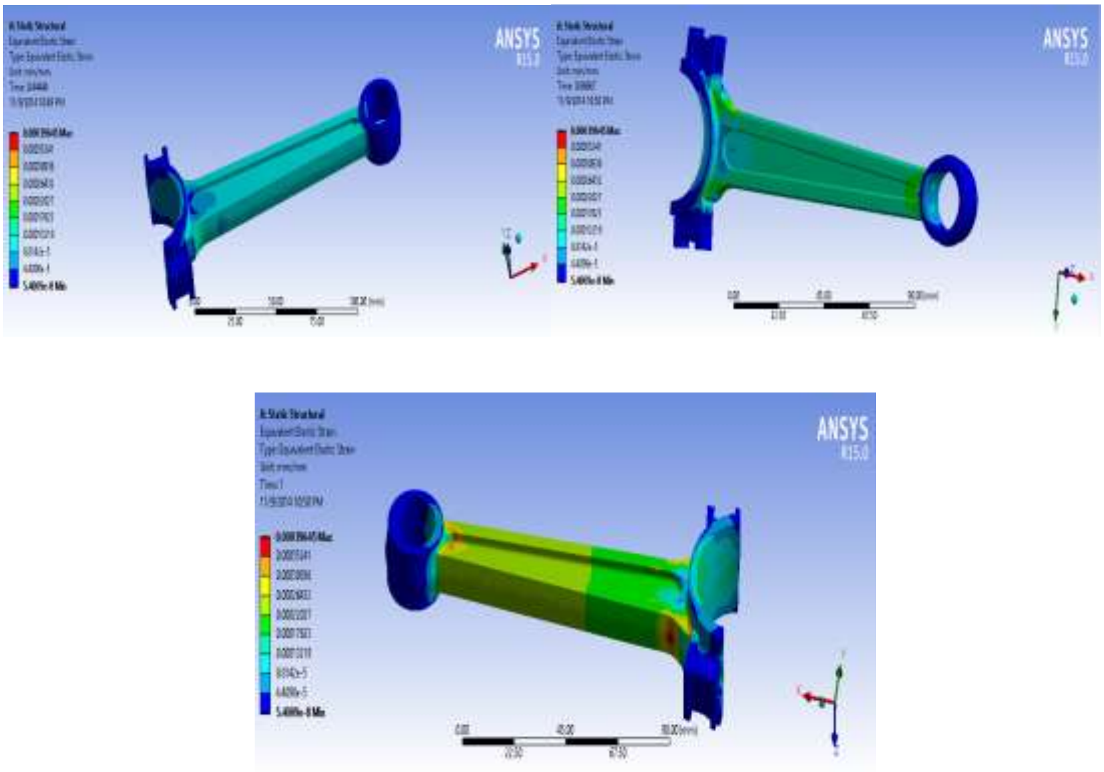
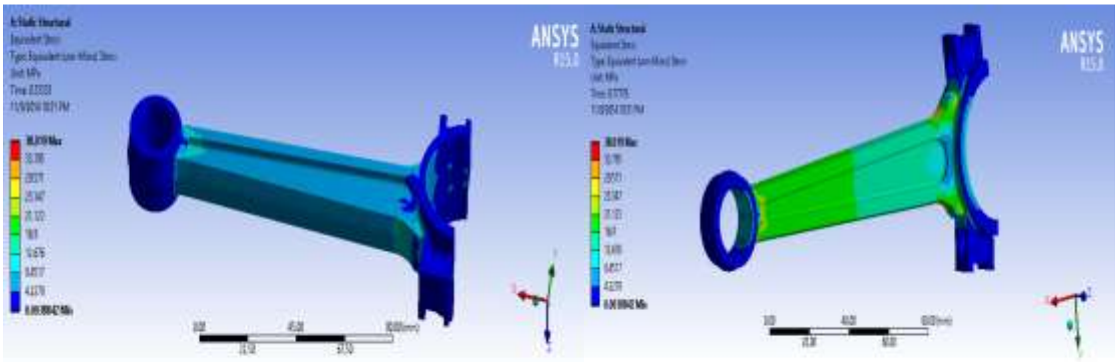


Fig: 8 Equivalent Elastic Strain on the Connecting Rod

Model> Static Structural > Solution > Equivalent Stress > Figure



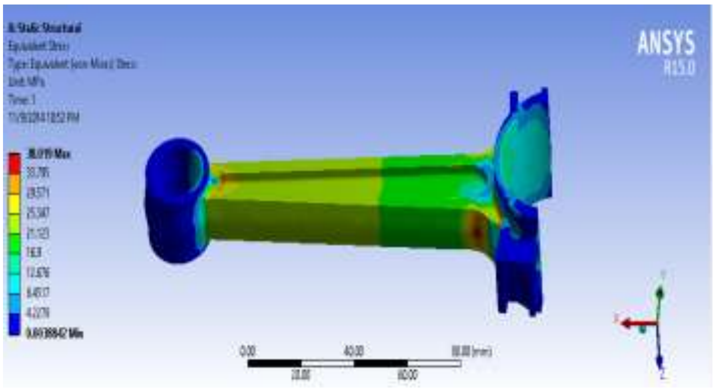


Figure: 9Equivalent Stress on the connecting rod

TABLE 7

Model > Static Structural> Solution > Results

Type	Total Deformation	Equivalent Elastic Strain	Equivalent (von-Mises) Stress
Results			
Minimum	0. mm	5.4009e-008 mm/mm	3.8842e-003 MPa
Maximum	3.9983e-002 mm	3.9645e-004 mm/mm	38.019 MPa
Minimum Value Over Time			
Minimum	0. mm	5.4009e-008 mm/mm	3.8842e-003 MPa
Maximum	0. mm	5.4009e-008 mm/mm	3.8842e-003 MPa
Maximum Value Over Time			
Minimum	3.9983e-002 mm	3.9645e-004 mm/mm	38.019 MPa
Maximum	3.9983e-002 mm	3.9645e-004 mm/mm	38.019 MPa

Material Data

Titanium Alloy

III. CONCLUSION

In our project we have designed a connecting rod and modeled in 3D modeling software CRE2and then we analyze the connecting rod with different materials like Aluminum Alloy and Titanium Alloy with help of fem. In this Project we describe the stress distribution of the connecting rod by using FEA. The finite element analysis is performed by using computer aided design (CAD) software.

Material	Equivalent (von-Mises) Stress	Deformation	Mass
Titanium Alloy	38.019 MPa	3.9983e-002 mm	0.15202 kg
Aluminum Alloy	38.249 MPa	5.4421e-002 mm	0.091145 kg

By comparing about loading conditions and results we can choose any material as a connecting rod material. Both are give almost comparable same results, here we can choose Aluminum as Connecting rod material because “Titanium has better mechanical properties than aluminum, at the expense of higher density and cost. This higher density and cost have made aluminum connecting rods more

REFERENCES

[1] Afzal, A., P. Shenoy, and A. Fatemi, Durability and Optimization of ConnectingRods, G.D.i.S. Seminar, 2004, Livonia, MI.

[2] Al-Hassan, A., Y. and D.R. Hill, Islamic Technology. 1994, New York:Cambridge University Press.

[3] Hill, D.R., Islamic Science and Engineering. 1993, Edinburgh: EdinburghUniveristy Press.

[4] Gille, B., The Problems of Power and Mechanization, in A History of Technology and Invention, M. Daumas, Editor. 1969, Crown Publishers, Inc: New York. p.446-47.

[5] Gille, B., The Growth of Mechanization, in A History of Technology andInvention, M. Daumas, Editor. 1969, Crown Publishers Inc: New York. p. 42-45.

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