

# PARAMETRIC DESIGNING OF AISI 8620 STEEL CONNECTING ROD AND OPTIMUM ANALYSIS

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## Abstract

Connecting rod is a common link between the piston and the crank shaft. The important function of the connecting rod is to transmit the required thrust force from the piston pin to crank pin, by converting the most reciprocating motion of the piston to rotary motion of the crank shaft. Generally, mass production of connecting rods are made using carbon steel and in advancement aluminium alloys are used for manufacture of the connecting rods. In this work the connecting rod material is replaced by AISI 8620 steel. The parametric modelling and analysis of connecting rod is also described. Finite element analysis was carried out by considering AISI 8620 steel. In this paper a solid 3D model of connecting rod was designed using PRO-E latest software and an analysis was carried out by using ANSYS R 15 Software and factors like von mises stress, von mises strain and displacement were found out.

**Key Words:** Ansys 10.0, FE Analysis, Connecting Rod, Pro-E 4.0, Von Mises Stress and Strain.

## 1 INTRODUCTION

Internal Combustion (I.C.) engine consists of cylinder, piston, connecting rod, crank and crank shaft. The Connecting Rod is the major part of an engine. The work is to transmit the thrust of piston from piston pin generated by the burnt gas pressure to the other part of engine called Crank via crank pin. It has two ends one is called small or piston end and other one is big or crank end. The big end is joint with crank or crank shaft by crank pin and small end is joint with piston by piston pin. It helps the rotating motion to the crank shaft by converting the reciprocating motion of piston into rotating motion. The connecting rod should be such that which can be withstand the maximum load without any failure during fatigue operation. The fracture toughness should not go below a certain minimum limit. Also the connecting rod should not buckle during operation. These requirements are important and are used to select an appropriate cross section and material for manufacture [3]. The connecting rod has a long shank, a small end and a big end. The cross-section of the shank may be taken as rectangular, circular, tubular, I-section or H-section. It is observed that circular section is used for low speed engines and I-section is used for high speed engines [6]. During research it has been noted that during reciprocating motion of the piston a wear of cylinder wall occurs, which is because of sideways force of piston acting on cylinder wall and results in an oval cross-section rather than being circular. Due to which piston rings lose their closeness to the cylinder wall and are failed to seal the cylinder. Geometrically, it can be seen that longer connecting rods will reduce the amount of this sideways force, and therefore may increase the engine life [5]. A connecting rod is one of the most mechanically stressed components in internal combustion engines. There are different types of stresses induced in connecting rod are viewed. The axial stress induced by cylinder gas pressure (compressive only) and second one is bending stress caused by centrifugal action and third one is inertial force generated by reciprocation of piston [11]. Then, vehicle construction led the invention and implementation of quite new materials which are light and meet design requirements. There are many materials which can be used in connecting rod for optimization. In modern automotive internal combustion engines, the connecting

rods are most usually made of steel for production engines, but can be made of aluminium (for reducing the weight and the ability of absorbing high impact at the expense of durability) or titanium (for a high performance engines) or of cast iron for applications such as motor scooters. In this study three materials Al360, Beryllium alloy 25 and Magnesium alloy have considered for analysis. Tukaram S. Sarkate et al [3], (2013) carried out an analysis to find out an optimum material for connecting rod. The results obtain by FEA for both Aluminium 7068 alloy and AISI 4340 alloy steel are satisfactory for all possible loading conditions. Kuldeep B. et al [4], (2013) described in the study that Weight can be reduced by changing the material of the current Al360 connecting rod to hybrid AlSiC composite. Leela Krishna Vegi, Venu Gopal Vegi [5], (2013), demonstrated that the factor of safety (from Soderbergs), stiffness of forged steel is more than the existing carbon steel found and The weight of the forged steel material is less than the existing carbon steel and reported that by using fatigue analysis life time of the connecting rod can be determined. B. Anusha et al [6] (2013), clarified in the paper and concluded that the stress induced in the structural steel is less than the cast iron for the present investigation. Pushpendra kumar Sharma et al [9] (2012), performed the static FEA of the connecting rod using the software and took the advantages of using crackable forged steel (C70) in place of current forging steel for reducing weight of connecting rod. And the software gives a view of stress distribution in the whole connecting rod which gives the information that which parts are to be hardened or given attention during manufacturing stage. Ram bansal [8] et al, in the paper a dynamic analysis was performed on a connecting rod made of aluminium alloy using FEA. The analysis was performed under dynamic to determine the in service loading of the connecting rod and FEA was conducted to find the stress at critical points.

## 2 PROBLEM FORMULATION

The objective of the present study is to design and analysis of two wheeler connecting rod and to find the best alternative material of connecting rod. In the present study AISI 8620 steel have taken in place of currently using materials like aluminium 360 for CAE

analysis for choosing and evaluating the material using for manufacture the connecting rod of single cylinder 4 stroke combustion engines. In this work, an analysis is done for AISI 8620 steel. AISI 8620 steel feature high fatigue strength and resistance to wear, corrosion, galling, and stress relaxation.

### 3 PROPERTIES OF MATERIALS

MATERIAL	DENSITY (Kg/m <sup>3</sup> )	YOUNG'S MODULUS(Gpa)	POISON RATIO
AISI 8620 steel	2800	70	0.34

### 4 ANALYSIS OF CONNECTING ROD

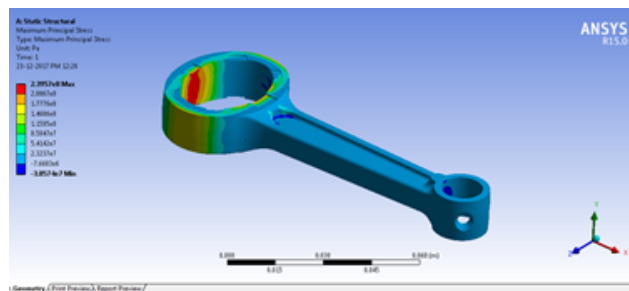


Figure 1: Elastic strain in connecting rod using AISI 8620 Steel

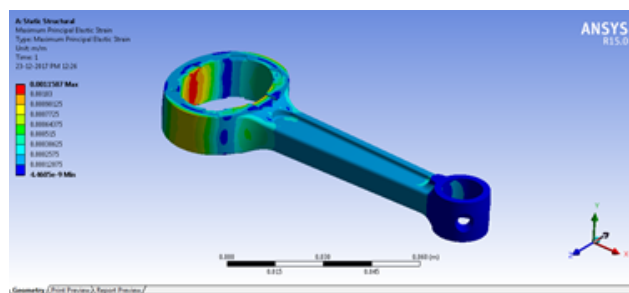


Figure 2: Maximum principal stress in connecting rod using AISI 8620 Steel

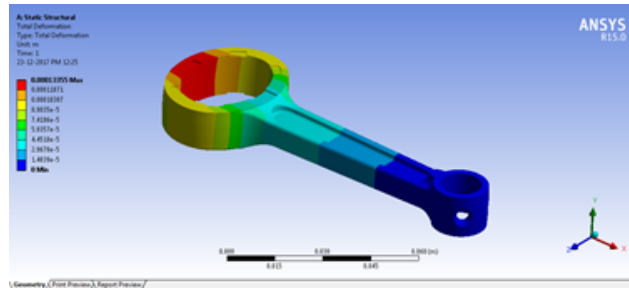


Figure 3: Maximum principal strain in connecting rod using AISI 8620 Steel

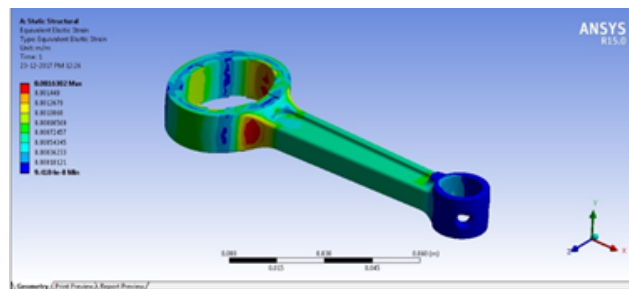


Figure 4: Total deformation in connecting rod using AISI 8620 Steel

## 5 RESULT AND DISCUSSION

It is evident from the Fig.1 that the elastic strain occurs at the piston end of the connecting rod is  $0.016E8$  Mpa. It is also evident from the Fig.2 that the maximum principal stress occurs at the piston end of the connecting rod is  $2.395E-8$ . It is noticeable from the Fig.3 that the maximum principal strain occurs at the piston end of the connecting rod is  $0.1629E-2$ . It is cleared from the Fig.4 that the total deformation occurs at the crank end of the connecting rod is  $0.011E-9$  for AISI 8620 steel.

## 6 CONCLUSIONS

By checking the above results it has been noticed that AISI 8620 steel is the best suitable material for connecting rod of two wheeler

vehicle. In the present study, the prime concern is to find the best suitable material for connecting rod. It is noteworthy that the economic aspect has not been incorporated in the present study. In the view of above discussion, following conclusion can be made.

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