ISSN : 2455-9679
Impact Factor : 3.805

IJRTSM

INTERNATIONAL JOURNAL OF RECENT TECHNOLOGY SCIENCE & MANAGEMENT

# "IC ENGINE CONNECTING ROD: A REVIEW"

***Manish khursange [1], Prof. Ranjeet Kumar [2], Dr. R. S. Shikarwar [3]***

[1 1]*M. Tech. Scholar, Department of Mechanical Engineering, Vaishnavi Institute of Technology & Science Bhopal, MP, India*

[2] *Assistant Professor, Department of Mechanical Engineering, Vaishnavi Institute of Technology & Science Bhopal, MP, India*

[3]*Professor, Department of Mechanical Engineering, Vaishnavi Institute of Technology & Science Bhopal, MP, India*

## ABSTRACT

***Connecting rod is an intermediate link which connects the piston and the crankshaft in an internal combustion engine, the main work of connecting rod is to convert the linear motion of the piston (thrust force) into rotary motion of the crankshaft. Here the materials are highly compared to their previous materials which are used in these components. This study deals with the various loads which are acting on these different-different components on their main loading sections. The objectives of this paper are to study costs and materials optimization with the help of thermal stress analysis by FEA technique.***

***Key Words:*** *Connecting rod, Thermal stresses, Finite Element Analysis (FEA), Optimizations, Combustion engine.*

## I. INTRODUCTION

It contains an upper forked portion which is assembled at the crosshead bearings and the lower part assembled at the lower side i.e. crankpin bearing. With this scarcely blueprint there is seriously overpowering center point stacking on the associating bar which achieves its top at the upper perfect considering the way that the gas pressure and the inertial forces encourage to expand the overall force. Other whimsical working conditions, for example, chamber seizure and passing enlargement in pinnacle weight can withal achieve astringent expansion in highlight on the con-pole and it could bomb because of attaching because of these forces. Unremarkably associating bars are produce made and the material utilized is reliably sensitive and medium carbon steel. The terminuses where the con bar is joined with the X-head or crankpin having course which are produced of white metal working surface and shims (think pressing) are adjusted to reveal the necessary upgrades. There are four stuns at every association point which advantage for get together and impression of the interfacing bar, and are fixed to their necessary force using water driven jack.deflection in connecting rod.

ISSN : 2455-9679
Impact Factor : 3.805


**Figure.1 Two wheeler connecting rod**

## II. LITERATURE REVIEW

The interfacing poles introduced to a stunning condition of stacking. It experiences high cyclic various the sales of $10^8$ to $10^9$ cycles, which assortment from incredible compressive weights considering devouring, to over the top flexible hundreds due to inaction. Along these lines, toughness of this issue is of key centrality. Because of those sections, the interfacing bar has been the subject of concentrates for unequivocal parts sweeping of creation period, materials, execution generation, weakness and different others. For the current day see, it wound up basic to explore limited detail displaying system, update structures, and affinities underway period, new substances, inadequacy appearing and assembling respect evaluation. These short synthesis chart decisions a part of these viewpoints.

**Webster et al. [1983]** performed three dimensional limited component investigation of a fast diesel engine interfacing pole. For this investigation they used the best compressive weight which was evaluated likely, and the most extraordinary manageable weight which is fundamentally the dormancy stack of the cylinder get together mass. The store disseminations on the cylinder stick end and wrench end were settled likely. They showed the interfacing pole top freely, and besides showed the shock guarantee using bar components and multi point confinement conditions.[1]

**Repgen [1998]** reliant on shortcoming tests did on undefined sections made of powder metal and c-70 steel (split part steel), in this paper he makes the exhaustion quality out of the made steel part is 21% higher than the powder metal portion and using the break part advancement achieves a 25% cost decline over the conventional steel delivering process. [2]

**Shenoy et. al. [2005]** did dynamic assessment and progress of interfacing bar. The dynamic assessment was done keeping cost and weight decay boundaries as key center centers.[ 3]

**Pravardhan S.Shenoy et. al [2005]** They completed the dynamic burden investigation and enhancement of associating pole. The primary target of this investigation was to investigate weight and cost decrease open doors for a creation produced steel interfacing bar. Change in the material, bringing about a critical decrease in machining cost. The basic variables considered for weight decrease during the advancement incorporate the clasping load factor, worries under the heaps, bowing firmness, and hub solidness. Cost decrease is accomplished by utilizing C-70 steel. It dispenses with sawing and machining of the bar and accepted to decrease the creation cost by 25%. [4]

**Dr. N. A. Wankhade et. al. [2006]** The interfacing pole is planned in Catia. To examinations the twisting pressure utilizing Ansys on every material. To plot the outcomes for twisting pressure following up on Structural steel, Al7075, Al6061 and high quality carbon fiber and contrasting this and bowing pressure following up on materials. The interfacing bar of high quality carbon fiber endures lesser and subsequently can be most appropriate for associating pole of diesel engine.[5]

**DR.B.K. Royet et. al [2012]** , In this examination paper designer DR.B.K. Roy examination the associating pole and streamlining of different boundaries of interfacing pole. The examinations in ANSYS 12.0 workbench. After examination they discover different outcome and contrasted and existing outcome. It has been discovered that the

ISSN : 2455-9679
Impact Factor : 3.805

examination introduced here has thought of better outcomes just as protected structure of associating pole under admissible restrictions of different boundaries and safe stresses.[6]

**Prof. N.P. Doshiet et. al [2013]** , In this exploration paper they select associating bar of TATA engines which as of now propelled in advertise. They examination in ANSYS programming and discovered what number of pressure create in associating pole when applied load.& they additionally found that there is plausibility of further decrease in mass of interfacing rod.[7]

**Christy V Vazhappillyet et. al [2013] ,** The fundamental item to contemplate this examination paper is diminish weight and cost of interfacing bar. This can be accomplished by playing out an itemized load investigation. Decrease in machining activities, accomplished because of progress in material and it's a valuable factor which help in cost decrease. The weakness quality is the most basic factor in the process.in this exploration paper designer configuration interfacing pole and examination under burden go tractable burden similar to different degree wrench edge at the greatest motor speed as one extraordinary burden, and compressive burden closely resembling the pinnacle gas pressure as the other outrageous burden. Additionally, they change material of associating bar the current interfacing bar material can be supplanted with another composite material.[8]

**Venu Gopal Vegi et. al. [2013]** In their paper portray structuring and investigation of an interfacing bar. As of now existing associating poles are made of carbon steel. Limited component investigation is completed on an associating pole made of fashioned steel. The boundaries like Von mises pressure, strain, disfigurement, factor of wellbeing and so forth were determined and discovered that fashioned steel have more factor of security, decreased weight, more noteworthy firmness than carbon steel.[9]

**Kuldeep Bet et. al [2013]** , In this examination paper innovator design new material for produced associating bar supplant by composite material strengthened with silicon carbide and fly debris. After fabricated interfacing bar by this new composite material they look at them and in result is decrease of 43.48% of weight, with 75% decrease in removal. [10]

**Prof. Vivek C. Pathade et. al [2013]** , Here the paper manage pressure examination of associating bar by FEA strategy utilizing ANSYS WORKBENCH 11.0 Software. The y additionally contrast that outcome with exploratory by strategy for photograph elasticity.[11]

**Kumar et. al. [2014]** completed amazing assessment on interfacing pole utilizing Bajaj pulsar (150cc) to diminish the weight and additionally decrease the portrayal of lethargy. They bare essential that 42CrMo steel blend is 11.67 % lighter material stood apart from 20CrMo and 6.42 % lighter when showed up distinctively corresponding to 30CrMo steel.[12]

**Digvijay, Mohd.Ahmad, et. al [2014]** Connecting pole is a halfway connection between cylinder and wrench. it's mindful to communicate the push and pull movement from the cylinder pin and wrench pin. they likewise changing over responding movement of the cylinder to turning movement of the wrench. The fundamental goal of this work is to weight decrease openings in the associating bar of an I. C. motor by analyzing different materials, for example, steel combination, cost Iron, Structural steel. The goal of the current work is to plan and investigations of associating pole made of basic steel. In this venture the material of interfacing pole as a steel amalgam supplanted with auxiliary steel and after examination in ANSYS.[13]

**Sushant, Victor Gambhir et. al, [2014]** In this paper, an associating bar for bikes was structured by diagnostic strategy. With the utilization of FEA von-mises pressure, shear pressure, strain and bowing pressure were calculatedfor a specific stacking conditions with assistance of ANSYS workbench. After examination they discover conclusive outcome and in result they see Aluminum 7068 associating bar was better than Carbon 70 steel interfacing bar as far as von-mises pressure, shear pressure, and bowing worry, with extensive decrease in mass.[14]

**Premkumar et. al [2015]** ,.In this examination paper interfacing bar is supplanted by aluminum based composite material fortified with Boron carbide and additionally done the displaying and investigation of associating bar. [15]

ISSN : 2455-9679
Impact Factor : 3.805

**Puran Singh, et. al [2015] ,**This investigation shows the significance of the arrangement of the interfacing bar large end contortions taking into account the adjustments in the bearing freedom at the most significant variations of the pressure This variation is habitually ignored and show the structure status of associating pole rather is protected or not.[16]

D**nyaneshwar. Et. al [2015]** In today‟s world situation, there is colossal advancement in the field of car and consistently, there is new innovation is shown up to improve out vehicle office. It is discovered that the prize of fuel is developing generally, so every organization is attempting to make the vehicle more eco-friendly and having best quality and solace for the client. Likewise organization may focused on significant truth, administration after deal it is think about spinal code in the field of car. The majority of the organization may spend their half of their salary on innovative work to improve their vehicle. Beforehand this assignment is extravagant without late innovation, for testing and configuration like CAD/CAM and the investigation programming like Ansys programming, the expectation is extremely troublesome about any item. Likewise CFD is assume significant job for the streamlined structuring for the car. Utilizing Different CAD/CAM programming one can plan the item according to the prerequisite, can likewise fabricate effectively on CNC machine. In earlier days, when the item is plan it will be at any rate hardly any years stays in the market .But now a days, in each half year new model will be propelled by the organization due the progression in the car segment. This task work depends on bi-metallic segment utilized in car; there are part numerous bimetallic segments utilized in car application. For this situation, interfacing pole is related to metal shrub at its eye end. It initiates the warm worry in the material to defeat this difficult issue. Henceforth it is proposed that the elective material for bushing.[17]

**Yogesh. B Dupare et. al. [2015]** got the most over the top weight decrease in an interfacing pole, without affecting the vital fundamental parameters.[18]

**Joshi et. al. [2015]** handled the improvement of weight and orchestrating of interfacing pole by considering varying materials such has incredible carbon fiber, treated steel and aluminum composite. They low down that the vonmises worry for carbon fiber is less veered from different materials.[19]

**Bhargav et. al. [2015]** pondered various materials by methods for completing both static and dynamic assessment on an associating pole. It is seen that the von-mises weight and weight of Al-MWCNT (Multi Wall Carbon Nano Tube) are less showed up distinctively according to Ti-6Al-4V, E-glass and carbon steel. [20]

**Taware et. al. [2015]** did FEA assessment of interfacing bar utilized in Hero Splendor motorbike and thought the impact of headway in material from ASTM A216 GR WCB and Aluminum 360, by then the outcomes were examined and accepted that there is less twisting in ASTM A216 GR WCB which assistants in long vigor furthermore it is more affordable.[21]

**Mahipal Manda el. al. [2017]** Connecting bar is a basic bit of the engine one of a kind structure, it isn't just a transmission section yet similarly moving part, in the interim it must withstand variable weight, for example, adaptable, compressive power and turning in the working philosophy. In that capacity, exceptional attributes consider on the interfacing pole has changed into a basic piece of structure. Isolated assessment is a successful technique to pick vibration mode shapes and powerless pieces of the complex mechanical framework. In this assessment, a specific assessment was related with an interfacing bar by ANSYS programming at three basic working conditions, for example, most preposterous moldable furthermore, compressive on little end, and adaptable of top finish of associating pole, the focal clarification behind assessment is to perceive the model boundaries of interfacing rod.[22]

**Achyut Chauhan et. al [2017]** In car motor associating bar is a high volume creation, basic component,Connecting bar is the Central connection between the cylinder and the crank.We all realize that the motivation behind the interfacing bar is to move the responding movement of the cylinder into rotational movement of the driving rod. &transmitting the push of the cylinder to the driving rod. Each vehicle that utilizes an interior burning motor. They require at any rate one associating pole and no of interfacing bar contingent on the quantity of chambers in the motor. Interfacing poles are primarily made by manufacturing from either fashioned steel or powdered metal. They could likewise be projected. At any rate, castings could have blow openings which are inconvenient from solidness and weakness perspectives. The

ISSN : 2455-9679
Impact Factor : 3.805

reality of forgings, it's produce blow-opening free and better poles gives them a preferred position over cast poles. some year prior associating bars are produced utilizing carbon steel and lately aluminum compounds are discovering its application in interfacing bar, since Carbon steel as an interfacing pole material is less solid and having more weight than aluminum. In this examination an endeavor is made to locate the best material of interfacing pole and streamlining of associating bar for diminish weight, Stress, Strain, Displacement while expanding or keeping up quality of Connecting bar. Examination of the interfacing pole is one of the technique in which complete structure just as working execution of the associating bar has been done separately. We will do different examination like static investigation and warm investigation by utilizing FEA method.[23]

**Kumbha Sambaiah et. al. [ 2017]** This paper depicts the investigation of advancement for associating bar of interior ignition motor by utilizing two unique materials like produced steel and C-70 interfacing bars. The exhibition of associating bar will be assessed with two kinds of materials. Interfacing poles work under high loads needs high quality in both pressure and pressure and high weariness quality. For satisfying that need here we have chosen ordinary produced steel or ultra-high quality steel. This steel has quality level above 900MPa and this steel for the most part have carbon content extending from 0.01-0.45%. It is notable that, as quality builds, strength lessens. So durability of ultra-high quality steel is a significant thought. As quality increments, basic length/size of imperfection diminishes. When the basic length of the imperfection is reached during handling or application, the material flops disastrously with no earlier notice. Ultra high quality prepares are characterized by their creation microstructure. The steel C-70 has been presented from Europe as split capable producing steel. Alloying components in the material empowers solidifying of manufactured interfacing bars when they experience controlled cooling in the wake of producing. Subsequently a similar investigation of these two materials for exhaustion stacking is the primary objective of this paper. The model was created in Pro/E rapidly spreading fire 5.0 and afterward imported as parasolid (IGES) structure in ANSYS workbench.[24]

**Durgesh Yadav et. al [ 2017]** Connecting bar is the crucial piece of an I.C.Engine. It is intended to withstand worries from the burning and development of the cylinder. The motivation behind an association pole is to give smooth motion among cylinders and a driving rod. When fabricating a superior motor, extraordinary consideration is paid to the associating poles. The best component of an interfacing pole is that it ought to be of uniform shape and lighter in weight. The fundamental motivation behind this paper is to dissect the anxieties created in interfacing bar of four stroke petroleum motor under static stacking conditions. And afterward search forward for weight decrease alongside material enhancement. The model of the interfacing pole is created utilizing CATIA V5 (measurements are estimated from Hero Splendor 100cc bicycle associating pole) and ANSYS is utilized for stresses investigation by recreation ( this strategy is otherwise called Finite Element Analysis by reenactment). This is the expense and time powerful technique for examination. Al 360 and Carbon steel are two material considered as the streamlining material [25]

**Naman Gupta et. al. [2018]** Connecting pole is one of the fundamental bits of the engine social event, it goes about as an official between cylinder get together and driving rod. It began from the sawmills to the engine unmistakable transmission powers. The associating bar accomplices reacting cylinder to turning driving rod, communicating the push of the cylinder to the driving rod. It has two culminations. The little end is connected with the cylinder by a gudgeon stick while uttermost edge is connected driving rod utilizing wrench stick.. Therefore,. This further assessment move towards von misses pressure so we give signs of progress part with diminished weight, financially able and give supported outcome over different segments. This paper portray an overall report on three plans of interfacing bar near to introduce day structure. [26]

## III. CONCLUSION

Various researchers are studied on connecting rod. The model of the Connecting rod was designed using Solid ,Catia, Pro-e, Autocad etc modelling software. The design of the model was created in two different stages .

1. Part designing where the connecting rod was designed with the required dimensions.
2. Assembly of the 3D model using various modelling operations like extrude, sweep, revolve, etc. Finite element model: The Solid model was imported into Ansys , hypermesh, altair etc simulation software and the results were obtained after applying the thermal boundary conditions.

ISSN : 2455-9679
Impact Factor : 3.805

## REFERENCES

1. Webster, W. D., Coffell R., and Alfaro D, "A Three Dimensional Finite Element Analysis of a High Speed Diesel Engine Connecting Rod," SAE Technical Paper Series, Paper No. 831322, 1983.

2. Repgen, B., "Streamlined Connecting Rods to Enable Higher Engine Performance and Cost Reduction," SAE Technical Paper Series, Paper No. 980-882, 1998.

3. Shenoy, Pravardhan S., and Ali Fatemi. "Interfacing pole streamlining for weight and cost decrease." No. 2005-01-0987. SAE Technical Paper, 2005.

4. Pravardhan S. Shenoy and Ali Fatemi, Connecting Rod Optimization for Weight and Cost Reduction, SAE International,2005.

5. Dr. N. A. Wankhade, Suchita Ingale"Review on Design and Analysis of Connecting Rod Using Different Material IJESC Volume 7 Issue No.5, 2006.

6. Dr. B.K.Roy "Design Analysis and Optimization of Various Parameters of Connecting Rod using CAE Softwares International Journal of New Innovations in Engineering and Technology October 2012.

7. Prof. N.P.Doshi, Prof .N.K.IngoleAnalysis of Connecting Rod Using Analytical and Finite Element Method International Journal of Modern Engineering Research Jan-Feb. 2013.

8. Christy V Vazhappilly, P.Sathiamurthi "Stress Analysis of Connecting Rod for Weight Reduction-A Review" International Journal of Scientific and Research Publications, February 2013.

9. Leela Krishna Vegi, Venu Gopal Vegi" "Design and Analysis of Connecting Rod Using Forged steel" International Journal of Scientific & Engineering Research, Volume 4, Issue 6, June2013, 2081 ISSN 2229-5518.

10. Kuldeep B, Arun L.R, Mohammed Faheem "ANALYSIS AND OPTIMIZATION OF CONNECTING ROD USING ALFA SiC COMPOSITES" International Journal of Innovative Research in Science, Engineering and Technology June 2013.

11. Prof. Vivek C. Pathade, Dr. Dilip S. Ingole Stress Analysis of I.C.Engine Connecting Rod by FEM and Photoelasticity IOSR Journal of Mechanical and Civil Engineering Apr. 2013.

12. Kumar, Amit, P. P. Bhingole, and Dinesh Kumar. "Dynamic Analysis of Bajaj Pulsar 150cc Connecting Rod Using ANSYS 14.0." Asian Journal of Engineering and Applied Technology (2014): 19-24.

13. Digvijay,Mohd.Ahmad, Ajay Mishra, Karunakar Mishra,Alok Panday, Shyam Bihary Lal Stress Analysis Of Connecting Rod Using Finite Element Method IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 2, Issue 2, Apr-May, 2014.

14. Sushant, Victor GambhirDesign and Comparative Performance Analysis of Two Wheeler Connecting Rod Using Two Different Materials Namely Carbon 70 Steel and Aluminum 7068 by Finite Element Analysis International Journal Of Research In Aeronautical And Mechanical Engineering June 2014.