ISSN : 2455-9679
Impact Factor : 3.340

IJRTSM

INTERNATIONAL JOURNAL OF RECENT TECHNOLOGY SCIENCE & MANAGEMENT

"DYNAMIC ANALYSIS ON TWO WHEELER CRANK SHAFT BY USING DIFFERENT MATERIAL"

Paras Mishra [1]***, Dr. S. L. Ahirwar*** [2]

[1] *M.Tech Research Scholar, Department of Mechanical Engineering, OIST , College Bhopal, MP, India*

[2] *Associate Professor & HOD, Department of Mechanical Engineering, OIST , College Bhopal, MP, India*

ABSTRACT

The modal analysis of a single-cylinder, two wheeler bike crankshaft is discussed using finite element method in this project. The analysis is done on three different materials which are based on their composition. Three-dimension models of diesel engine crankshaft was created using Solid edge software. The finite element analysis (FEM) software ANSYS was used to analyze the thermal transient analysis of the crankshaft. The maximum stress point and dangerous areas are found by the deformation analysis of crankshaft. The relationship between the temperature, thermal stresses and deformation is explained by the thermal transient analysis of crankshaft. The results would provide a valuable theoretical foundation for the optimization and improvement of engine design. In this work we find value of von misses stresses , EN – 8 material , ADI material and AL 360 are respectively 190.3 MPa,190.36 MPa and 188.89 MPa. Shear stresses , EN – 8 material , ADI material and AL 360 are respectively 87.74 MPa, 87.75 MPa and 87.96 MPa. Deformations , EN – 8 material , ADI material and AL 360 are respectively 0.028 mm , 0.034 mm and 0.028 mm. Weights, EN – 8 material , ADI material and AL 360 are respectively 5.63 kg , 5.1 kg and 2.45 kg

Keyword: *Crankshaft, Finite Element Analysis; Optimization; Thermal analysis , ANSYS, Catia V5 R20*

I. INTRODUCTION

Crankshaft is a standout amongst the most imperative moving parts in interior combustion engine. It must be sufficiently able to take the descending power of the power stroked without over the top bowing. So the unwavering quality and life of inward combustion engine rely upon the quality of the crankshaft to a great extent. Furthermore, as the engine runs, the power motivations hit the crankshaft in one place and after that another. The torsional vibration shows up when a power drive hits a crankpin toward the front of the engine and the power stroke closes. If not controlled, it can break the crankshaft. Quality estimation of crankshaft turns into a key factor to guarantee the life of engine. Shaft and space outline display were utilized to figure the worry of crankshaft for the most part previously. Be that as it may, the quantity of hub is restricted in these models. With the improvement of PC, increasingly more design of crankshaft has been used limited component strategy (FME) to ascertain the worry of crankshaft. The utilization of numerical reproduction for the designing crankshaft helped engineers to productively enhance the procedure improvement maintaining a strategic distance from the expense and restrictions of arranging a database of genuine parts. Limited component examination permits an economical investigation of self-assertive blends of information parameters including design parameters and process conditions to be researched. Crankshaft is an entangled constant structure. The vibration execution of crankshaft has critical impact to engine. The figuring of crankshaft vibration execution is troublesome in light of the unpredictability of crankshaft structure, the troublesome determinacy of limit condition.

ISSN : 2455-9679
Impact Factor : 3.340

The crankshaft is the foundation of the inside combustion engine. It is in charge of the correct task of the engine it is an engine part now and then called the crankshaft, it switches the here and there movement that is the direct (reciprocating) movement of the cylinders into rotating movement. To change over the movement, the crankshaft has at least one balanced shafts. The cylinders are associated by these poles to the crankshaft. At the point when the cylinder climbs and down, it pushes the counterbalance shaft. This thus turns the crankshaft. The crankshaft is the principle turning part of an engine and is ordinarily made of bendable iron, produced steel and other combination material. So as to change over two movements, the crankshaft has " crankshaft tosses " or "crankpins".

Fig 1.1 Crankshaft

II. MODELLING

2.1 Crank shaft Design Procedure on CATIA

There are two different load sources acting on the crankshaft. Inertia of rotating components (e.g. connecting rod) applies forces to the crankshaft and this force increases with the increase of engine speed. This force is directly related to the rotating speed and acceleration of rotating components. The second load source is the force applied to the crankshaft due to gas combustion in the cylinder. The slider-crank mechanism transports the pressure applied to the upper part of the slider to the joint between crankshaft and connecting rod. This transmitted load depends on the dimensions of the mechanism

Step I: Bearing reactions At the top dead centre position, the thrust in the connecting rod will be equal to the force acting on piston.

Step II: Design of Crank Pin

Step III: Design of left hand crank web

Step IV: Design of right hand crank-web, Right web is made identical from balancing consideration. Therefore the thickness of right and left are made equal.

Step V: Design of shaft under flywheel

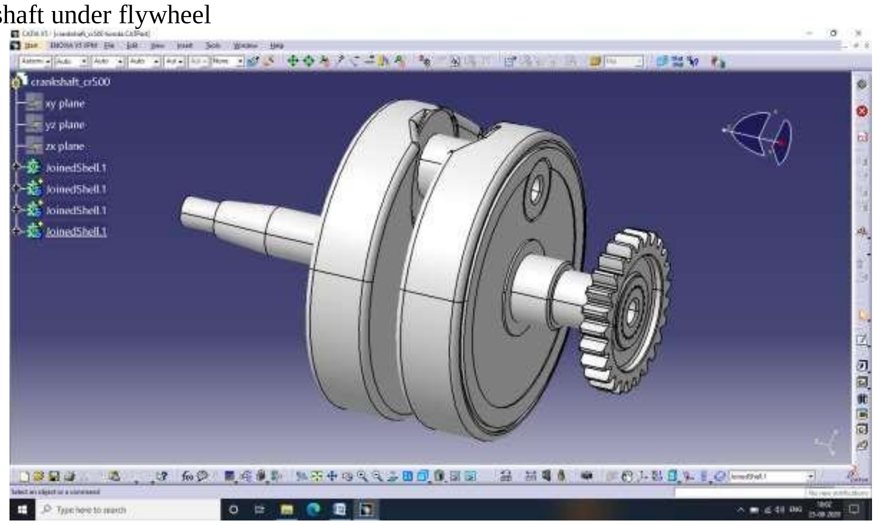

Fig.2.1 Crank model on CATIA V5 R20

ISSN : 2455-9679
Impact Factor : 3.340

III. SIMULATION

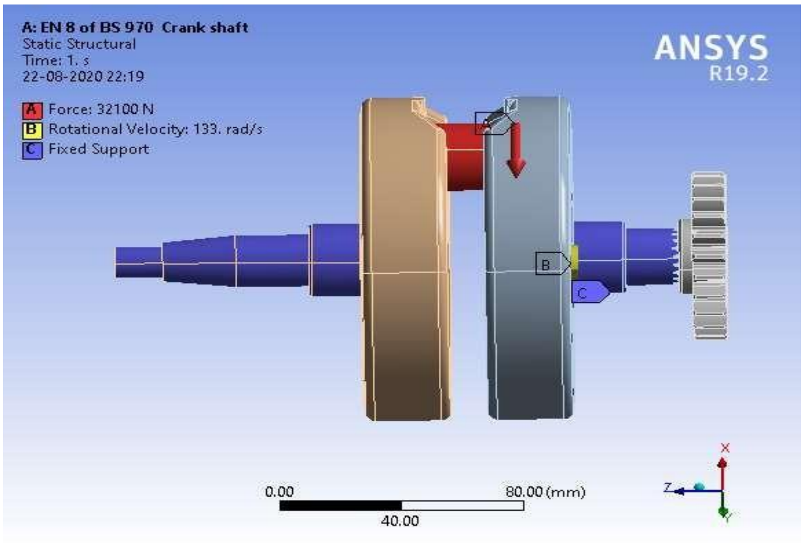

Fig.3.1 Crank model EN 8 of BS 970 material applied boundary conditions

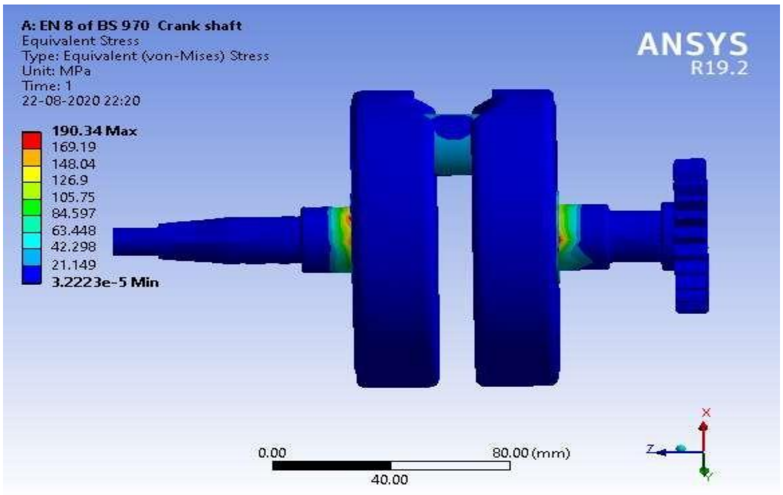

Fig.3.2 Crank model EN 8 of BS 970 material von misses stresses

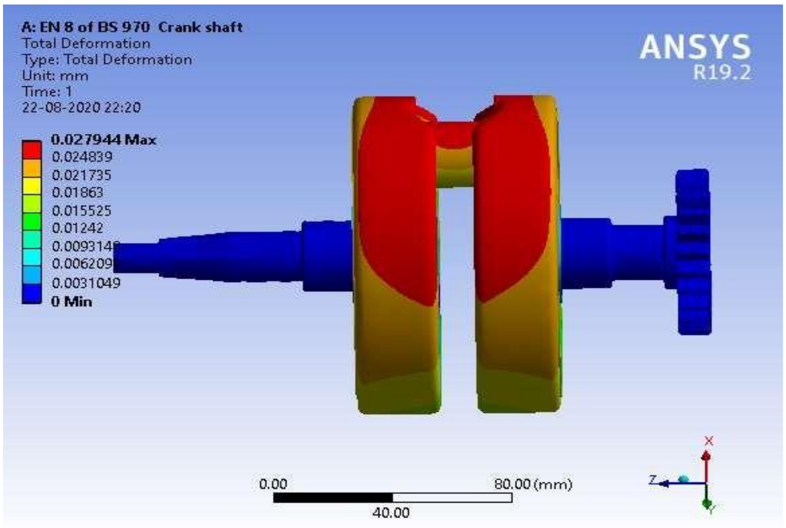

Fig.3.3 Crank model EN 8 of BS 970 material deformation

ISSN : 2455-9679
Impact Factor : 3.340

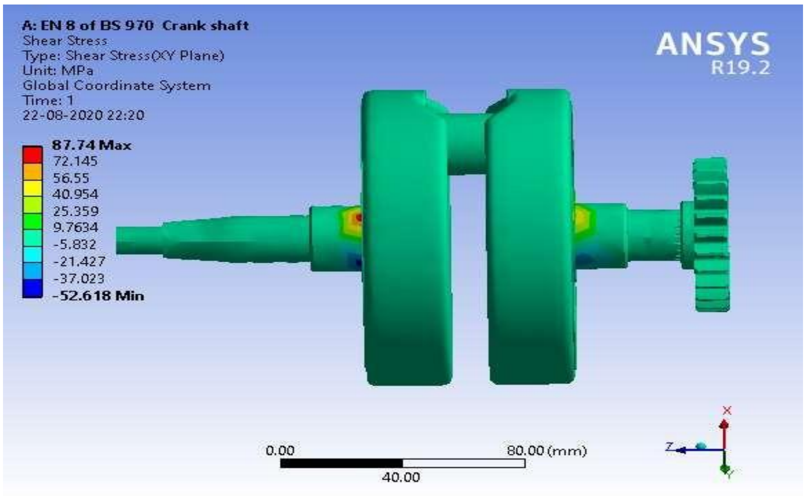

Fig.3.4 Crank model EN 8 of BS 970 material shear stress results

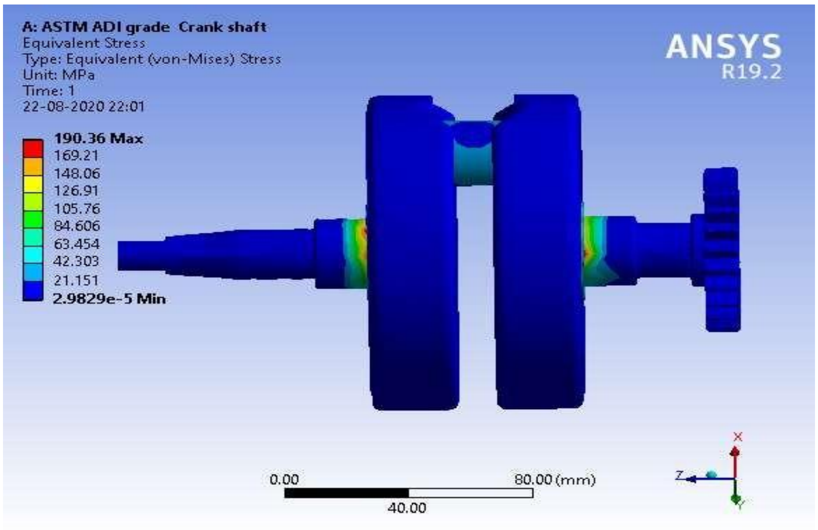

Fig.3.5 Crank model ASTM ADI Grade material Von misses stresses

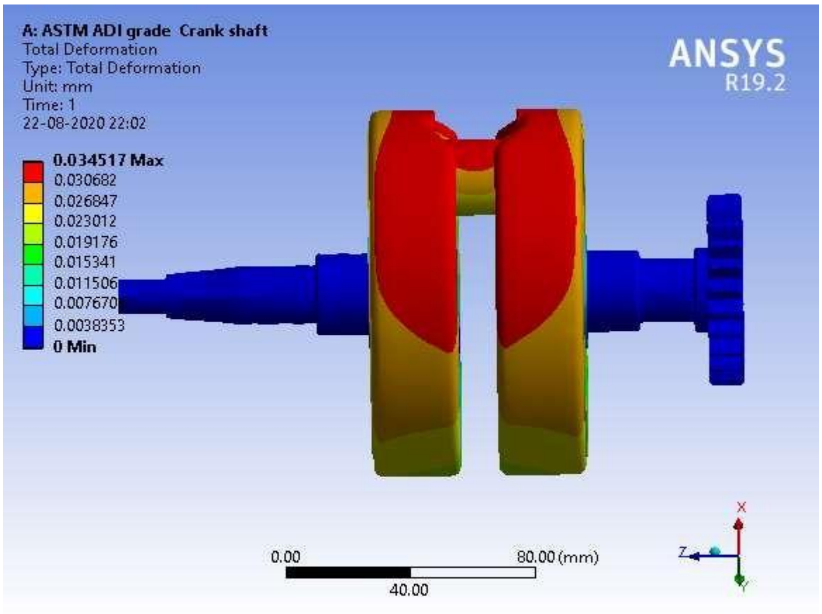

Fig 3.6 Crank model ASTM ADI Grade material Deformation

ISSN : 2455-9679
Impact Factor : 3.340

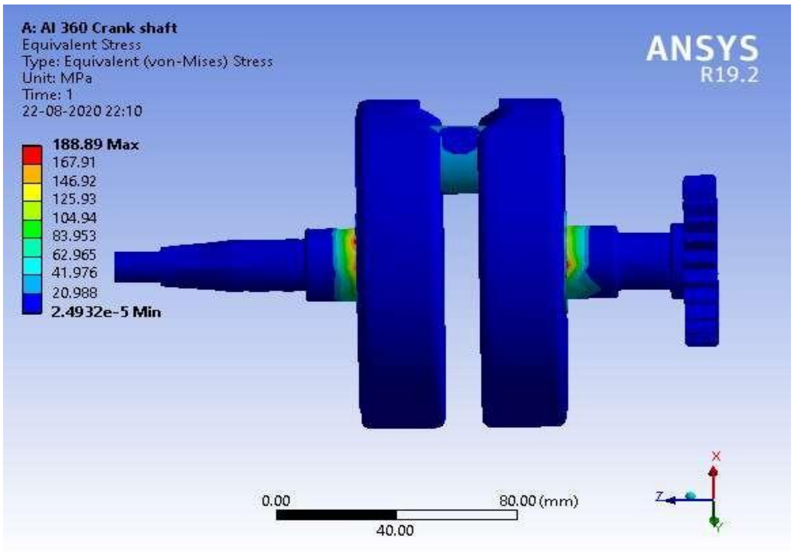

Fig.3.7 Crank model AL 360 material Von misses stresses

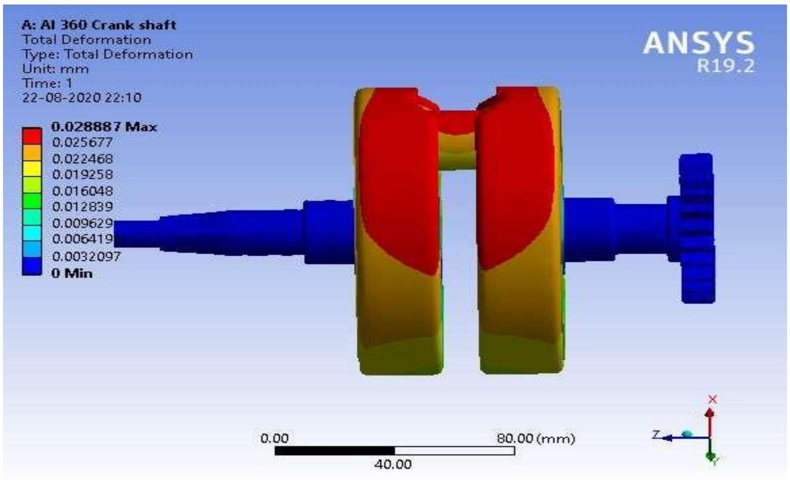

Fig.3.8 Crank model AL 360 material deformation results

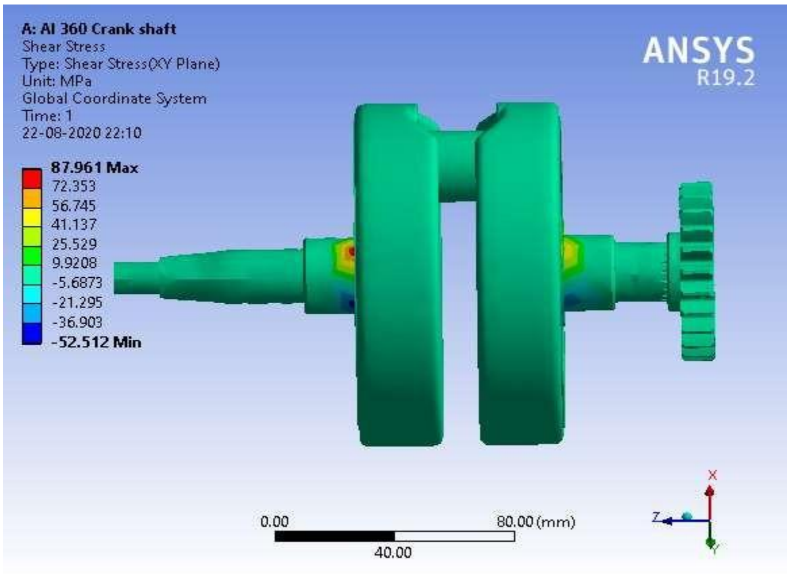

Fig.3.9 Crank model AL 360 material shear stresses

ISSN : 2455-9679
Impact Factor : 3.340

IV. RESULTS & DISCUSSION

In this work we find value of vonmisses stresses , EN – 8 material , ADI material and AL 360 are respectively **190.3** MPa, 190.36 MPa and **188.89 MPa**
Shear stresses, EN – 8 material, ADI material and AL 360 are respectively **87.74** MPa, 87.75 MPa and **87.96 MPa**
Deformations , EN – 8 material , ADI material and AL 360 are respectively **0.028 mm** , 0.034 mm and **0.028 mm**
Weights, EN – 8 material , ADI material and AL 360 are respectively **5.63 kg** , 5.1 kg and **2.45 kg**
Here we can see that we have used two different materials in all materials we will be selected AL 360 material to other than because it is light weight and heavy duty its deformation and stresses are under considerable range.

Table.4.1 Material comparison tables

Materials	**EN-8**	**ASTM ADI**	**AL 360**
Von misses (MPa)	190.3	190.36	188.89
Shear stress (MPa)	87.74	87.751	87.96
Deformation (mm)	0.028	0.034	0.028
Weight (Kg)	5.63	5.1	2.45

V. CONCLUSION

This project, the current and future scenarios about the possible choices of material for crankshafts of high-performance engines have been analyzed, also with an overview on simulation technique and cost saving potentials. In this project, the crankshaft show is made by CATIA V5 R20 programming. By then the model made by CATIA V5 R20 was imported in to ANSYS 19.2 programming.

1. For the EN – 8, ADI and AL 360 materials, we find the values of vonmisses stresses are respectively 198.3 MPa, 190.36 MPa and 188.89 MPa.
2. For the EN – 8, ADI and AL 360 materials, we find the values of shear stresses are respectively 87.74 MPa, 87.75 MPa and 87.96 MPa.
3. For the EN – 8, ADI and AL 360 materials, we find the values of deformations are respectively 0.028 mm, 0.034 mm and 0.028 mm.
4. For the EN – 8, ADI and AL 360 materials, we find the values of weights are respectively 5.63 kg, 5.1 kg and 2.45 kg.

So from the above points we may conclude that the AL 360 **(**ALUMINIUM ALLOYS**)** material in comparission with other two materials having minimum deformation and minimum vonmisses stress with light weight and heavy duty strength.

ISSN : 2455-9679
Impact Factor : 3.340

REFERENCES

[1] Silva.F.S., Analysis of a vehicle Crankshaft Failure, Pergamon, Engineering Failure Analysis, 10,605-616.**2003**

[2] Farzin H. Montazersadgh and Ali Fatemi " Stress Analysis and Optimization of crankshafts Subjected to Dynamic Loading", AISI, August **2007**.

[3] Ali Keskin, Kadir Aydin, "Crank Analysis Of A Gasoline Engine Crankshaft,"Gazi University Journal of Science, Vol.2, **2010**, ISSN 487-492.

[4] C.M Balamurugan, R. Krishnaraj, Dr.M.sakhivel, K.kanthavel, Deepan Marudachalam M.G, R.Palani, "Computer Aided modelling and smoothing out of crankshaft", International Journal of scientific and Engineering Reaserach, Vol-2, issue-8, ISSN:2229-5518, August-**2011**.

[5] Gu Yingkui, Zhou Zhibo, "Strength Analysis of Diesel Engine Crankshaft Based on PRO/E and ANSYS", Third International Conference on Measuring Technology and Mechatronics Automation, **2011**.

[6] Jian Meng, Yongqi Liu, Ruixiang Liu, "Finite element examination of 4-cylinder diesel crankshaft," I. J. Image, graphics and Signal Processing, Published Online Aug- **2011** in MECS.(http://www.mecs-press.org/),PP. 22-29

[7] Rincle Garg, Sunil Baghla, "Restricted part examination and upgrade of crankshaft", International Journal of Engineering and Management Reaserch, vol- 2,Issue-6,ISSN: 2250-0758, Pages:26-31, December **2012**

[8] Abhishek choubey, Jamin Brahmbhatt, "Design and Analysis of Crankshaft for single cylinder 4-stroke engine", International Journal of Advanced Engineering Reaserch and studies, vol-1, issue-4, ISSN:2249-8974, pages: 88-90, July-sept **2012**.

[9] B. Kareem, Y.R Suple, " Analysis and improvement of Crankshaft using FEM", International Journal of Modern Engineering Reasearch, vol-2, issue-5, ISSN:2249- 6645, pages:3086-3088, Sept-Oct **2012**.

[10] Jaimin Brahmbhatt, Prof. Abhishek choubey, "Plan AND ANALYSIS of CRANKSHAFT FOR SINGLE CYLINDER 4-STROKE DEISEL ENGINE" IJAERS/Vol. I/Issue IV/July-Sept., **2012**/88-90

[11] K. Thriveni1 Dr.B.JayaChandraiah2," Modeling and Analysis of the Crankshaft Using Ansys Software"International Journal of Computational Engineering Research||Vol, 03|Issue, 5|May ||**2013**

[12] Kirankumar Barangi1, Vijaykumar B Hubballi2, Ajaykumar L Gogi3, U M Daivagna4," Design and Stress Analysis of Crank Shaft of Four-Stroke Diesel Engine Using Photo-Elasticity and FEA" Volume 3 Issue IX, September **2015**

[13] Mr. V. C. Shahane, Dr. R. S. Pawar, " A Review on Finite Element Analysis of the Crankshaft of Internal Combustion Engine"International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 - 0056 Volume: 03 Issue: 08 | Aug-**2016** www.irjet.net p-ISSN: 2395-0072

[14] PL. Vairakanna*, M. Chandran, "Plan AND MATERIAL STUDY OF RACE BIKE CRANK" [Vairakanna* et al., 6(4): April, **2017**] Impact Factor: 4.116 IC™ Value: 3.00 CODEN: IJESS7

[15] Iain McEwen , David E. Cooper , Jay Warnett , Nadia Kourra ID , Mark A. Williams3and Gregory J. Gibbons ,*, "Structure and Manufacture of a High- Performance Bicycle Crank by Additive Manufacturing" Received: 17 July 2018; Accepted: 7 August 2018; Published: 13 August **2018**

[16] Hla Min Htun,Chit Zone Nyi Nyi," Structural Analysis of Crank Arm for Quadracycle" International Journal of Science, Engineering and Technology Research (IJSETR) Volume 8, Issue 1, January **2019**, ISSN: 2278 - 7798