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Modification of Rear Sprocket in Two-Wheeler for Improve the Vehicle Performances

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Abstract:- In the current scenario, the prices of fuels are gradually increased manner. So, the mileage of the vehicle is most important thing in the way of financial problem. In our project, we reduce the unused torque in our two-wheeler by reducing the diameter and tooth counts of the rear wheel sprocket in the two-wheeler to improve the vehicle performances of speed and mileage. It also gives the positive results to us and the performance of the two-wheeler is always increased. The resultant graph variations are shown in the result and discussion chapter.

Keywords:- *Rear tooth sprocket, Vehicle performances, Torque, Speed, Mileage.*

I. INTRODUCTION

Our project is to be done in the TVS Sport ES (2013 Model). In that vehicle, the drive sprocket has 13 teeth and the driven sprocket has 39 teeth. And it has the sprocket diameter of 170mm. We are reducing the sprocket diameter and the tooth counts of 150mm and 36 teeth. And the changing in drive ratio of 3.0 (39 divided by 13) to 2.76 (36 divided by 13). The rear wheel sprocket is used to transmit the power to the wheel. We are able to change the two-wheeler performances by "gear up" or "gear down" by changing sprockets, front or rear, to different sizes. The gear up is the meaning of changing the gear tooth to higher gear and the gear down is the meaning of changing the gear tooth to lower gear.

We are doing our project in the basis of gear down process. Our concept of this project is to reducing the unused torque is usefully converted into the speed and mileage by the help of gear down process. We are changing the drive ratio in the two-wheeler and to changing the smaller diameter sprocket when compared to the existing sprocket diameter. It includes the reduction in the teeth counts also.

For the reduction of drive ratio, the speed of the vehicle is slightly increases and also the mileageis always increased. And the resultant of the reducing drive ratio can gives +8.3% more speed and the -8.3% reduced torque can be produced. This reduction of torque is not affects more in the running condition of the vehicle.

In this reduction, we can alternate the chain drive by the sequence of the smaller rearsprocket. In our case, we were reduce about to 4 links, we had to get a118-link chain. Overall, it's a relatively simple job and the results are amazing.

These, of course, will quick down to reach the top speed at short span of time. And initially it may affect the sudden pick-up of the vehicle also.

II. COMPONENTS AND MATERIAL SELECTION

A. *Sprockets*

A sprocket or sprocket-wheel is a profiled wheel with teeth, or cogs, that mesh with a chain, track or other perforated or indented material. The sprockets are have to transmit the power to the rear axle in the bicycles and motorcycles and cars in an automobile sectors.

Sprockets are used in the automobiles are to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles.

Fig 1:- Sprocket

Sprockets are of various designs, a maximum of efficiency being claimed for each by its originator. Sprockets typically do not have a flange. Some sprockets used with timing belts have flanges to keep the timing belt centered. The sprockets and the chains are used to transmit the power transmission from one shaft to another with no slip. The sprockets are connected to the chain drive and to rotate at the high speed with noiseless with an instead of chain links.

Sprockets should be as large as possible the application. The larger a sprocket is, the less the working load for a given amount of transmitted power, allowing the use of a smaller-pitch chain.

B. *Chain Drive*

A chain is used to connect two sprockets. One is the driver sprocket and another one is the driven sprocket. The transmission of power can be done by the help of chain drive. It transmits the motion and the force from the one

sprocket to another sprocket. It is called as power transmission chains.

Chain drive was a popular power transmission system from the earliest days of the automobile. It gained prominence with its rigid Hotchkiss driveshaft and Universal joints.

The major group of power transmission chains are:

- Standard general purpose roller chains, widely used in an industry.
- High performance roller chains, these roller chains are stronger than general purpose roller chains.
- Lube-free chains, these chains can be used without lubrication.
- Environmentally resistant chains with special corrosion resistance.
- Speciality chains, Type 1: Used as bicycle chains, motorcycle chains, automotive chains.
- Speciality chains, Type 2: Including miniature chains, leaf chains and also rollers and bushes.

Fig 2:- Roller Chain

Fig 3:- Chain Drive

C. *Material Selection*

At present sprocket chain is made of mild steel material. So, first analysis is done using ms as material. Steel is the traditional material for sprocket chain. Steel is easy to get. Machinery to manipulate the steel is easy to get. Steel is easy and also cheap. This is main reason that 99% of the chain sprocket made from steel. Steel is stiff but dense(heavy). Steel rate well in terms of both yield strength and ultimate strength, particularly if it's carefully alloyed and processed. Steel also resists fatigue failure well it is extremely useful. Even if the sprocket the sprocket chain flexes under load, such flexing need not lead to a critical failure. Chemical composition of is 2062: c- 0.23%, mn-1.5%, s-0.05%, p-0.05%, si-0.4%

Property	Value
Young's modulus, e	2.1×105 mpa
Poisson' s ratio, v	0.3
Density, ρ	7850 kg/m3
Yield stress, σ yield	250 mpa
Ultimate tensile stress, σ uts	390 mpa

Table: 1 The properties of mild steel sprocket are listed below, Structural properties (is 2062)

III. WORKING AND DESIGN CALCULATIONS

A. Working

The main aim of this project is to improve the vehicle performances by reducing the size of the rear sprocket wheel in their teeth counts and its diameter also. There is no change in the front sprocket size. And the alterations would be applied in the chain drive. The rear sprocket would be rotated by the front sprocket. The front sprocket is to be rotated by the output shaft connection from the gearbox output. It will always rotate based on the engine output.

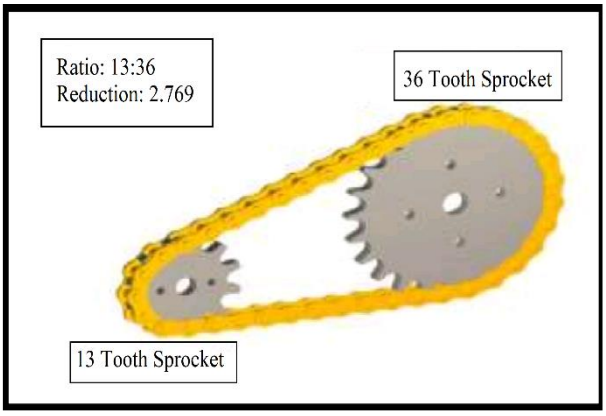

Fig 4:- Block Diagram

B. *Experimental Setup*

Fig 5:- Modified TVS Sport ES

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C. *Design Calculations*

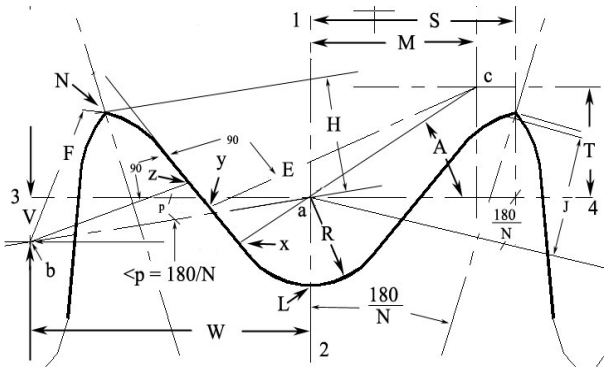

Fig 6:- Sprocket Tooth Geometry

A. Design Calculation for 39 Teeth Sprocket

Pitch, P = 13.7 mm

Number of Teeth, N = 39

Roller Diameter, Dr = 0.301 mm

Seating curve Dia, Ds = 1.0005Dr + 0.003 = 0.304 mm

R = Ds/2 = 0.5025 Dr + 0.0015 = 0.152 mm

A = 35˚ + 60˚⁄N = 36.54˚

B = 18˚ - 56˚/N = 16.56˚

ac = 0.8 x Dr = 0.2408 mm

M = 0.8 x Dr cos (35˚ + 60˚/N) = 0.1935 mm

T = 0.8 x Dr sin (35˚ + 60˚/N) = 0.1434 mm

E = 1.3025 Dr + 0.0015 = 0.3936 mm

Chordal Length of Arc xy = (2.605 Dr + 0.003)sin (9˚ - 28˚/N) = 0.1133 mm

yz = Dr[1.4sin(17˚ - 64/N) – 0.8sin(18˚ - 56˚/N)] = 0.0431 mm

ab = 1.4 Dr = 0.4214 mm

W = 1.4 Dr cos 180˚/N = 0.42 mm

V = 1.4 Dr sin 180˚/N = 0.034 mm

F = Dr[0.8cos(18˚ - 56˚/N) + 1.4cos(17˚ - 64˚/N) – 1.3025] - .0015 = 0.243mm

H = √[F2 – (1.4Dr – P/2)2] = 6.4231 mm

S = P/2 cos 180˚/N + H sin 180˚/N = 7.3447 mm

PD = P/ sin (180˚/N) = 170.25 mm

B. Analysis of 39 Teeth Rear Sprocket

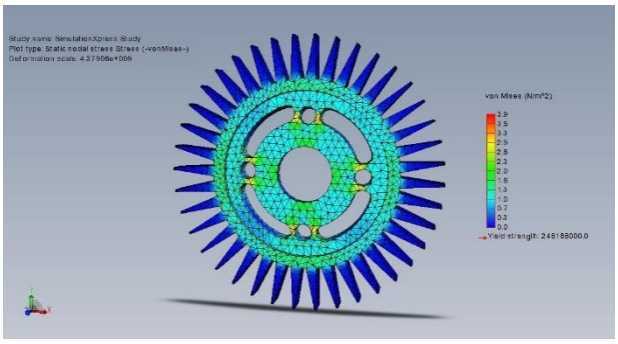

Fig 7:- Analysis of Stresses

C. Design Calculation for 36 Teeth Sprocket

Pitch, P = 12.7 mm

Number of Teeth, N = 36

Roller Diameter, Dr = 0.204 mm

Seating curve Dia, Ds = 1.0005Dr + 0.003 = 0.207 mm

R = Ds/2 = 0.5025 Dr + 0.0015 = 0.103 mm

A = 35˚ + 60˚⁄N = 36.66˚

B = 18˚ - 56˚/N = 16.44˚

ac = 0.8 x Dr = 0.1632 mm

M = 0.8 x Dr cos (35˚ + 60˚/N) = 0.1309 mm

T = 0.8 x Dr sin (35˚ + 60˚/N) = 0.0974 mm

E = 1.3025 Dr + 0.0015 = 0.2672 mm

Chordal Length of Arc xy = (2.605 Dr + 0.003)sin (9˚ - 28˚/N) = 0.0756 mm

yz = Dr[1.4sin(17˚ - 64/N) – 0.8sin(18˚ - 56˚/N)] = 0.02879 mm

ab = 1.4 Dr = 0.2856 mm

W = 1.4 Dr cos 180˚/N = 0.2845 mm

V = 1.4 Dr sin 180˚/N = 0.0249 mm

F = Dr[0.8cos(18˚ - 56˚/N) + 1.4cos(17˚ - 64˚/N) – 1.3025] - .0015 = 0.164mm

H = √[F2 – (1.4Dr – P/2)2] = 6.0622 mm

S = P/2 cos 180˚/N + H sin 180˚/N = 6.8542 mm

PD = P/ sin (180˚/N) = 145.71 mm

D. Analysis of 36 Teeth Rear Sprocket

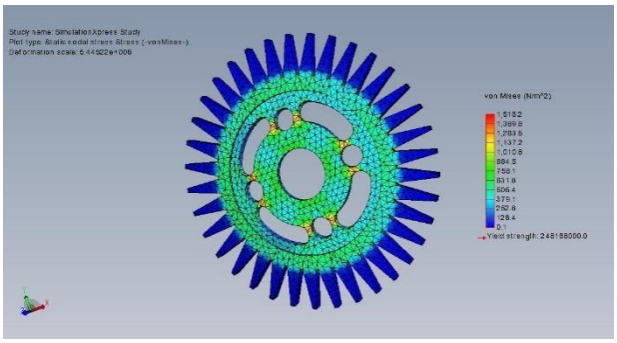

Fig 8:- Analysis of Stresses

IV. RESULT AND DISCUSSION

The results of our project can be explained in terms of the comparison of the graphs. The results of our project can be done by the Two-Wheeler Chassis Dynamometer in Tamilnadu College of Engineering. It contains the torque and speed variations of the vehicle can be fully explained.

A. *Results*

- *Graph for 39 Teeth Rear Sprocket Performance (without load)*

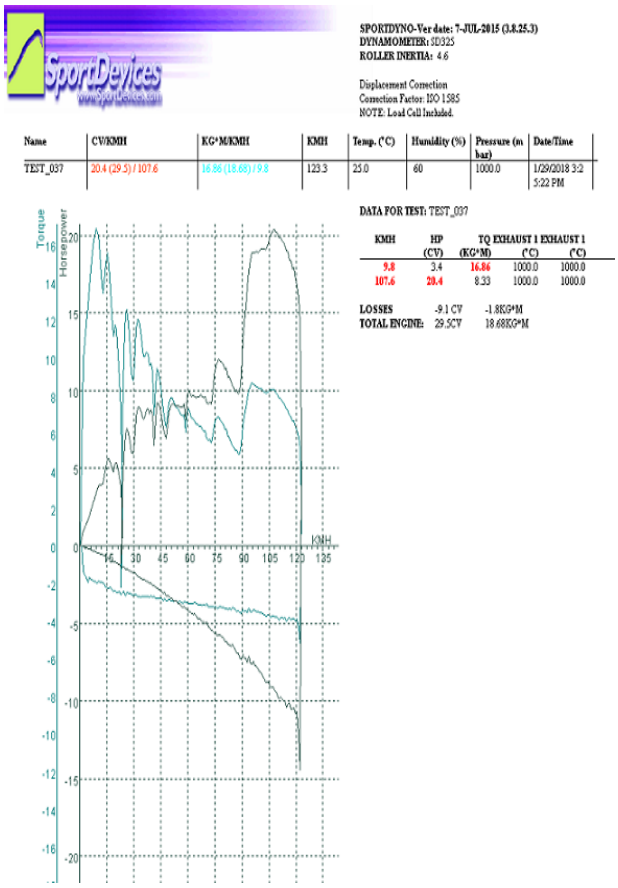

Fig 9:- Performance of 39 Teeth Sprocket (Without Load)

- *Graph for 36 Teeth Rear Sprocket Performance (without load)*

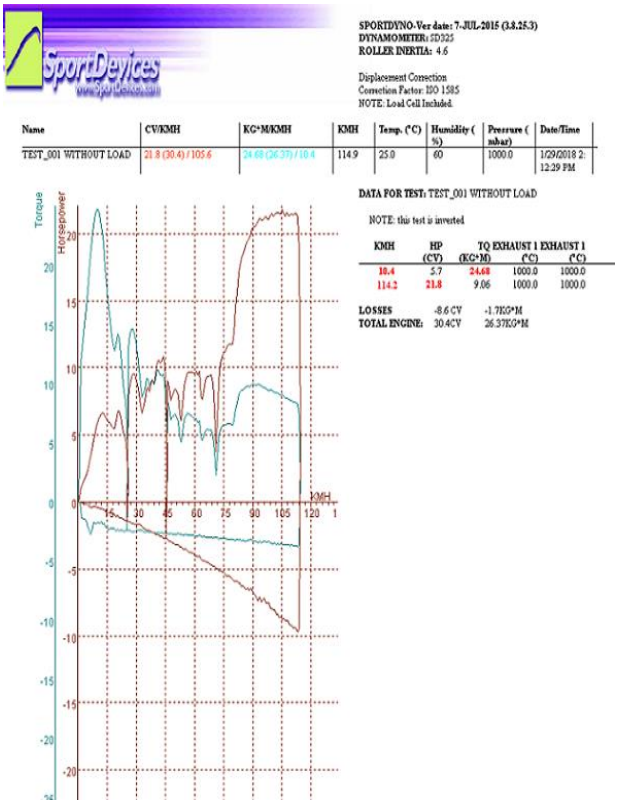

Fig 10:- Performance of 36 Teeth Sprocket (Without Load)

- *Graph for 39 Teeth Rear Sprocket Performance (with load)*

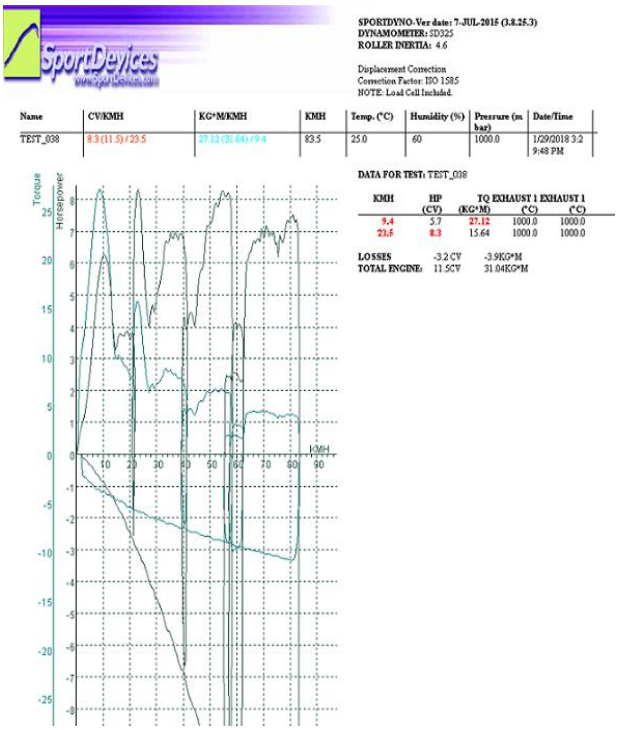

Fig 11:- Performance of 39 Teeth Sprocket (With Load)

- *Graph for 36 Teeth Rear Sprocket Performance (with load)*

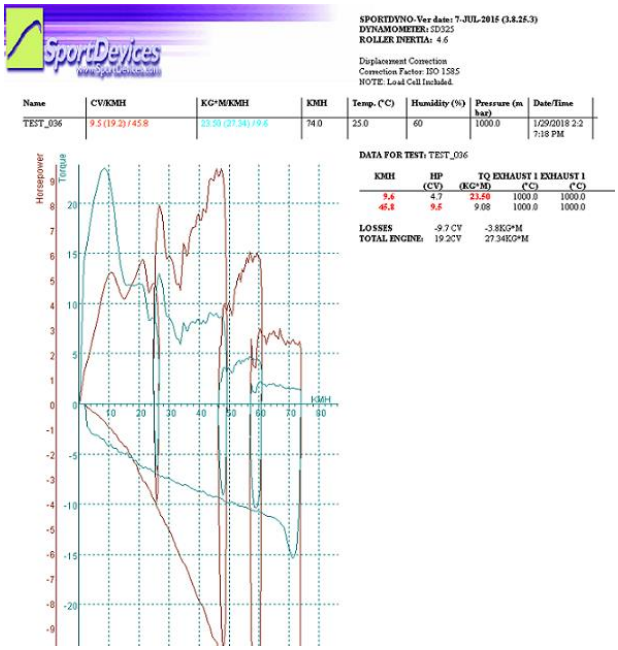

Fig 11:- Performance of 36 Teeth Sprocket (With Load)

B. *Discussion*

These graphs can be gives the comparison about the improvement in the vehicle performance by our rear sprocket modification. And also the graphs can be explains as:

• The maximum speed of 114.2 KMH can be obtained from the 36 teeth rear sprocket for without load condition. At the same stage, there is only 107.6 KMH can be obtained from the 39 teeth rear sprocket for without load condition.

• The maximum speed of 45.8 KMH can be obtained from the 36 teeth rear sprocket for with load condition. At the same stage, there is only 23.5 KMH can be obtained from the 39 teeth rear sprocket for with load condition.

• At the same time, the maximum horse power of 21.8 CV can be obtained from the 36 teeth rear sprocket for without load condition. At the same stage, there is only 20.4 CV can be obtained from the 39 teeth rear sprocket for without load condition.

• At the same time, the maximum horse power of 9.5 CV can be obtained from the 36 teeth rear sprocket for with load condition. At the same stage, there is only 8.3 CV can be obtained from the 39 teeth rear sprocket for without load condition.

Thus the results of our modified rear sprocket performances are shown in the graph. And it will be more successful for us and we are getting some useful knowledge for doing this project.

V. CONCLUSION

This project can gives the way to check our technical skills and the experience.And we are getting the more knowledge about the performance of the two-wheeler. We feel that the project work is a good solution and helps for improving the performance of a vehicle also.

We are proud that we have completed the work with the limited time successfully. The "MODIFICATION OF TWO-WHEELER REAR SPROCKET AND IMPROVE THE VEHICLE PERFORMANCES" is working with satisfactory conditions. We are able to understand the difficulties in the sudden pickup drop in the vehicle. It is not the big issue for the travelling of two members in that bike. And we are getting the smooth ride after our modification of the rear wheel sprocket.

The conclusion of our project is, the modification of the rear sprocket will gives the improvement in the speed of the vehicle and the horse power of the engine performances. For the concept of reduction in the counting of teeth in the rear sprocket, will gives the improved speed and mileage, we are achieving this concept as a practical knowledge and our efforts.

REFERENCES

[1]. Sagar N. Vasoya, P.L. Koradiya, B.J. Patel "Development of Sprocket to Improvement the Torque for Off Road Bike" 3rd International conference on Multidisciplinary Research & Practice , Volume 4,Issue 1,pg.68-178.
[2]. Nikhil P. Ambole, Prof. P. R. Kale "Finite Element Analysis Carbon Fiber Sprocket using ANSYS" IJSRD - International Journal for Scientific Research & Development| Vol. 4, Issue 05, 2016 | ISSN (online): 2321-0613
[3]. Ebhota Williams S, Ademola Emmanuel, Oghenekaro Peter "Fundamentals of Sprocket Design and Reverse Engineering of Rear Sprocket of a Yamaha CY80 Motorctcle", International Journal of Engineering and Technology Volume 4 No. 4, April, 2014.
[4]. "GEARS Designing and Drawing a Sprocket Educational Systems" 105 Webster St. Hanover Massachusetts 02339. www.gearseds.com
[5]. Nikhil P. Ambole, Prof. P. R. Kale "Design and Analysis of Carbon Fiber Sprocket" International Engineering Research Journal Page No 218-225
[6]. Sine Leergaard Pedersen "Simulation and Analysis of Roller Chain Drive Systems", PHD Dissertation, technical university of Denmark
[7]. Rexnord (n. d.). Chain Drive Design. A guideline to calculating and designing chain drives with a view to application-related criteria. http://rexnord.eu/fileadmin/Rexnord_Kette/PDF/Catalogue_Flyer/Auslegung_Kettentrieb_E.pdf
[8]. Wikipedia, Sprocket. http://en.wikipedia.org/Sprocket