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Impact of Poor Maintenance of Vehicle on its Fuel Consumption

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Abstract: The fuel consumption of automobiles is influenced by several number of factors like type of vehicle, traffic conditions, tire conditions, tire pressure, maintenance of the vehicle, load on the vehicle, Air fuel mixture, Fuel injection, fuel additives and speed etc.

In this research we analyses the effect of different parameters on fuel consumption. The benefit of this research is that if the fuel economy is calculated for vehicle is below up to a specific value, the it will put an emphasis on the maintenance of the vehicle and driving it under the safer conditions

Key Words: Vehicle, Fuel consumption, Maintenance, Load, Air-Fuel Mixture. Speed, Tire Pressure.

1. INTRODUCTION

In the context of transport, fuel economy is the energy efficiency of a particular vehicle, is given as a ratio of distance travelled per unit of fuel consumed. Fuel efficiency is dependent on many parameters of a vehicle including its engine parameters, aerodynamic drag, and Weight and rolling resistance. The fuel consumption of vehicles depend upon various aspects of the driving pattern, ie. Speed and acceleration profile which varies with the external conditions. It is now a well known fact that powered two wheeler occupy a leading position in the personal transportation sector both in the urban and rural areas in India. It is not surprising that the production and sales of two wheelers have been surpassing those of passenger cars by nearly a factor of five consistently for the last several years. Two wheelers have been forming over 75% of annual domestic sales of all vehicles for the last many years.

2. THEORY

Urbanization has paved the way for higher level of comfort and standard of living . Rapid urbanization has thus caused an increase in the number of vehicles and this on the other hand, is causing various types of problems lack of space, reduction in natural resources, environmental pollution etc. Thats why we need to consider the existence of a future generation and plan the utilization of our environment and resources wisely. The following sections are helpful in bringing about changes in the development of sustainable environment. For this we need to have a basic knowledge about fuel consumption, emission and air pollution, which are discussed briefly.

a) Fuel Economy: The fuel economy of an automobile is the fuel efficiency relationship between the distance travelled and the amount of fuel consumed by the vehicle. Consumption can be expressed in terms of volume of fuel to travel a distance, the distance travelled per unit volume of fuel consumed. Driver behaviour can affect the fuel economy, such as sudden acceleration and use of brakes excessively.

b) Air-Fuel Ratio:

The air fuel ratio is the mass ratio of air to fuel present in a combustion process such as in an internal combustion engine. If exactly enough air is provided to completely burn all the fuel, the ratio is known as stoichiometric mixture. For precise air-fuel mixture calculations, the oxygen content of combustion air should be specified because of possible dilution by ambient water vapour, or enrichment by oxygen additions. The air-fuel mixture is an important measure for anti-pollution and performance tuning reasons.

c) Overloading:

Exceeding a vehicle's maximum permissible weight is not only a danger to the driver and other road users and it is also an illegal offence which carries with it a range of risks and penalties. When transporting goods, the temptation to overload a vehicle in a bid to maximize payload and reduced overall fuel costs can be a costly mistake.

i) Increased running cost.

ii) Downtime

iii) Invalid insurance

iv) Loss of licence

v) Increased likelyhood of accidents

vi) Damage to roads

d) **Speed Range:** Introducing lower speed limits on motorways is expected to cut both fuel consumption and pollutant emissions. The exact benefit depend on the number of factors, however including both technological effects such as the fall in energy consumed when decreasing speed and non technological factors such as vehicle fleet composition, driving patterns, frequency of speeding, congestion and traffic diversion due to the speed limit. Setting a speed limit is about balancing three core priorities ie, mobility, safety and the environment. This suggests that there is clear value in providing citizens with a clear understanding are encouraging government to rethink their speed limits decisions and work to find a new optimum balance.

e) **Tire pressure:** A tire is a ring shaped vehicle component that covers the vehicle rim to protect it and enable better vehicle performance. We should not inflate our tyres above 40 psi or 280 kPa because when tyres get hot from driving, the pressure will increase even more. An under inflated tire creates more rolling resistance and therefore more fuel consumption. A tire pressure gauge is a pressure gauge used to measure the pressure of tires on a vehicle. Correct Tyre pressure can help to extend the life of your tire, improve vehicle safety and maintain fuel efficiency. Pressure is measured by calculating the amount of air that has been pumped into the inner lining of your tire in pounds force or bar pressure.

3. METHODOLOGY

Data were collected during an experimental study using a motorbike at different air fuel mixtures, under different loading conditions, at different traffic and road conditions, driving at different set of speed range. The bike was driven by two drivers and the readings were recorded analysed and worked upon.

First of all readings were taken at stochiometric A/F mixture. Then the air valve and fuel valve were set such as that the air- fuel mixture changed to rich and again the readings were recorded, the same procedure was followed with the air and fuel valves so as to get the air-fuel mixture is leaner.

Specifications:

Motorbike:
Type: Air cooled, four stroke single cylinder OHC
Displacement: 97.2 cc
Maximum power: 6.15 kW (8.36 Ps)@8000 rpm
Maximum torque: 0.82 Kg-m(8.05 N-m)@5000rpm
Bore*stroke: 50.0 mm*49.5 mm
Compresssion Ratio: 9.9:1
Starting: Kick start/ Self Start
Ignition: DC- Digital CDI

4. RESULTS

There are various types of graphs are shown below that shows the variation in fuel consumption at different parameters:

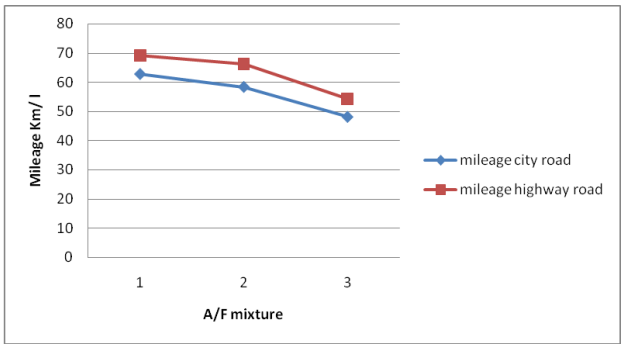


Fig 1: Variation of mileage at different A/F mitures under standard loading condition for two wheelers

The graph shows the changes in mileage with change in air-fuel mixture in case od standard loading. The mileage is measured in Km/l . Greater mileage is recorded on highway roads than on city roads. Lean A/F mixture means more mileage. It can be seen from the graph that as the amount of fuel increases from lean to standard. The mileage decreases from 69.1 Km/l to 66.2Km/l on highway roads and 62.7 Km/l to 58.3 Km/l on city roads. There is a steep decrease in the case of rich air-fuel mixture

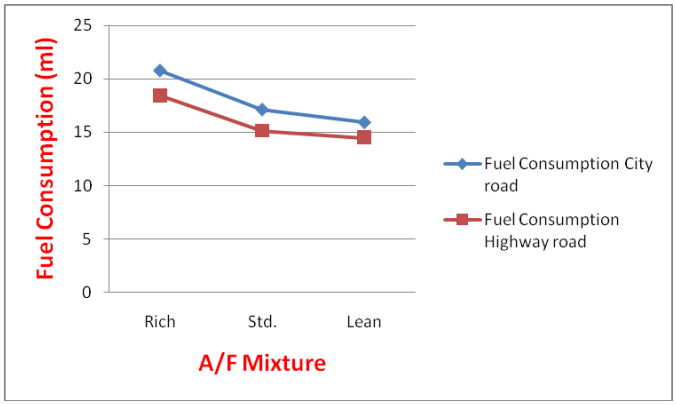


Fig 2: Variation of fuel consumption at different A/F mixtures under standard loading conditon for two wheeler

This shows that the change in fuel consumption with change in A/F mixture for a drive of one km. Fuel consumption is indicated in ml. Fuel consumption is more in city as compare to highway roads. On standard loading, as the amount of fuel increases from 14.47 to 15.1 on highway roads and 15.95 to 17.15 on city.

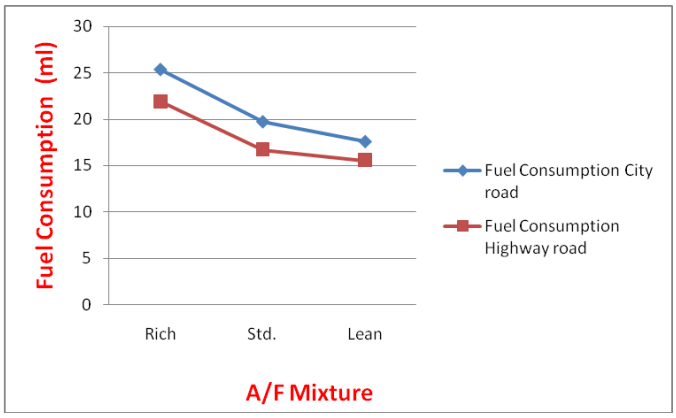


Fig 3: Variation of fuel consumption at different A/F mixture under overloading conditions for two wheeler

In overloading condition, as the amount of fuel increases in the mixture, the fuel consumption increases from 15.55 to 16.72 on highway roads and 17.57 to 19.72 on city roads. There is a higher increase in case of rich mixture.

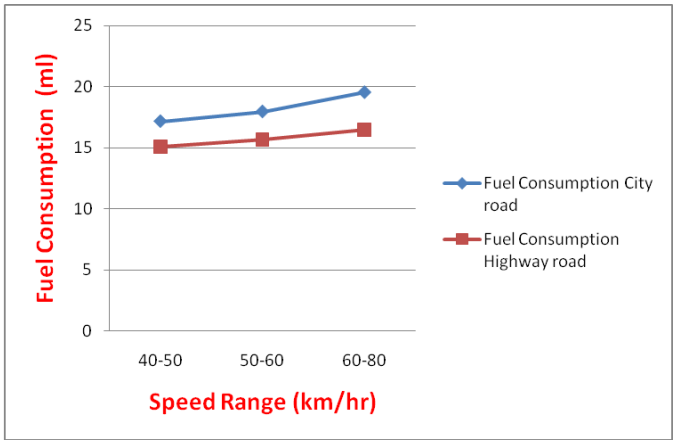


Fig 4: Variation of fuel consumption at different speed range for two wheelers

This graph shows the change in fuel consumption with change in speed range. The fuel consumption is in ml and speed in km/ hr. there is steady increase in the amount of fuel consumed with the increase in speed range. As the speed increases from 40-50 range to 50-60 range the fuel consumption increases from 15.1 ml to 15.65ml on highway roads and from 17.15 to 17.95 on city roads. Greater change can be observed in case of 60-80 speed range.

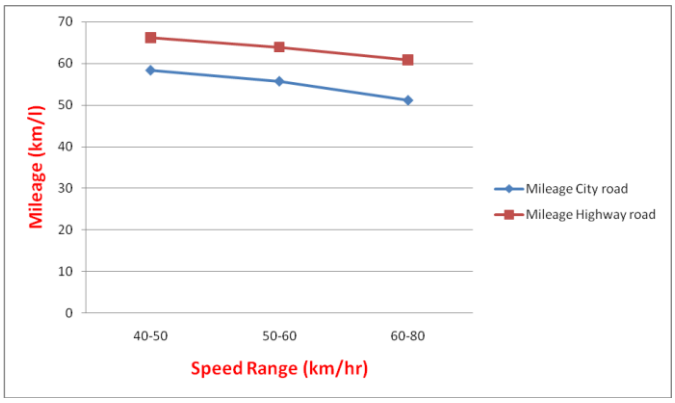
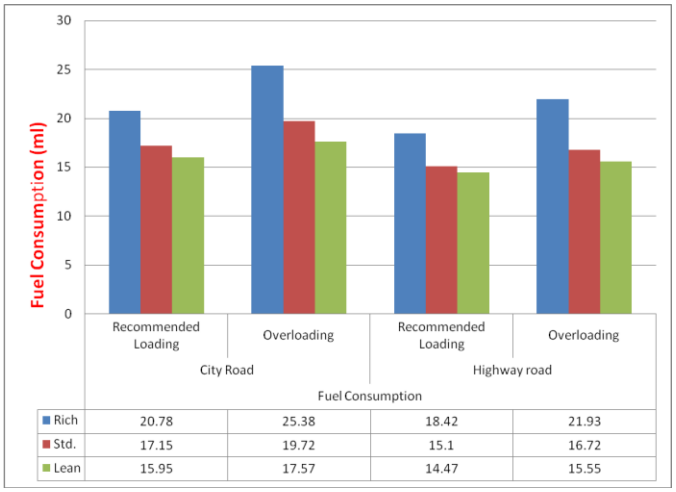


Fig 5: Variation of mileage at different speed range for two wheelers

The graph shows the change in mileage with change in speed range. The mileage is in km/l and speed in km/hr. There is steady decrease in mileage with the increase in speed range. As the speed increases from 40-50 range to 50-60 range the mileage decreases from 66.2 to 63.9 on highway roads and from 58.3 to 55.7 on city roads. Greater change can be observed in case of 60-80 speed range on city roads.

As per the change in tyre pressure the mileage is also changed. the tyre pressure decreases, range of the mileage decreases from 59.7 to 56.1 on city roads and from 67.1 to

62.8 on highway roads. Greater change can be observed in case of below 35 psi on city roads and also on highway roads.



Rich	20.78	25.38	18.42	21.93
Std.	17.15	19.72	15.1	16.72
Lean	15.95	17.57	14.47	15.55

Fig 6: Comparision of fuel consumed at different air-fuel mixtures under different loading conditions for two wheelers

The graph shows the change in fuel consumption on different roads for different types of loading as the mixture of fuel is changed. There is a slight increase in the amount of fuel consumed on recommended loading when the fuel mixture changes from lean to standard while it is prominent in case of change from standard to rich. This increase is much steeper in case of overloading.

5. CONCLUSION

The graph given below shows the change in %extra fuel consumed with change in A/F mixture for a drive of 1 km. %extra fuel consumed is more on city roads than on highway roads. As the amount of air decreases in the mixture, the %extra fuel consumed increases sharply. This increase is much sharper in case of rich mixture. From graph, %extra fuel consumed from 7.46% to 10.73% on highway roads and 10.16% to 14.98% on city roads as the mixture changes from lean to stoichiometric.

A/F Mixture	% Extra Fuel Consumed	
	City road	Highway road
Lean	10.16	7.46
Std.	14.98	10.73
Rich	22.14	19.05

Fig 7: % of extra fuel consumed

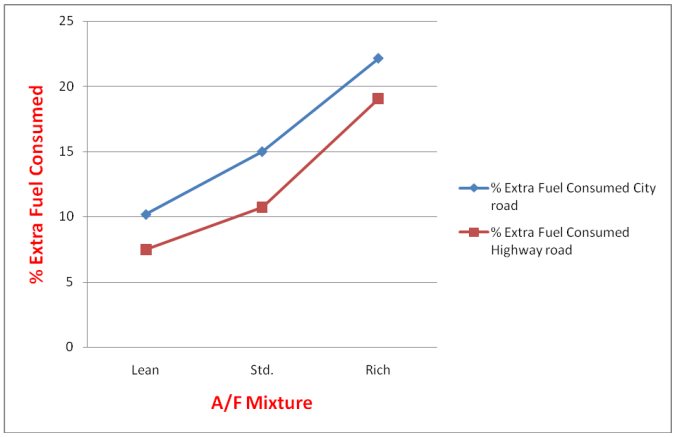


Fig 8: Graph between %age of fuel consumed and A/F mixture

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