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Fundamentals and Parameters Affecting the Performance of Tire down the road

Vikram Kulkarni[1], Santosh Kumar Bawage[2]

[1,2] *Assistant Professor,Dept.of Mechanical Engineering,DYPCOE,AK,Savithribai Pule Pune University,Maharashtra,India*

Abstract - The shape of the car tire not always round. but flat one weighing 30 pounds per square inch (psi) of pressure can support a car. If you were looking up at a car through a glass road, you could measure the size of the contact patch When the tire is spinning, the contact patch must move around the tire to stay in contact with the road. At the spot where the tire meets the road, the rubber is bent out. It takes force to bend that tire, and the more it has to bend, the more force it takes.

The force is converted to heat in the tire by the friction and work of bending all of the rubber. An under inflated or overloaded tire needs to bend more, it takes more force to push it down the road, so it generates more heat. The force required to overcome the friction is equal to the CRF multiplied by the weight on the tire.

Key Words: **CRF,Infalted Tire,Overloaded Tire.**

1. INTRODUCTION

In ancient time, after the discovery of wheel by man, it has been used extensively for various purposes and it is vital part of human life for ages. These wheels runs human life faster and faster with new technology used in automobiles. Tires are the second-highest cost for the trucking industry. Maintaining correct inflation pressure in tire helps to keep vehicle handling and braking at its best, as well as improving fuel efficiency and Tire life.

1.1 Parts of Tire

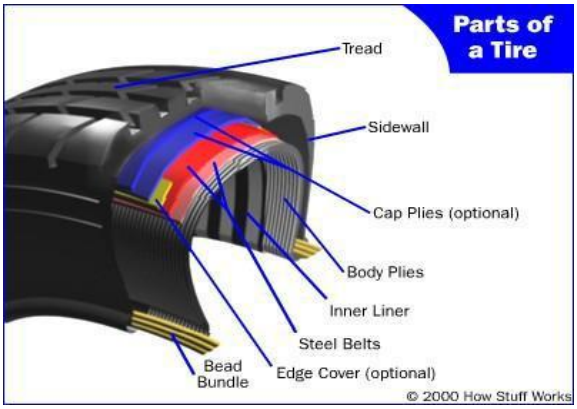

Fig-1: Parts of Tire

1.1.1. The Bead Bundle

The bead is a loop of high-strength steel cable coated with rubber. It gives the tire the strength it needs to stay seated on the wheel rim and to handle the forces applied by tire mounting machines when the tire are installed on rims.

1.1.2. The Body

The body is made up of several layers of different fabrics, called plies. The most common ply fabric is polyester cord. The cords in a radial tire run perpendicular to the tread. Some older tire used diagonal bias tire, tire in which the fabric ran at an angle to the tread. The plies are coated with rubber to help them bond with the other components and to seal in the air. A tire's strength is often described by the number of plies it has. Most car tire have two body plies. By comparison, large commercial jetliners often have tire with 30 or more plies.

1.1.3 The Belts

In steel-belted radial tire, belts made from steel are used to reinforce the area under the tread. These belts provide puncture resistance and help the tire stay flat so that it makes the best contact with the road.

1.1.4 Cap Plies

Some tire has cap plies, an extra layer or two of polyester fabric to help hold everything in place. These cap plies are not found on all tire; they are mostly used on tire with higher speed ratings to help all the components stay in place at high speeds.

1.1.5 The Sidewall

The sidewall provides lateral stability for the tire, protects the body plies and helps keep the air from escaping. It may contain additional components to help increase the lateral stability.

1.1.6 The Tread

The tread is made from a mixture of many different kinds of natural and synthetic rubbers. The tread and the sidewalls are extruded and cut to length. The tread is just smooth

rubber at this point; it does not have the tread patterns that give the tire traction.

2. Properly and Overinlated Tires

2.1 Properly inlated Tires

Properly attention of inflation on tire,load and speed are best parameters to decideand careful attention on hot weather.So the tire has proper pressure in the load to resistance ratio.

2.2 Under inlated Tires

It creates the more stress even without the proper loading. Stress will reduce the life. You can see that the under inflated/overloaded tire is less round than the properly inflated, properly loaded tire. When the tire is spinning, the contact patch must move around the tire to stay in contact with the road. At the spot where the tire meets the road, the rubber is bent out. It takes force to bend that tire, and the more it has to bend, the more force it takes. The tire is not perfectly elastic, so when it returns to its original shape, it does not return all of the force that it took to bend it. Some of that force is converted to heat in the tire by the friction and work of bending all of the rubber and steel in the tire. Since an under inflated or overloaded tire needs to bend more, it takes more force to push it down the road, so it generates more heat.

Fig-2: Properly and underinflated tires

3. Coeffiecient of Rolling Friction(COF)

You can use this number to calculate how much force it takes to push a tire down the road. The CRF has nothing to do with how much traction the tire has; it is used to calculate the amount of drag or rolling resistance caused by the tire. The CRF is just like any other coefficient of rolling friction: The force required to overcome the friction is equal to the CRF multiplied by the weight on the Tire.

Table-1:CRF for different type of Wheels

Tire	Coefficient of Rolling Friction
Low rolling resistance car tire	0.006 – 0.01
Ordinary car tire	0.015
Truck tire	0.006 – 0.01
Train wheel	0.001

4.Results

Table-2: Results of tire

Type of Vehicle	Weight in Pounds	Weight in Kg's	CRF	F=W*CRF in pounds
Car	4,000	1814.369	0.015	60

We know that power is equal to force times speed. So the amount of power used by the tire depends on how fast the car is going.

At 75 mph (120.7 kph), the tire are using 12hp, and at 55 mph (88.513 kph) they use 8.8 horsepower.

5. CONCLUSIONS

From these calculations you can see that the three things(Speed, Load and CRF) that affect how much force it takes to push the tire down the road (and therefore how much heat builds up in the tire) are the weight on the tire, the speed you drive and the CRF (which increases if pressure is decreased).

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