

Analysis of the Influence of Tread Pattern on Tire Grip on Road Surface

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Abstract. The role of tires on motor vehicles is very important, and very useful for reducing vibrations caused by road surface. Tires are the components of a vehicle that is in direct contact with the road. When we are driving a vehicle, the tires will also protect the wheel from wear and damage, as well as provide stability between the vehicle and the condition of the road surface to increase speed and facilitate the movement or friction between the tire with the road surface. Tires are one component of a vehicle that has a very vital function, in addition to controlling direction of the vehicle tires also functioned as penanggung vehicle weight including passengers it greatly affects the stability and performance of the tire during use so that the required accuracy in the selection of tires for vehicles. The study entitled "Analysis of the Effect of Shape traction Tread Pattern Of Ban On Asphalt Road Surface", formulated problem of how to influence the form of the tread pattern of the tire grip on the asphalt road and fuel consumption on a motorcycle. The purpose of this study was to determine the effect of the tread pattern of the tire grip on the asphalt surface and determine how much influence the fuel consumption in the engine capacity of 110cc motorcycles bertransmisi manual. This study uses a friction test on the tread pattern to be conducted performed by the run the vehicle up to speed past a predetermined total braking. Based on the analysis carried actual data, obtained the conclusion that the effect of the tread pattern using the same two types of tire that is bias-type braking distance cruiser get good results and stable use se30 corsa tires compared with nr72 irc tires. Keywords: tires; tread pattern; swipe test.

1. Introduction

Tire is a component of a vehicle contact with the road. The role of tires on any useful to reduce vibration caused by surface road. When we were driving a vehicle, the also will tires protect the wheel from wear and damage, as well as provide stability between the vehicle and the condition of the road surface to increase speed and facilitate the movement or friction between the tire with the road surface. Road surface roughness is a major factor affecting the coefficient of friction between the tire and the road surface. For a dry road with a smooth surface will give the coefficient of friction between the tire and the road surface, but on the contrary if wet it will give a small friction coefficient. In addition, the shape of the grooves on the tire also affects grip of the tire with the road surface.

2. Review of Literature

2.1 Tires

are one component of a vehicle that has a very vital function, in addition to controlling direction of the vehicle tires also functioned as penanggung vehicle weight including passengers it greatly affects the stability and performance of the tire during use so that the required accuracy in the selection of tires for vehicles.

2.2 Tire Type

There are several types of tires used on the vehicle:

- a. Structural Bias

Tire with bias structure is the most widely used. Made of many pieces of cord were used as a frame (frame) of the tire. Cord is woven with a zigzag manner to form an angle of 40 to 65 degree angle to the circumference of the tire.

- b. Radial structure for radial tire, the carcass construction cord angle 90-degree angle to the circumference of the tire. So viewed from the side cord construction is in the radial direction towards the center or crown of the tire. Part of the tire in direct contact with the road surface is reinforced by a kind of harness called "Breaker" or "Belt". These tires suffered only minor deformation in the form of centrifugal force, even at high speeds. This radial tire also has a "Rolling Resistance" is small.

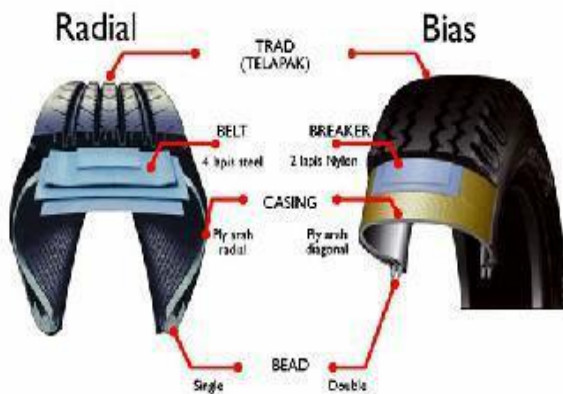


Figure 1. Structure Radial and Structural Bias On Tires (Buntarto., In 2015, the system of tires and wheels)

2.3 Function Tire

- a. Holding all the weight of vehicles

While holding the load, then the most influential is the wind pressure because the wind in the tires serves to support the weight of the vehicle and payload.



Figure 3. tire load bearing function (Buntarto., 2015, tire and wheel system)

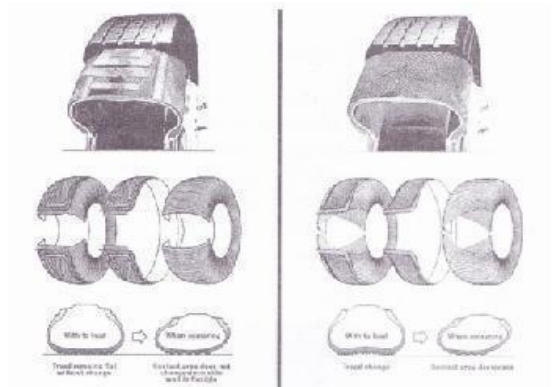


Figure 2. cross section of the tire (Buntarto., In 2015, the system of tires and wheels)



Figure 4. function tire to withstand shocks (Buntarto., 2015, tire and wheel system)

- b. Transfer the power to surface road pressure air and type tires (radial / bias) is very influential in dampen the early shocks before damped again by the suspension. Radial type tires able to absorb shocks better than bias tires.
- c. Moving the braking force to the road surface Tires serves to forward motion and the braking force to the road surface, which is influential in this regard is a *pattern* or a flower from palmstire.



Figure 5. function facilitates tire force Braking (Buntarto., 2015, *System Tires & Wheels*)

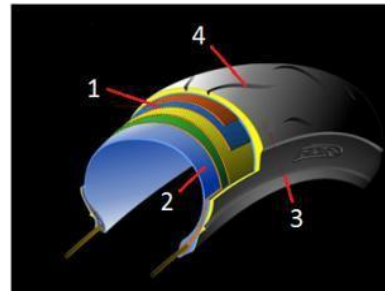


Figure 6. structure of the tire (Sugeng., 2013. *macam different types of motorcycle tires*)

d. Turn the steering system can work

Tires are very important in controlling the direction of the vehicle, this will determine the maneuverability and stability in driving, especially when turning.

e. Reduce the shock caused by uneven road surfaces.

2.4 Ban structure

1). Carcass

Carcass is an order of tires loud enough, strong enough to withstand high-pressure air, but be flexible enough to drown out the changes in load and impact. *Carcass* consists of a *layer of tire cord* (parallel woven sheets of strong material) are glued together with rubber. *Cord* on motorcycle tires normally made of polyester or nylon.

2). Inner Liner

special coating on tubeless tires that function similarly to the inner tube, which is as airbags. In tube type tire inner liner layer does not exist.

3). Rim Line

Lines useful reference when mounting the tire on the rim so that the tire does not feel shaky.

4). Tread grooves

forming grooves on the tire tread (pattern) which serves to remove water wet while crossing the street.

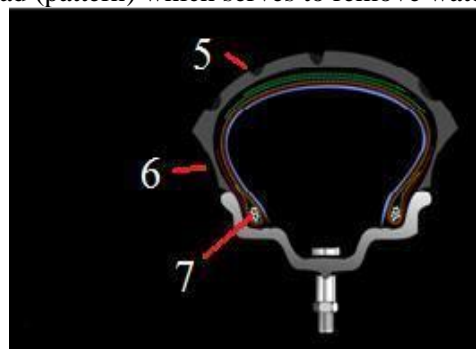


Figure 7. the tire structure (Sugeng., 2013. *macam different types of motorcycle tires*)

5). Tread

Tread is the outer rubber layer that protect *Carcass* against wear and damage caused by the road surface. This is the part that directly relate to the road surface and produces a frictional resistance force that moved into the vehicle braking force to the road surface.

6). sidewall

Sidewall is a rubber layer closes the side of the tire and may protect *Carcass* against wear and tear from the outside. *sidewall* Tire is part of the largest and most flexible, *sidewall* continuous to flex under load dipikuli during walking. On the *sidewall* of the information contained tire.

7). bead

In order to prevent tearing of the tire on the rim, because the variety of styles that work, the free side is surrounded by a steel wire called a wire. *bead* Pressurized air inside the tire pushing the *bead* out of the

rim and retained strong there. *Bead* protected from wear due to friction with the rim to the road gave him a hard rubber layer called *chafer* strip.

8). Swipe coefficient

of friction coefficient is symbolized by the Greek letter μ , which is a non-dimensional scale small value that describes the ratio of the frictional force between the two parts and the second compressive force. The coefficient of friction general formula is:

$$\mu = \frac{F}{N} \quad (Sears.Zemansky., 1962.fisika to universitas1) \quad (1)$$

Where:

μ = coefficient of friction

F = frictional force (Newton)

N = normal force (Newton)

The coefficient of friction depends on the materials used, as examples ice on steel has a low coefficient of friction, while rubber on tarmac (pavement) has a high coefficient of friction.

Table 1. coefficient of friction

Material 1	Material 2	Coefficien of friction
Rubber	Asphalt (Dry)	0.5 – 0.8
Rubber	Asphalt (Wet)	0.25 – 0.75
Rubber	Concrete (Dry)	0.6 – 0.85
Rubber	Concrete (Wet)	0.45 – 0.75

(Sears.Zemansky., 1962.fisika to universitas1)

3. Researcher's Methodology

3.1 Flowchart of Research



3.2 Tools and Materials

Tools and materials used this study as adalahin the following:

- a. Motorcycles
Motorcycles used in this test b erkapasitas 110cc engine Bertransmisi manual.
- b. Tires
Using two types of tires of different standards, namely tire cruiser (dealer) and cruiser (non-dealer).
- c. Sorong term
- d. meter
- e. Camera
- f. measuring cup
- g. Markers and pilox

3.2 Time and Place Obviously there

Executed in Lampung port city during the daytime hari.

3.2.1 Recording

There are two tests to be carried out which exams penginfluenceshapetread pattern of the grip and influenceshapetreadpattern Konsumtheof the fuel. In each test performed with different tires. Testing is done with traction tires menjallakan vehicle until a predetermined speed. eremanpeng then performed to obtain the distance and pen whether the tires on the road surface. Lakuk an experiment on any different tires. This test uakan sealed during the day, with normal asphalt road surface conditions (good) flat streets. Later experiments carried out bythemodifying fuel tank capacity of 1 liter BB M, then motor run and an kecepatan the same. Then viewed berap a lot of fuel is reduced. Normal vehicle condition, tire pressure on the front tire standarn yes 29 psi and 33 psi rear tire, with a vehicle weight of 96 kg plus rider 71 kg to 167 kg.

4. Results

4.1 Cengkram Tire Test Results

After the p engujian form the tread pattern of the tire grip da yaon the surface of the asphalt road to the state standard pressure front tire 29psi and rear tire 33psi, then the results obtained in the table as:

1). Actual Data Tread Pattern Tires IRC NR72 (dealer)

Table 2. actual data tread pattern tire irc nr72

N o	Kecepat an	Kondi si awal	Kondi si akhir	Jarak pengerem an
1	20km/ja m	5,34m m	5,28m m	1,66m
2	40km/ja m	5,34m m	5,18m m	5,53m
3	60km/ja m	5,34m m	5,02m m	8,67m

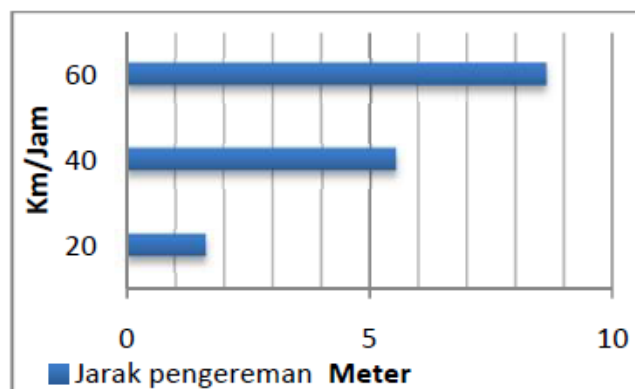








Figure 8. Graph distance irc nr72

Table 3. Result eroding on tire

No	Kecepatan	Kondisi Awal	Kondisi Akhir	Hasil Pengikisan pada ban
1	20km/jam	5,34mm	5,28mm	0,06mm
2	40km/jam	5,34mm	5,18mm	0,16mm
3	60km/jam	5,34mm	5,02mm	0,32mm

Table 4. Photo appearance tire on surface

No	Kecepatan	Foto penapakan ban pada permukaan jalan aspal	Kondisi Permukaan pada ban
1	20km/jam		
2	40km/jam		
3	60km/jam		

4.2 Data Actual Tread P attern Ban CORSA SE30 (non-dealer)

Table 5. actual data tread pattern tires corsa se30

No	Kecepatan	Kondisi awal	Kondisi akhir	Jarak pengereman
1	20km/jam	5,90mm	5,86mm	1,61m
2	40km/jam	5,86mm	5,76mm	5,39m
3	60km/jam	5,90mm	5,74mm	8,58m

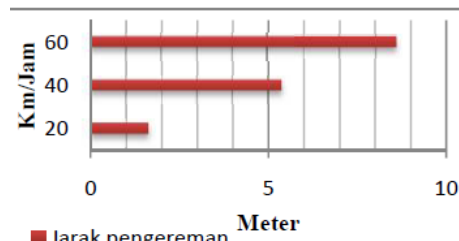


Figure 9. Distance braking tire corsa se30

Table 6. Result eroding on tire

No	Kecepatan	Kondisi Awal	Kondisi Akhir	Hasil Pengikisan pada ban
1	20km/jam	5,90mm	5,86mm	0,04mm
2	40km/jam	5,86mm	5,76mm	0,10mm
3	60km/jam	5,90mm	5,74mm	0,16mm

Table 7. Photo appearance tire on surface

No	Kecepatan	Foto penapakan ban pada permukaan jalan aspal	Kondisi Permukaan pada ban
1	20km/jam		
2	40km/jam		
3	60km/jam		

4.3 Discussion

That type of tire CORSA better SE30 comparison with the type of IRC tires NR7 2. with better braking distance SE30 CORSA tire type than the type of tires IRC NR72, abrasion tread pattern

(pattern tire) on the tire type COR SA SE30 more extravagant if done gereman pen in total due to SE30 CORSA tire traction over bai k compared with IRC tires NR72 and erosion at a very minimal tire tires CORSA contained in SE30. So tires are effective for everyday use a dalam kinds of bias tires Cruiser type CORS A SE30, because this tire has a tread pattern (pattern tire) that is g k to power permukaanengkrannya on asphalt roads. Based on test results traction tires on actual dat a treadpattern Theaboveby usingthe same two types of tire that is bias-type braking distance cruiser get good results and stable tires COR SA SE30 compared with IRC N R72 tires.

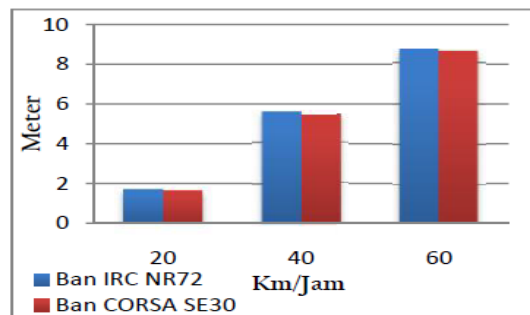


Figure 10. Different of distance braking

That type of tire is CORSA SE30 better than his grip with IRC NR72 tire type. With distance braking better type of CORSA tires SE30 compared to the IRC NR72 tire type, erosion tread pattern (flower pattern tires) on the CORSA SE30 tire type more wasteful if done braking total due to tire grip power CORSA SE30 is better than with IRC NR72 tires and erosion on a very minimal tire is on tires CORSA SE30. So an effective tire for daily use is a type of tire CORSA SE30 Cruiser bias type, Because This tire has a tread pattern (pattern flower tires) are good against power grip on the surface of the asphalt road.

The Kinetic Swipe Style that Occurred in this test the frictional force the kinetic that occurs is between the tread pattern on the asphalt road surface flat and obtained data as follows:

$$\begin{aligned} F_k &= N \cdot \mu_k \\ N &= W \cdot g \end{aligned} \quad (2)$$

Where:

$$\begin{aligned} N &= \text{load} = 167 \text{ Kg} \cdot g \text{ gravity} = 9.81 \text{ m/s}^2 \text{ normal force (Newton)} \\ F_k &= \text{gaya gesek kinetik (Newton)} \\ \text{Maka :} \\ N &= 167 \text{ Kg} \times 9.81 \\ &= 1638.27 \text{ Newton} \end{aligned} \quad (3)$$

$$\begin{aligned} &= \text{kinetic friction coefficient (obtained_ based on table)} \\ N &= \text{the kinetic frictional force (Newton)} \\ &= \text{So:} \\ &167 \text{ Kg} \times 9.81 \\ &1638.27 \text{ Newton} \end{aligned}$$

Thus, the kinetic frictional force (Fk):

$$\begin{aligned} F_k &= \\ &1064.8755 \text{ Newton} \end{aligned}$$

4.4 Fuel consumption test Results

1. Testing of fuel on the motorcycle engine capacity 110cc manual transmission using IRC tires NR72, capacity 1 liter of fuel (premium) is run until they run at a constant speed 40- 60km / h, can travel a distance of 47.9 km.
2. Testing the next fuel on the motorcycle 110cc engine capacity manual transmission using CORSA tires SE30, a capacity of 1 liter of fuel (premium) is run until they run at a constant speed 40-60km / h, can travel a distance of 48.2 km.

Table 8. Fuel consumption on a motorcycle

No	Nama Ban	Jarak Tempuh (Km)
1	IRC NR72	47.9 Km
2	CORSA SE30	48.2 Km

Fuel Based on the test results above, testers get the difference is not much different from just 0.3 Km = 300 Meter.

5. Closing

5.1 Conclusion

From the research result shape *tread pattern* of the traction tires on asphalt road surface has been get the conclusion

1. that the type of tire CORSA better SE30 types of tire grip compared to the IRC NR72. With better braking distance SE30 CORSA tire type than the type of tires IRC NR72, abrasion *tread pattern* (pattern tire) on the type of tire CORSA SE30 more wasteful when braking in total due to SE30 CORSA tires grip better than the tire IRC NR72.
2. After testing the fuel consumption in the engine capacity of 110cc motorcycle manual transmission, with a capacity of 1 liter of fuel (premium) is run until the end, it was concluded that the mileage in getting the IRC tires and tire NR72 47.9 Km CORSA SE30 48, 2 Km. Difference in distance of only 0.3 Km = 300 Meter.
3. The tires are effective for everyday use is a type tires CORSA Cruiser SE30.

5.2 Suggestions

1. Using homemade tire (*customize*) so that the ratio more detail.
2. Using the *tread pattern* (pattern tire) are different.
3. Using a large engine capacity motorcycles as motor sport.
4. Testing on winding roads and wet.
5. Using fuel pertalite or pertamax

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