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The Effect of Brake Padding Strikes and Reversing Spring Pressure on Acceleration of Drum Brakes

Listiyono[1*], Nurhadi[2], Hazlina Md Yusof[3]

[1,2] State Polytechnic of Malang ,Indonesia
[3]International Islamic University Malaysia

*Author Email: listiyono@polinema.ac.id, nurhadi@polinema.ac.id, myhazlina@iium.edu.my

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ABSTRACT

Car performance is getting better and better over time. This is thanks to developments in engineering technology. Starting from conventional systems to VVTI technology. What you get is great power with very economical fuel consumption (high efficiency). Even more important is good exhaust emissions. All of this is simply managed by a tool called the ECU (Electronic Computerized Unit).
However, this large power output cannot be used properly by a vehicle if it is not equipped with a good chassis system and power scanning system. For this reason, this research will look for/obtain a good chassis system that can match the good engine system to date. The objectives of this research are 1. Is there a big influence of the tensile force of the return lining spring and the stroke of the brake lining on speed acceleration. 2. Look for the right pulling force of the cotton turning spring and the right lining strokes to produce high speed acceleration. The method used in this research is experimental. Meanwhile, the material used is a type of brake lining that is available on the market and is marked with strokes. The reversing spring is set to the desired tensile force. And the research data will be processed using Minitab software.
The research results show that: 1. Scratches on the surface of the brake lining have a big influence on the release of the brake lining from the brake drum wall. By periodically applying strokes to the surface of the canvas, it will increase/maintain vehicle acceleration. 2. The pressure of the brake lining return spring affects the release of the drum brake lining. However, the greater the spring pressure, the more the vehicle's acceleration decreases. 3. Maximum scratches on the drum brake lining surface are 1 (mm).

Keywords: Drum Brakes, Spring Style, Drum Brake Pads, Speed Acceleration,

1. INTRODUCTION

There is no need to doubt the progress of automotive technology. All units in vehicles (cars) are now fully automatic. Lastly, there is the driver system. Just set the vehicle to run, stop and park wherever we want. Starting from starting the vehicle until the car stops again (with the engine off). This can be done automatically starting from the engine, power scanner, chassis and even accessories. It cannot be denied that these units can be used as icons as superior in producing new cars in the face of competition. However, until now there are still vehicle users who feel uncomfortable and unsafe when driving [1], [2]. Almost every day, even all the time, there is news about traffic accidents involving many vehicles on the highway. Even new vehicle products, this means that there are certain parts that are less safe [3], [4]. The main factor is usually caused by the chassis, then the next is human error. Recently there have been many large vehicle accidents, even on the highway. If studied more seriously, this is a lack of caution and accuracy on the part of vehicle users and technicians [5]–[7]. Many accidents are caused by poor chassis equipment [8], [9]. For example the braking system. Apart from functioning as a brake speed limiter. The brakes must also be able to be released quickly when the driver wants the car to accelerate quickly [10], [11]. The accident occurred on a straight, flat road, this was caused by a brake failure. Accidents that occur on uphill roads also occur because the brakes do not function [12], [13]. How a mechanic should prepare his vehicle before using it on the road. Because this concerns other road users. Especially the safety of public road users. In the case of vehicles like this, many studies have been carried out regarding problems with the brake system [14], [15]. However, brake problems are still the main problem causing car accidents on the highway.

Besides being used to limit vehicle speed by reducing vehicle speed, brakes are also used to stop vehicles quickly [16]–[18]. In addition, all brakes must also be released on time. How a driver must quickly release brake resistance quickly. The reason is that the driver wants to accelerate the

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vehicle quickly and precisely [19]–[21]. We can feel this when a vehicle is about to overtake another vehicle. Must immediately resolve and escape from the vehicle being overtaken. This means that the brake system must not hinder speed [22]–[24]. So the vehicle does not feel like it is moving forward, it even feels like it is going backwards faster than the vehicle it is trying to overtake. This means that the brake shroud clearance adjustment is incorrect. Not to mention if the surface area of the drum and its coating is less than proportional, this will hinder the reduction of friction force on the vehicle wheels [25]–[27]. Apart from flat and straight roads, many vehicle accidents occur on uphill roads. Indeed, sometimes the cause is human error, lack of dexterity in driving [28], [29]. But what is more important is that the brakes are adjusted correctly when pressing and releasing. How can a vehicle release the brakes and quickly change gears and increase speed quickly, meaning there must be an acceleration of speed and speed can increase [30], [31]. Because if you are even a little late, the vehicle can stop or even reverse. Especially with the heavy burden of passengers, panic atmosphere and so on. All this increases errors in vehicle braking and control [32].

For this reason, in this research the researcher focuses on the chassis, especially the vehicle brake system settings. Proper brake settings will provide responsive vehicle acceleration. Improve the coating engineering and adjustment of the return spring so that vehicle acceleration is not lost.

2. RESEARCH SIGNIFICANCE

In principle, brakes are used to limit vehicle speed by reducing the vehicle's speed, brakes are also used to stop the vehicle quickly. Brake performance depends on several factors, both the power available and the dimensions of the equipment. Brakes must be able/strong to withstand the load. Both in straight/flat road conditions as well as sloping and uphill. Apart from that, all brakes must also be released in a timely manner. How a driver must quickly release brake resistance quickly. Because the driver wants to accelerate the vehicle quickly and precisely. We can feel this when a vehicle is about to overtake another vehicle. Must immediately complete and escape from the vehicle being overtaken. This means that the brake system must not slow down the vehicle's speed for long while traveling. So the vehicle doesn't feel like it's moving forward, it even feels like it's going backwards less quickly than the vehicle it's about to overtake. This means incorrect brake sheath clearance adjustment. Not to mention if the surface area of the drum and lining is less than proportional, this will hinder the reduction of friction force on the vehicle's wheels..

3. RESEARCH METHODS

This research aims to obtain the number of lining strokes and the minimum spring pressure on the brake drum relative to vehicle speed acceleration. The brakes used in this research were drum brakes and were given spring pressure and lining strokes. Factors other than those mentioned above are conditioned to be the same for each sample. The samples/specimens in this study used hydraulic brakes

Testing is carried out by applying loads to the simulator construction. Data was recorded and collected on a data sheet prepared with three factors. .

This research was carried out at the Malang State Polytechnic Mechanical Engineering Workshop specializing in automotive. The research time is 60 (days) starting. The samples we used were 36 (thirty six) pieces selected well. The selected variables are

1. The independent variables are two factors: the number of lining strokes and the pressure force of the lining spring
2. Level factor brake lining stroke distance 4 mm, 5 mm and 6 mm.
3. Brake spring pressure factor levels 3 bar, 4 bar and 5 bar.
4. The dependent variable is the accuracy of acceleration

3.1 Setup Experiment

In collecting data, the steps used are as follows:

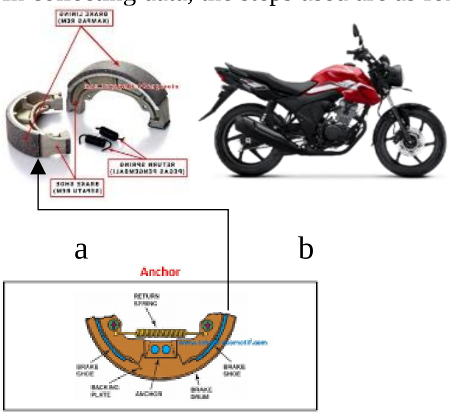

Fig 1. Setup Exsperiment

Whereas: 1. Brake pads are etched crosswise Level factor 4, 5, 6 (mm). 2. Reversing Spring is set at pressure force 3, 4, 5 (bar). 3. t is the result of the response time recorded over the distance (l) starting from a speed of 0 to 40 km/hour

4. RESULTS AND DISCUSSION

From the experimental results the following data can be collected.

Table 1 travel time data (seconds)

Padding scretches	Replication	Return Spring Presure (bar)		
		3	4	5
4	1	6,40	4,60	3,40
	2	6,20	4,40	3,70
	3	6,80	4,70	3,60
	4	6,50	4,30	3,10
5	1	6,10	4,10	3,05
	2	6,05	4,30	3,10
	3	5,60	4,10	3,25
	4	5,70	4,05	3,20

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6	1	5,90	4,10	3,05
	2	5,70	4,30	3,10
	3	5,60	3,60	2,90
	4	5,80	3,50	2,70

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Model	8	54,9910	6,8739	83,86	0,000
Linear	4	54,8140	13,7035	167,18	0,000
Distance of canvas stroke	2	2,9651	1,4826	18,09	0,000
Ret.Spring presure	2	51,8489	25,9244	316,28	0,000
2-Way Interactions	4	0,1769	0,0442	0,54	0,708
Distance of canvas *.Ret.Spring presure	4	0,1769	0,0442	0,54	0,708
Error	27	2,2131	0,0820		
Total	35	57,2041			

From the Minitab output, the results are as shown in the table above. It is shown that the F statistic for the distance of the lining strokes is 18.09 and the p-value is 0.00. Therefore, the temporary conclusion is that the distance of the lining on the lining influences the process of removing the brake lining from the drum wall.

That when the surface of the canvas is roughened/scratched, the friction surface area is reduced, this will cause the repulsion force to be smaller. So the speed of separating is faster. This is also supported by research by Prameswari, Diajeng where the smooth brake lining surface has a small coefficient. With a small coefficient, two rubbing surfaces can easily separate/separate.

Likewise, for the pressure force on the return spring out put Minitab F was calculated at 316.28 while the p-value was 0.00. Therefore, the temporary conclusion is that the return spring pressure has a significant effect on the release of the brake lining against the drum wall.

The large return spring pressure helps to release the lining, because this tensile force directly pulls the lining to counter the remaining brake fluid pressure due to the release of braking pressure. The greater the spring pressure, the faster the lining can be removed from the drum wall.

Meanwhile, the interaction between the distance of the canvas strokes and the return spring did not have a joint effect on the release of the canvas.

For this reason, we can then look at the optimum graphic analysis method for the Design of Experiment and the output can be seen as follows.

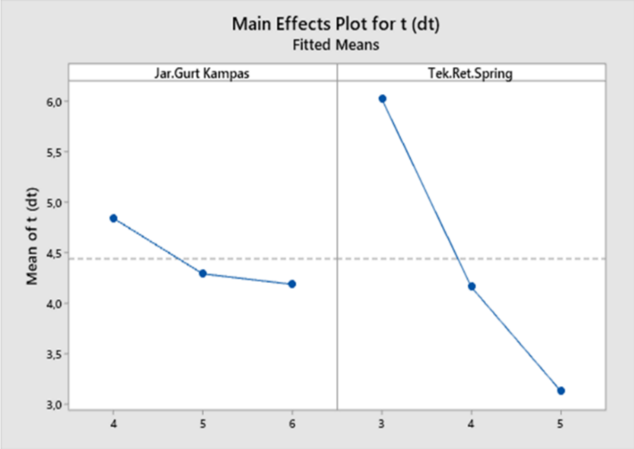

Figure 1 Influence Graph

From the results of the Minitab graph, it was found that at a stroke distance of 4 and a pad return spring pressure of 3.5, the greatest effect was on the release time of the brake pads against the drum wall. If you look at the lining with a smaller stroke distance and a maximum lining return spring pressure of 3 (bar), it is the fastest in releasing the brake lining from the drum wall.

From the graph, it can be seen that the smaller the distance between the canvas strokes, the faster the release speed of the canvas against the drum wall. Meanwhile, the longer the stroke distance and the higher the return spring pressure, the slower the release. This means that the surface of the brake lining becomes rougher, regardless of the size of the brake return spring pressure, it functions very well as long as the brake lining is still attached to the lining holder. It can be concluded that the brake lining return spring pressure made by the manufacturer can be used indefinitely until it breaks.

5. CONCLUSIONS

From the results of the analysis it can be concluded as follows.

1. The scratches on the surface of the brake lining have a big influence on the release of the brake lining from the brake drum wall. By periodically applying strokes to the surface of the canvas, it will increase/maintain vehicle acceleration.
2. The pressure of the brake lining return spring influences the release of the drum brake lining. However, the greater the spring pressure, the more the vehicle's acceleration decreases.
3. Maximum scratches on the drum brake lining surface are 4 (mm).

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7. AUTHOR CONTRIBUTIONS

- Conceptualization: Listiyono, Nurhadi
- Data curation: Listiyono,
- Formal analysis: Listiyono, Nurhadi
- Funding acquisition: Nurhadi, Hazlina Md Yusof.
- Investigation: Nurhadi
- Methodology: Listiyono, Hazlina Md Yusof
- Project administration: Nurhadi
- Resources: Listiyono, Hazlina Md Yusof
- Software: Listiyono
- Supervision: Listiyono, Hazlina Md Yusof.
- Validation: Nurhadi .
- Visualization: Nurhadi
- Writing – original draft: Listiyono
- Writing – review & editing: Listiyono, Hazlina Md Yusof

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