

THE DEMAGE ANALYSIS OF TOYOTA CALYA 1.2 TYPE GM/T 2017 REAR SHOCK ABSORBER

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ABSTRACT

One of the current trends is the LCGC (Low Cost Green Car), one of the LCGC cars that people are interested in is the Toyota Calya. However, like other automotive products, the Toyota Calya did not escape the complaints of its users. The complaint that is often experienced by consumers is that the rear shock absorber of the Toyota Calya has collapsed and leaked, even though the age of this car is actually not even 3 years old and the kilometers have not reached 40 thousand kilometers. In this final project, the author conducts several analyzes of what only cause damage to the shock absorber Toyota Calya. In this study, load tests and measurements were carried out on several factors that caused damage to the Toyota Calya shock absorber. From the results of the study, it was found that the damage to the shock absorber occurred due to the fatigue material in the shock absorber seal, causing oil leakage in the rear shock absorber of the Toyota Calya. The cause of damage to the genuine Toyota Calya shock absorber is due to deformation of the shock absorber spring due to the spring not being able to reduce the force load that occurs when the vehicle is fully loaded, so that the shock absorber has a stroke (shortening) that exceeds the allowable standard limit.

This causes the shock absorber to last longer. One solution to prevent the Toyota Calya shock absorber from sinking is to replace the shock absorber and spring with Kayaba's after-market products. Kayaba shock absorber has a larger diameter spring wire and a larger shock absorber diameter than the genuine Toyota Calya shock absorber. The second solution to prevent the Toyota Calya shock absorber from being damaged quickly is to reduce the full load on the vehicle. To avoid deflection or sinking symptoms in the rear shock absorber of the Toyota Calya is to reduce the full load on the vehicle. This of course will extend the life of the shock absorber, because a large spring deflection would result in damage faster in shock absorber components.

Keywords: Toyota Caly Rear Shock Absorber Damage

INTRODUCTION

In this era of technology that is developing very quickly, many new technologies have emerged to facilitate and assist in doing a job (Azis and Ramadhani 2021). Lately, many automotive manufacturers seem to be competing to create vehicles that are needed by the community. One of the current trends is the LCGC (Low Cost Green Car), one of the LCGC cars that people are interested in is the Toyota Calya. For the advantages of this car, namely the affordable price, flexibility of use, and fuel efficiency are three important points why this car is favored by the people of Indonesia. In fact, it's not just the new car that is being targeted by many consumers, this 7 seater LCGC used car is also still being hunted by many consumers.

However, like other automotive products, the Toyota Calya did not escape the complaints of its users. For example, a complaint that is often experienced by 2 consumers is that the rear shock absorber of the Toyota Calya has collapsed and leaked, even though the age of this car is actually not even 3 years old and in kilometers it has not reached 40 thousand kilometers. The damage was evident from the presence of oil seepage out of the shock absorber tube of his car.

There is oil seepage on the shock absorber tube, it often collapses when used for a full capacity of 7 people, and the slam feels hard and stuck when passing through potholes or speed bumps. The problem of leaking the rear shock absorber of the Toyota Calya was also found in the Daihatsu Sigra, several other consumers who are fellow users of similar but not the same cars feel that this complaint is not an open secret anymore.

THEORETICAL FRAME WORK

A. Definition of Analysis

System Analysis as the decomposition of a complete information system into its component parts with a view to identifying and evaluating problems and opportunities (Azis, Pribadi, and Nurcahya 2020)

B. Damage

Most of the damage to the car occurs due to negligence in carrying out maintenance on the car itself, whether it is due to the busyness of the user or lack of knowledge in the maintenance of the car used. Therefore, car owners need regular maintenance by detecting any damage that occurs to the car. (Qussay Rizhain and Sumadyo 2016)

C. Car Definition

Cars that have more passenger capacity are the choice of almost the majority of Indonesian people, the majority of whom have a large number of families, including in the city of Pekanbaru. The car, which is a low-cost car, is a family car with a capacity of 7-8 passengers, becoming an option for consumers. So that a car that is included as an affordable type that also has a large capacity is the toughest choice for the Indonesian people (Wulandari 2013)



Figure 1. Car

Definition of Suspension

Suspension can be defined as a preparation containing finely divided drug particles distributed evenly in a vehicle where the drug shows a very minimum solubility (Wahyuni, Yunalti, and Syofyan. 2017) , Suspension is a dosage form containing solid drug ingredients in fine and insoluble, dispersed in a liquid carrier and is a heterogeneous system consisting of two phases (Chasanah, Trisharyanti DK, and Indrayudha 2012)



Figure 2. Suspension

1. Shock A absorber

Shock absorber is an important component of a vehicle's suspension system, serves to reduce the oscillating force of the spring. Shock absorbers slow down and reduce the magnitude of the vibration of the movement, by converting the kinetic energy of the suspension movement into heat energy that can be dissipated through the hydraulic fluid (Majanasastra 2013) .



Figure 3. Shock absorber

Spring

A spring is a flexible machine element that can store energy from applied loads or forces and will return energy equal to the load if the load is removed (Jufri Sialana & Melianus Bunai 2018) .

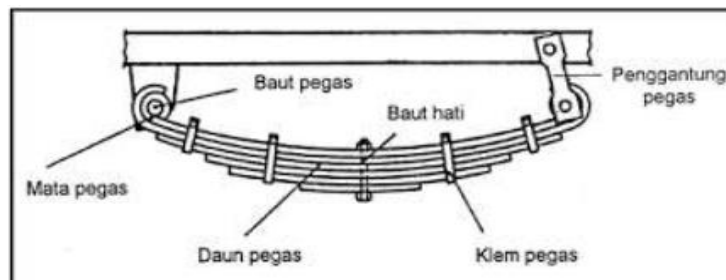


Figure 4. Spring

METHODS

This research was conducted in the Jatiwaringin Super Shop & Drive workshop area by observing the condition of the Toyota Calya shock absorber when there were customers who did service to the workshop, then the author conducted several analyzes of what caused damage to the Toyota Calya shock absorber. The author then carried out load tests and measurements of several factors that were considered the cause of the Toyota Calya shock absorber damage. The test results will be recorded data .



Figure 5. Toyota Calya Rear Absorber Seal Leak.

A. Research Flow

Explanation of each research flow step :

- Start
The steps of identification, testing, data collection and processing of the preparation of the report to completion.
- Field studies include:
 - a. Car user interview to the problematic part.
 - b. See the suspension components that are problematic
- Study literature
Based on references or references to books and the web in accordance with the material.
- Identification of problems
Find the factors what are the causes of the occurrence of the problem.
Pengujian against troubled suspension suspension Toyota Calya Test against the full load caused damaged suspension components.
- Data collection or data processing.
 - a. Data collection is the result of testing on problematic vehicle suspensions.
 - b. Data processing analyzes the results of the testing process.
- Preparation of reports.
Compile each process resulting from each of the steps of the Flow Chart.
- Done

B. Object Overview

1. Toyota Calya GM/T 2017



Figure 7. Research Object

DIMENSION OF TOYOTA CALYA G.MT/2017	
L x W x H	4070 mm x 1655 mm x 1600 mm
Wheel axle distance	2525 mm
Number of seats	7 seats
Empty weight	975 kg
Maximum capacity weight	1500 kg

Table 1 Specifications of Toyota Calya GM/T 2017 Based on Dimensions

ENGINE SPECIFICATION OF TOYOTA CALYA G.MT/2017	
Type	3NR-VE, 4 stroke in line, DOHC, dual VVT-i
Cylinder Volume	1197 cc
Maximum power	88HP @ 6000 rpm
Maximum torque	108 Nm @4200 rpm

Table 2 Specifications of Toyota Calya GM/T 2017 by Engine

FRAME SPECIFICATION OF TOYOTA CALYA G.MT/2017	
Transmission/drive	5 speed manual/front wheel drive
Front suspension	Mac Phearson Strut, Stabilizer, conch spring
Back suspension	Conch spring,torsion beam
Front /rear brake	Ventilated disc/ drum
Wheel size	Ring 14 with PCD 4x100

Table 3 Specifications Toyota Calya GM/T 2017 Based on the Frame

DISCUSSION

A. Measurement Result Table Data

The following is a table of test results for weighing each person's weight used in testing the loading of 7 passenger cars

Table 4 Measurement of Body Weight

MAN	WEIGHT
Man -1	75 kg
Man -2	72 kg
Man-3	65 kg
Man-4	83 kg
Man -5	68 kg
Man-6	60 kg
Man-7	72 kg

The following is a table of test data results, it can be seen the maximum vehicle load limit, the weight of an empty car, the total weight of 7 people and added 3 gallons of mineral water

Table 5 Load Specification

CATEGORY	LOAD	FORCE
Maximum capacity	1500 kg	15000 N
Empty weight	975 kg	9750 N
7 men weight	495 kg	4950 N
Car + 2 men weight	1122 kg	11220 N
Car + 5 men weight	1338 kg	13380 N
Car + 7 men weight	1470 kg	14700 N
3 gallon water weight	50 kg	600 N
Car + 7 men + 3 gallon of water weight	1530 kg	15300 N

Table 6 Results of Genuine Rear Shock Absorber Spring Constant

NO	CAR MASS	CAR FORCE	SPRING FORCE	DEFLECTION	DEFLECTION	SPRING CONTANT
1	975 kg	9.750 N	2437,5 N	80 mm	0,08 m	30.468,75 N/m
2	1.122 kg	11.220 N	2805 N	90 mm	0,09 m	31.166,6 N/m
3	1.338 kg	13.380 N	3345 N	110 mm	0,11 m	30.409 N/m
4	1.470 kg	14.700 N	3675 N	154 mm	0,154 m	23.863,6 N/m
5	1.530 kg	15.300 N	3825 N	174 mm	0,174 m	21.982,75 N/m

Average value of Spring Constant = $137.890.7 \text{ N/m} : 5 = 27.578.14 \text{ N/m}$

The following are the results of the shock absorber stroke stroke calculation:

Table 7 Calculation Results of Stroke Shock Absorber

SHOCK ABSORBER	GENUINE STANDART	GENUINE BROKEN	AFTER MARKET KAYABA
RESULT	174 mm	195 mm	85 mm

From the table data above, it can be seen a comparison of the calculation of the Stroke Shock Absorber step, for the allowable stroke condition on the Toyota Calya rear Shock Absorber is a maximum of 196 mm, it can be concluded:

1. The stroke condition on the genuine shock absorber which is still standard is 174 mm, meaning that this condition is very risky if the vehicle is running and receives a shock from the road surface, because it only leaves a clearance of 22 mm against the allowable stroke condition of 196 mm.
2. The stroke condition of the genuine shock absorber that has been damaged is 195 mm, meaning that this condition is very bad if the vehicle is running and receives a shock from the road surface, because it only leaves 1 mm of clearance against the allowable stroke condition of 196 mm.
3. The stroke condition on the after market Kayaba shock absorber is 85 mm, meaning that this condition is very safe if the vehicle is running and receives a shock from the road surface, because it still leaves a clearance of 111 mm against the allowable stroke condition of 196 mm.

CONCLUSION

From the research conducted, the following conclusions are obtained:

1. The cause of damage to the genuine Toyota Calya shock absorber is due to deformation of the shock absorber spring due to the spring not being able to reduce the force load that occurs when the vehicle is fully loaded with 1500 kg, so the shock absorber has a stroke that exceeds the allowable standard limit and causes shock damage. faster absorbers.
2. Referring to the results of hardness test data or hardness seal shock absorber. In accordance with the standard seal data table, a good seal condition has a maximum hardness of 85 Shore A , while the actual result of the seal hardness test is 93 Shore A. It can be concluded that material fatigue occurs in the shock absorber seal, causing oil leakage in the rear shock absorber of the Toyota Calya. .

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