

## Conference Paper

# Portion Improvement of Vehicle Entry Units Through The Improvement of Express Periodic Maintenance Service Methods in Cars Workshop

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### Abstract

This study aims to improve the specific periodic maintenance service method so that it can increase the unit entry portion per one working day in a workgroup in the car repair shop. The measurement using the standard time working group map used in the specific periodic maintenance service method before repairing was 44 minutes and 55 seconds with a total delay of 21 minutes and 10 seconds so that the unit entry portion was 9 units per one working day. The specific periodic maintenance service method that has undergone improvements results in an equal time between completing the work process at each vehicle position between technicians A and B and no delay time. So that the portion of the vehicle's entry unit from before being repaired 9 units to 12 units after the repair done because the time needed to complete a periodic vehicle service work with the specific periodic maintenance service method becomes more efficient, namely 34 minutes. In other words, there an increase in entry units of 3 units or 33% per one working day for each working group.

**Keywords:** periodic maintenance, express, unit entry.

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## 1. Introduction

The increasing need for transportation equipment in the community will not only affect the increasing number of companies engaged in the production of transportation equipment but also will have an impact on increasing competition in after-sales services. In the after-sales service sector, every company engaged in it must have an effective and efficient strategy to survive and win the competition [1].

After sales divided into four types of services, namely warranty, service services, spare parts sales, and supporting facilities. Maintaining customer satisfaction one of the right steps that can applied by companies to remain competitive and dominant

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market share in the after sales sector. To achieve this goal a Japanese-branded car repair shop in East Jakarta required to provide effective and efficient services to its customers. Companies that serve service services, service speed factors play a very dominant role along with the best and satisfying service quality [2].

Periodic maintenance service of four-wheeled vehicles in the workshop carried out every time the customer has traveled 10,000 kilometers or average time of 6 months, whichever of the two scales achieved faster by the vehicle. Because in the range of travel or time, several vehicle components must checked and maintained, even some others require replacement of components due to several factors, for example when every multiple of 20,000 kilometers of vehicle components such as nickel or brake pads must replace because wear and/or the possibility of deformation and the process requires more time [3].

Express periodic maintenance service one of the periodic maintenance service products on four- wheeled vehicles offered to customers in workshops that have very high mobility in big cities like Jakarta. Express periodic maintenance service a service product that offers periodic maintenance services for four-wheeled vehicles specifically for certain brands with a fast time because it done by two technicians who equipped with theory and work procedures so that they trained in their fields. However, from the observations there still several points in the working method which results in less efficient processing time, this can seen from the time waiting by the technicians to complete the work process. Efficient working methods in working time needed so that periodic maintenance service services run even better.

Planning the implementation of work by work procedures or Standard Operation Procedures essential, in which planning has conceptualized so that the work will become more efficient in processing time and effective on increasing the portion of the unit entry [4]. The existence of a structured concept can influence the process of implementing a regular and smooth service and can provide comfort for vehicle owners. Routine maintenance carried out by each vehicle owner to prevent the occurrence of damage that not unexpected to endanger the safety of the driver [5]. For this reason, efforts to improve periodic maintenance services need to address in order to obtain time efficiency and increase the number of repaired cars.

## 2. Literature Review

Maintenance activity carried out repeatedly with the aim that the equipment always has the same conditions as the initial state. Maintenance also did to keep equipment in a

condition that acceptable to its users. So periodic maintenance service an activity that programmed to follow certain ways to get the agreed conditions. Maintenance activities carried out in the workshop have two categories namely preventive and corrective care [6]. Preventive maintenance intended to protect the vehicle before the equipment becomes damaged. The treatment carried out to prevent unexpected damage from occurring so that it can endanger the safety of the driver. Corrective care intended to treat vehicles that already in an extreme condition. The activity carried out maintenance and maintenance carried out after the occurrence of an abnormality symptom in the drum brake system. This activity often referred to as repair or repair activities, so that this type of maintenance activity cannot predicted when it comes [4]. Judging from the understanding that periodic maintenance service categorized into preventive care. The method of express periodic maintenance service in the workshop a method used as a basis for work instructions on periodic maintenance services of certain brands of four-wheeled vehicles quickly with the provisions: vehicle age or use a maximum of under 10 years, periodic maintenance of vehicles at a distance of 80,000 kilometers and multiples then oil change transmission, axle oil, power steering oil, and radiator water carried out by technicians who handle general service, and if damage found that can hamper the periodic maintenance service process then the work will carried on by general service technicians [3].

For vehicle repairs, a special place needed. Workshop means a place that has activities and has definite direction and goals. Based on the decree of the minister of industry and trade number 551/MPP/Kep/10/1999 the workshop was classified into three criteria, namely class 1 workshop class II workshop and class III workshop. The meanings of the three workshops as follows: Class 1 workshop a workshop that able to perform periodic maintenance work, minor repairs, major repairs, chassis and body repairs, Class 2 workshops workshops capable of periodic maintenance work, small repairs and major repairs, or types of repairs to periodic maintenance, minor repairs and repair of chassis or body, and class 3 workshops workshops capable of carrying out regular maintenance and minor repairs.

Working group map (gang chart) a diagram that describes the steps of the process or a collection of several process flow maps where each process flow map shows a workshop series in more detail and complete. The usefulness of the working group process map as follows: providing information on the flow of materials or activities of people from the beginning of the process until the last activity, giving information about the completion time of a process, knowing the amount of activity experienced by the material or person during the process, and the tools for process improvement or work

method. The working group map contains the current work order and proposed work order wherein the workgroup process map which now contains the existing work order, while in the map the proposed work group process contains a work sequence that has adjusted or modified so that it looks different old and new, so that we can see the efficiency and effectiveness of the work as a whole.

The work group process map can analyze existing working conditions in order to obtain benefits or work process improvements such as: eliminating unnecessary operations, reducing the distance of movement from one operation to another, reducing time wasted due to waiting activities, indicate which operations should have the possibility to combined, show the steps of operation or over-checking or repetition, and show the work and location where the work carried out [7].

Work instructions according to ISO 9001; in 2000 a working mechanism document that regulates in detail and the sequence of an activity that only involves one function as supporting quality procedures or work procedures [8]. In principle, work instructions describe how one step in a procedure performed. Sometimes writing procedures very long so that the details not detailed, so it requires a more detailed and detailed explanation using work instructions. Work instructions made to explain parts of the procedure in detail.

### 3. Research Methods

In this study, the author conducted a study in one of the Japanese brand car repair shops in East Jakarta. In order to increase the portion of the unit entry through the improvement of the specific periodic maintenance service work method, in this study, an ongoing periodic maintenance service method observed. Measuring time efficiency on the work method of express periodic maintenance service. After it known the time of each stage then analyzed to improve the process sequence more efficiently. It expected that with time efficiency can increase the entry-level portion.

The data processing procedure consists of some basic processing operations that carried out in several sequences, namely:

1. Recording, that is, entering the value of the length of time from the points in the process of the work method express periodic maintenance service on the prepared worksheet, recording the process observed when needed, and finding and recording other appropriate supporting data.

2. Duplication (duplicating), this operation the duplication of data on forms or documents into a computer so that it easier to justify if an error occurs.
3. Verifying, because usually recording a manual operation, it essential that the data that has recorded carefully examined, there may errors, the addition of supporting data or even the reduction of unnecessary data. Moreover, it's better if you confirm to the competent resource person.
4. Classification, which separates data into various categories. The category in question the processes that must carried out in a stage of the entire process of implementing express periodic maintenance service.
5. Sorting, which to sort the stages according to the work process flow and work procedures.
6. Merging, which brings together the stages in one work method that complete.
7. Calculation, which to do numerical calculations on data that has put together so that the data can read and understood in its entirety.
8. Check tables, find and retrieve data (table look-ups, searching, retrieving). This operation intends to re-evaluate the data that has obtained in order to facilitate later when searching for data when needed.

Data processing done using a working group process map (Gang Chart). Then, from the two work maps, a working map proposed, proposed by the working method of express periodic maintenance service.

## 4. Results and Discussion

### 4.1. Before the proposal

Based on the results of the preliminary study before the proposal, a working group map recorded in Table 1-4. To handle periodic service maintenance, one vehicle needed by two technicians. Each technician's activity classified according to examination activities (P), input (I), transfer (T), and delay (D). When each activity recorded and sorted according to the sequence of Technicians A and B. From the time the two technicians can see how long the delay time occurs in Technician A nor Technician B.

From Table 1-4, we can see that when a vehicle under (I) technician B experiences a delay of 18 minutes and 5 seconds. When vehicles above (II) the technician B again

experience a delay of 2 minutes and 35 seconds. When a vehicle in the middle (III) the technician A experiences a delay of 20 seconds, and when a vehicle under (IV) technician A experiences a delay of 20 seconds.

TABLE 1: When the vehicle position under (I).

NO	TECHNICIAN A	ACTIVITY				TIME	TECHNICIAN B	ACTIVITY				TIME
		P	I	T	D			P	I	T	D	
1	POSITION OF VEHICLE BELOW					0:00:00	POSITION OF VEHICLE BELOW					0:00:00
2	Check the FR-LH door					0:00:05	Check the trunk lid backdoor					0:00:10
3	Check the seat belt FR-LH					0:00:05	Check RR-RH door					0:00:05
4	Check RR-LH door					0:00:05	Check seatbelt RR-RH					0:00:05
5	Check seat belt RR-LH					0:00:05	Check the FR-RH door					0:00:05
6	Check the engine hood					0:00:05	Check the FR-RH seatbelt					0:00:05
7	Install fender cover					0:00:20	Pull the engine hood opening lever					0:00:05
8	Check the shockbreaker bracket bolt					0:00:05	Check the brake brake function					0:00:20
9	Check the battery water level					0:00:10	start the engine					0:00:05
10	reservoir					0:00:10	Check the AC panel function and air flow					0:00:20
11	Check the level of water washer					0:00:10	Check steerig wheel freeplay					0:00:10
12	Check the fuel line leak					0:00:05	pedals					0:00:30
13	Check brake and clutch oil levels					0:00:05	Turn off the engine					0:00:05
14	Check the radiator cap					0:00:05	Check parking brake function (return to					0:00:10
15	Check radiator leakage (pressure tester)					0:00:20	Check the gas pedal					0:00:05
16	Check the air filter					0:00:10	Install the elevator on the right side of					0:00:10
17	Loose pressure tester					0:00:05	Change the AC filter					0:01:00
18	Replace spark plugs (nickel type only)					0:20:00	Install the left side lift of the vehicle					0:00:10
19	Open the oil filling lid					0:00:05	Remove the spare tire					0:01:00
20	Install one man brake bleeder bottle					0:00:30	Delay					
<b>TOTAL</b>		<b>4</b>	<b>15</b>	<b>1</b>	<b>0</b>	<b>0:22:45</b>	<b>TOTAL</b>	<b>7</b>	<b>11</b>	<b>1</b>	<b>1</b>	<b>0:04:40</b>
<b>DELAY</b>						<b>0:00:00</b>	<b>DELAY</b>					<b>0:18:05</b>

TABLE 2: When the vehicle position above (II).

NO	TECHNICIAN A	ACTIVITY				TIME	TECHNICIAN B	ACTIVITY				TIME
		P	I	T	D			P	I	T	D	
21	POSITION OF ABOVE VEHICLES					0:00:20	POSITION OF ABOVE VEHICLES					0:00:20
22	Wear a protective helmet					0:00:05	Wear a protective helmet					0:00:05
23	Install the oil drain tank					0:00:05	Check RR-LH wear and tire damage					0:00:20
24	Open the engine oil drain plug					0:00:10	Check the parking brake cable LH					0:00:10
25	Remove the oil filter					0:00:20	Check RR-LH suspension					0:00:05
26	Check engine oil and radiator leaks					0:00:10	Check RR-RH wear and tire damage					0:00:20
27	Check the brake and clutch pipe leaks					0:00:20	Check the RH parking brake cable					0:00:05
28	Replace the drive belt					0:03:00	Check RR-LH suspension					0:00:05
29	Install a new oil filter					0:00:20	Check the exhaust system					0:00:10
30	Install the oil drain plug					0:00:10	Check the wear and damage of FR-RH tires					0:00:05
31	Move the oil drain tank					0:00:05	Check RR-LH suspension					0:00:20
32	Remove the protective helmet					0:00:05	Check RR-RH wear and tire damage					0:00:05
33							Check RR-LH suspension					0:00:20
34							Remove the protective helmet					0:00:05
35							Delay					
<b>TOTAL</b>		<b>9</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>0:05:10</b>	<b>TOTAL</b>	<b>2</b>	<b>11</b>	<b>1</b>	<b>1</b>	<b>0:02:35</b>
<b>DELAY</b>						<b>0:00:00</b>	<b>DELAY</b>					<b>0:02:35</b>

Working hours The car repair shop at 8:00 a.m. to 4:00 p.m. with a 1 hour break time from 12:00 to 13:00. Only 7 hours of active employee work in one day. Procedurally, the time needed to complete one-time express periodic maintenance service 45 minutes (rounding from 44 minutes and 55 seconds). So that the portion of the periodic maintenance service for each technician 9 units/day.

### 4.2. After the proposal

When the vehicle in the 'under (I) position, technician B experiences a delay of 18 minutes and 5 seconds which should not occur, as a solution or proposal there several

TABLE 3: When the vehicle positioned in the middle (III).

NO	TECHNICIAN A	ACTIVITY				TIME	TECHNICIAN B	ACTIVITY				TIME
		P	I	T	D			P	I	T	D	
36	POSITION OF VEHICLES IN THE MIDDLE					0:00:10	POSITION OF VEHICLES IN THE MIDDLE					0:00:10
37	Check tire air pressure					0:00:10	Check tire air pressure					0:00:10
38	Check the wheel bearing					0:00:10	Check the wheel bearing					0:00:10
39	Remove the wheel (then the balancing process)					0:00:10	Remove the wheel (then the balancing process)					0:00:10
40	Install one man vacuum bleeder					0:00:10	Install one man vacuum bleeder					0:00:10
41	Check shockbreaker					0:00:05	Check shockbreaker					0:00:05
42	Check for brake fluid leakage					0:00:05	Check for brake fluid leakage					0:00:05
43	Check the brake pad thickness and clean it					0:00:30	Check the brake pad thickness and clean it					0:00:30
44	Check the thickness and thickness of the					0:05:00	Check the thickness and thickness of the					0:05:00
45	Check sealpiston leak front brakes					0:00:10	Check sealpiston leak front brakes					0:00:10
46	Remove one man vacuum bleeder					0:00:30	Remove one man vacuum bleeder					0:00:30
47	Check tire air pressure					0:00:10	Check tire air pressure					0:00:10
48	Check the wheel bearing					0:00:10	Check the wheel bearing					0:00:10
49	Remove the wheel (then the balancing process)					0:00:10	Remove the wheel (then the balancing process)					0:00:10
50	Install one man vacuum bleeder					0:00:30	Install one man vacuum bleeder					0:00:30
51	Check shockbreaker					0:00:05	Check shockbreaker					0:00:05
52	Check for brake fluid leakage					0:00:05	Check for brake fluid leakage					0:00:05
53	Check the brake pad thickness and clean it					0:00:30	Check the brake pad thickness and clean it					0:00:30
54	Check the thickness and thickness of the					0:05:00	Check the thickness and thickness of the					0:05:00
55	Check sealpiston leak front brakes					0:00:10	Check sealpiston leak front brakes					0:00:10
56	Remove one man vacuum bleeder					0:00:10	Remove one man vacuum bleeder					0:00:10
57	Delay						Check the damage and wear of spare tires					0:00:20
<b>TOTAL</b>		<b>6</b>	<b>14</b>	<b>1</b>	<b>1</b>	<b>0:14:10</b>	<b>TOTAL</b>	<b>6</b>	<b>15</b>	<b>1</b>	<b>0</b>	<b>0:14:30</b>
<b>DELAY</b>						<b>0:00:20</b>	<b>DELAY</b>					<b>0:00:00</b>

TABLE 4: When the vehicle position below (IV).

NO	TECHNICIAN A	ACTIVITY				TIME	TECHNICIAN B	ACTIVITY				TIME
		P	I	T	D			P	I	T	D	
58	POSITION OF VEHICLE BELOW					0:00:10	POSITION OF VEHICLE BELOW					0:00:10
59	Remove the brake bleeder bottle					0:00:10	Enter the spare tire again					0:01:00
60	Fill the engine oil and replace the lid					0:01:00	Pull the parking brake lever					0:00:10
61	start the engine					0:00:10	Fasten the FR-LH wheel					0:00:10
62	Turn off the engine					0:00:05	Fasten the FR-RH wheel					0:00:10
63	Check engine oil level					0:00:10	Remove the lift from the right and left side of					0:00:20
64	Remove the fender cover					0:00:10	Fasten RR-LH wheels					0:00:10
65	Close the engine hood					0:00:05	Fasten the RR-RH wheel					0:00:10
66	Delay											
<b>TOTAL</b>		<b>6</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0:02:00</b>	<b>TOTAL</b>	<b>7</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0:02:20</b>
<b>DELAY</b>						<b>0:00:20</b>	<b>DELAY</b>					<b>0:00:00</b>

points from the process done by technician A to transferred and divided to technician B and there additional points that done to technician B, namely the rearview mirror, so that the time taken by technicians A and B will the same, namely 13 minutes and 35 seconds. We can see the description in Table 5.

When the vehicle in the position above, technician B experiences a delay of 2 minutes and 35 seconds which should not occur, as a solution or proposal there several points from the process that done by technician A which will transferred and divided to technician B and there additional points did to technician B, which checking the power steering oil leakage, so the time taken by technicians A and B will the same, namely 3 minutes and 35 seconds. We can see the description in Table 6.

When the vehicle in a position in the middle of technician B experiences a delay of 20 seconds which should not occur, as a solution or a suggestion there a point from the process done by the technician B who will moved to the part when the vehicle under (IV), i.e., damage check and the wear of spare tires, so the time taken by technicians A and B will the same, which 14 minutes. We can see the description in Table 7.

TABLE 5: Proposed when the vehicle position above (I).

NO	TECHNICIAN A	ACTIVITY				TIME	TECHNICIAN B	ACTIVITY				TIME
		P	I	T	D			P	I	T	D	
1	POSITION OF VEHICLE BELOW					0:00:00	POSITION OF VEHICLE BELOW					0:00:00
2	Check the engine hood					0:00:05	Pull the engine hood opening lever					0:00:05
3	Install fender cover					0:00:20	start the engine					0:00:05
4	Check the fuel line leak					0:00:05	Check the AC panel function and air flow					0:00:20
5	Check brake and clutch oil levels					0:00:05	Check the brake brake function					0:00:20
6	Check the battery water level					0:00:10	pedals					0:00:05
7	Check the radiator water level of the reservoir					0:00:10	Check steering wheel freeplay					0:00:10
8	Check the level of water washer					0:00:10	Turn off the engine					0:00:05
9	Open the oil filling lid					0:00:05	(free position)					0:00:10
10	Replace spark plugs (nickel type only)					0:12:25	Check the gas pedal					0:00:05
11							Check the rearview mirror					0:00:15
12							Check the FR-RH door					0:00:05
13							Check the FR-RH seatbelt					0:00:05
14							vehicle					0:00:10
15							Check FR-RH door					0:00:05
16							Check seatbelt FR-RH					0:00:05
17							Check the trunk lid backdoor					0:00:05
18							Remove the spare tire					0:01:00
19							Check RR-LH door					0:00:05
20							Check seat belt FR-LH					0:00:05
21							Check the FR-LH door					0:00:05
22							Check the seat belt FR-LH					0:00:05
23							Change the AC filter					0:01:00
24							Install the left side lift of the vehicle					0:00:10
25							Check the shockbreaker bracket bolt					0:00:05
26							Check the radiator cap					0:00:05
27							Check radiator leakage (pressure tester)					0:00:20
28							Check the air filter					0:00:10
29							Loose pressure tester					0:00:05
30							Install one man brake bleeder bottle					0:00:30
31							Replace spark plugs (nickel type only)					0:07:35
<b>TOTAL</b>		<b>3</b>	<b>6</b>	<b>1</b>	<b>0</b>	<b>0:13:35</b>	<b>TOTAL</b>	<b>10</b>	<b>20</b>	<b>1</b>	<b>0</b>	<b>0:13:35</b>
<b>DELAY</b>						<b>0:00:00</b>	<b>DELAY</b>					<b>0:00:00</b>

TABLE 6: Proposed when the position of the vehicle below (II).

NO	TECHNICIAN A	ACTIVITY				TIME	TECHNICIAN B	ACTIVITY				TIME
		P	I	T	D			P	I	T	D	
32	POSITION OF ABOVE VEHICLES					0:00:20	POSITION OF ABOVE VEHICLES					0:00:20
33	Wear a protective helmet					0:00:05	Wear a protective helmet					0:00:05
34	Check engine oil and radiator leaks					0:00:10	Check RR-LH wear and tire damage					0:00:20
35	Check the clutch pipe leakage					0:00:15	Check the parking brake cable LH					0:00:10
36	Replace the drive belt					0:03:00	Check RR-LH suspension					0:00:05
37	Remove the protective helmet					0:00:05	Check RR-RH wear and tire damage					0:00:20
38							Check the RH parking brake cable					0:00:05
39							Check RR-LH suspension					0:00:05
40							Check the exhaust system					0:00:10
41							Check the wear and damage of FR-RH tires					0:00:05
42							Check RR-LH suspension					0:00:20
43							Check RR-RH wear and tire damage					0:00:05
44							Check RR-LH suspension					0:00:20
45							Check the leakage of power steering oil					0:00:05
46							Check the brake pipe leak					0:00:05
47							Install the oil drain tank					0:00:05
48							Open the engine oil drain plug					0:00:10
49							Remove the oil filter					0:00:20
50							Install a new oil filter					0:00:20
51							Install the oil drain plug					0:00:10
52							Move the oil drain tank					0:00:05
53							Remove the protective helmet					0:00:05
<b>TOTAL</b>		<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>0:03:55</b>	<b>TOTAL</b>	<b>8</b>	<b>13</b>	<b>1</b>	<b>0</b>	<b>0:03:55</b>
<b>DELAY</b>						<b>0:00:00</b>	<b>DELAY</b>					<b>0:00:00</b>

When the vehicle in a position below (IV) technician A experiences a delay of 20 seconds which should not occur, as a solution or a suggestion there a point from the process carried out by technician B to transferred to technician A, that “Pull the parking brake lever”, and there additional points made to technician B, namely checking damage and wear of spare tires, so that the time taken by technicians A and B will the same, namely 2 minutes and 10 seconds. We can see the description in Table 8.

TABLE 7: Proposed when positioning the vehicle in the middle (III).

NO	TECHNICIAN A	ACTIVITY				TIME	TECHNICIAN B	ACTIVITY				TIME
		P	I	T	D			P	I	T	D	
36	POSITION OF VEHICLES IN THE MIDDLE					0:00:10	POSITION OF VEHICLES IN THE MIDDLE					0:00:10
37	Check tire air pressure					0:00:10	Check tire air pressure					0:00:10
38	Check the wheel bearing					0:00:10	Check the wheel bearing					0:00:10
39	Remove the wheel (then the balancing					0:00:10	Remove the wheel (then the balancing					0:00:10
40	Install one man vacuum bleeder					0:00:10	Install one man vacuum bleeder					0:00:10
41	Check shockbreaker					0:00:05	Check shockbreaker					0:00:05
42	Check for brake fluid leakage					0:00:05	Check for brake fluid leakage					0:00:05
43	Check the brake pad thickness and					0:00:30	Check the brake pad thickness and clean					0:00:30
44	Check the thickness and thickness of the					0:05:00	Check the thickness and thickness of the					0:05:00
45	Check sealpiston leak front brakes					0:00:10	Check sealpiston leak front brakes					0:00:10
46	Remove one man vacuum bleeder					0:00:30	Remove one man vacuum bleeder					0:00:30
47	Check tire air pressure					0:00:10	Check tire air pressure					0:00:10
48	Check the wheel bearing					0:00:10	Check the wheel bearing					0:00:10
49	Remove the wheel (then the balancing					0:00:10	Remove the wheel (then the balancing					0:00:10
50	Install one man vacuum bleeder					0:00:30	Install one man vacuum bleeder					0:00:30
51	Check shockbreaker					0:00:05	Check shockbreaker					0:00:05
52	Check for brake fluid leakage					0:00:05	Check for brake fluid leakage					0:00:05
53	Check the brake pad thickness and					0:00:30	Check the brake pad thickness and clean					0:00:30
54	Check the thickness and thickness of the					0:05:00	Check the thickness and thickness of the					0:05:00
55	Check sealpiston leak front brakes					0:00:10	Check sealpiston leak front brakes					0:00:10
56	Remove one man vacuum bleeder					0:00:10	Remove one man vacuum bleeder					0:00:10
<b>TOTAL</b>		<b>6</b>	<b>14</b>	<b>1</b>	<b>0</b>	<b>0:14:10</b>	<b>TOTAL</b>	<b>6</b>	<b>14</b>	<b>1</b>	<b>0</b>	<b>0:14:10</b>
<b>DELAY</b>						<b>0:00:00</b>	<b>DELAY</b>					<b>0:00:00</b>

TABLE 8: Proposed when the vehicle position below (IV).

NO	TECHNICIAN A	ACTIVITY				TIME	TECHNICIAN B	ACTIVITY				TIME
		P	I	T	D			P	I	T	D	
57	POSITION OF VEHICLE BELOW					0:00:10	POSITION OF VEHICLE BELOW					0:00:10
58	Remove the brake bleeder bottle					0:00:10	Check the damage and wear of spare tires					0:00:20
59	Fill the engine oil and replace the lid					0:01:00	Enter the spare tire again					0:01:00
60	Pull the parking brake lever					0:00:10	Fasten the FR-LH wheel					0:00:10
61	start the engine					0:00:10	Fasten the FR-RH wheel					0:00:10
62	Turn off the engine					0:00:05	Remove the left-hand vehicle lift					0:00:10
63	Remove the right-hand vehicle lift					0:00:10	Fasten RR-LH wheels					0:00:10
64	Check engine oil level					0:00:10	Fasten the RR-RH wheel					0:00:10
65	Remove the fender cover					0:00:10						
66	Close the engine hood					0:00:05						
<b>TOTAL</b>		<b>8</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0:02:20</b>	<b>TOTAL</b>	<b>6</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0:02:20</b>
<b>DELAY</b>						<b>0:00:00</b>	<b>DELAY</b>					<b>0:00:00</b>
<b>TOTAL PROCESS WITHOUT DELAY</b>						<b>0:34:00</b>	<b>TOTAL PROCESS WITHOUT DELAY</b>					<b>0:34:00</b>

From the results of the research data analysis table, we can see that during the express periodic maintenance service process both technician A and B have not experienced delay in other words finished at the same time, and the total time required much shorter, i.e., 34 minutes from the original 44 minutes and 55 seconds or approximately 10 minutes and 55 seconds. Then the total time required per working day 12 units/working day. The portion of work using the improved periodic maintenance service express method obtained now to 12 units per one more working day 3 units of entry than the previous 9 units per one working day. If we calculate the percentage increase in unit entry portion per working day in one working group using the specific periodic maintenance service method that has fixed 33%. The improvement of the specific periodic maintenance service method can increase the unit entry portion by 3 units per one working day or by 33% from before repairs.

In this research, the improvement of specific method periodic maintenance service produced a new work instruction that had tested and confirmed by those who have competence in their fields, namely foreman as a quality control job and at the same time as the supervisor of this research. So that the work instructions can applied directly

to the workshop in East Jakarta or other branches through the approval of the company representative, namely the head of the workshop (workshop head).

## 5. Conclusion

Based on observations by using a working group map (gang chart) on the express periodic maintenance service method before experiencing improvement, it known that there an unbalanced division of work processes seen from the length of work time between technicians A and B, resulting in a delay in the process time and less systematic work processes. thus causing the technician not to use the maximum time given. The measurement using the standard time working group map used in the specific periodic maintenance service method before repairing was 44 minutes and 55 seconds with a total delay of 21 minutes and 10 seconds so that the unit entry portion was 9 units per one working day. The specific periodic maintenance service method that has undergone improvements results in an equal time between completing the work process at each vehicle position between technicians A and B and no delay time. So that the portion of the vehicle's entry unit from before being repaired 9 units to 12 units after the repair done because the time needed to complete a periodic vehicle service work with the specific periodic maintenance service method becomes more efficient, namely 34 minutes. In other words, there an increase in entry units of 3 units or 33% per one working day for each working group.

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## References

- [1] M. J. Bitner *et al.*, "Developing a car maintenance service concept for business customers - a case study of Veho Autotalot Oy," *Park. ...*, vol. 50, no. 3, pp. 66–94, 2008.
- [2] P. Kotler and K. L. Keller, *Marketing Management*, vol. 22, no. 4. 2009.
- [3] Nissan, "2016 Service and Maintenance Guide Table of Contents Owner ' S Literature Information," 2016.

- [4] G. Ravnestad, S. S. Panesar, D. Kayrbekova, and T. Markeset, "Improving Periodic Preventive Maintenance Strategies Using Condition Monitoring Data," *Adv. Prod. ...*, pp. 260–267, 2012.
- [5] A. Grigoriev, J. van de Klundert, and F. C. R. Spieksma, "Modeling and solving the periodic maintenance problem," *Eur. J. Oper. Res.*, vol. 172, no. 3, pp. 783–797, 2006.
- [6] R. L. Higgins, *Maintenace Engineering Handbook*. 2002.
- [7] R. S. Hussain, K. Ruikar, M. P. Enoch, N. Brien, and D. Gartside, "Process mapping for road works planning and coordination," *Built Environ. Proj. Asset Manag.*, vol. 7, no. 2, pp. 157–172, 2017.
- [8] A. Parida and U. Kumar, "Maintenance productivity and performance measurement," *Handb. Maint. Manag. engeneering*, pp. 17–41, 2009.