An Analysis of The Damage and Estimated Maintenance Costs A. Rozak Street City of Palembang

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Abstract. .A.Rozak Street is one of the city's streets that functions as a liaison between Patal Pusri Street with Monghinsidi.i Street. This road played an important role as a liaison to the industry area access and warehousing which have long 4.181 km, having two lanes to four lanes and a width of 14 m with the kind of roughness supple. The purpose of this research is to get how big the damage condition and value levels of damage with the clan Method so it can be known how much cost to repair on segment of A. Rozak Street City of Palembang. The kind of damage that occur, there are 7 different with each wave Damage Values 5,576.50 m2, the Groove 258.56 m2, Vanish 834.95 m2, convex 329.3 m2, The Damage To The Banks 452,91 m2, Cracked Lines 570.70 m2, Overweight 842,5 m2. Damage to the most dominant type of wave damage 9,53%, overweight 1,44%. The level of damage to the road conditions are with priority handling maintenance intervals. Based on the results of the estimation of costs to A.Rozak Street City of Palembang is Rp. 1,981,096,815.

Keywords: Road Damage, clan Method, Periodic Maintenance

1. Introduction

Road infrastructure has a very important role for human life. For the present and the future, during the industrialization period, trade and public transport, goods and services must be supported by adequate infrastructure, one of which is the main road infrastructure namely the highway. which is in the city of Palembang, one of which is the road A.Rozak / Patal Pusri / Mongosidi, which is the main route and its existence is very important, because in this path there are dense settlements, center of the pure, fertilizer factory Pusri, and ports that pass through this path. A.Rozak/Patal Pusri/Mongonsidi road, with a length of 4,181 km with a width of 14 m, is planned according to the design standards set by Bina Marga. In fact, there is a change in the composition of the traffic load, the earlier defects that should occur in this case need not occur, given the age of the plan has not been exceeded. Damages that occur include: Surface Texture, Pot Holes, Patching, Cracking, Rutting, Depression.

From the description above can be seen that the problem that needs to know solution is:

a. How much damage to road conditions on A.Rozak / Patal Pusri / Monghinsidi road?
b. What is the value of the priority sequence of road handling on the A. Rozak / Patal Pusri / Monghinsidi road segment?
c. How much does it cost to repair roads A. Rozak / Patal Pusri / Monghinsidi?

The research objective of pavement value on the A. Rozak / Patal Pusri / Mongosidi road segment is:

a. Analyzing the calculation of flexible pavement on A.Rozak / Patal Pusri / Monghinsidi road.
b. Analyzing the degree of damage to pavement bending road A.Rozak / Patal Pusri / Monghinsidi.

c. Analyze the need for repair costs and estimated costs of the A.Rozak / Patal Pusri / Monghinsidi road segment.

In order not to deviate from the objectives of the study then carried out some of the limitations of the problem as follows:

a. The streets under study are A.Rozak/ Patal Pusri / Monghinsidi along 4,181 km.
b. Analyzing the type of damage to the flexible pavement that has been occurring in the A. Rozak / Patal Pusri / Monghinsidi road segment is limited to the damage that occurs on the surface of flexible and functional pavement only.
c. Research method using DGH method (Procedure of Road Maintenance Program Repair), No.018/T/BNKT/1990.

2. Literature Review

2.1 Pavement Performance

Performance of road pavement then evaluated the value of road condition. In general, road conditions are grouped into 3 groups such as good condition, medium condition, and bad condition:

a. Good condition, i.e., pavement free condition of damage or defect and requires only routine maintenance in order to maintain road conditions is only to improve the quality of the vehicle without increasing the strength of the road structure.
b. Moderate conditions (fair), i.e. pavement conditions have significant damage and require periodic maintenance. overlaid and surface treatment. This type of maintenance increases structural strength.
c. Poor condition, i.e. paved road conditions that have extensive damage and require rehabilitation, structural reconstruction, multi-layer overlay, and general road improvement plans from maintenance upgrades of 8 - 10 years.

2.2 Road Damage

Basically, any road pavement structure will experience progressive destruction process since the first road opened to traffic **(Sulaksono 2001)**.

According to Road Maintenance Manual No.03/MM/B/1993 issued by the Directorate General of Highways, road damage can be differentiated above **(Silvia S, 1993)** type of damage**:**

a. Cracked fractures, crocodile cracks, edge fractures, shoulder crack joints and pavements, cracked road connections, cracked road extension joints, reflection cracks, shrinkage cracks, slip cracks.
b. Distortion, groove, curl, fall down, collapsed, convex.
c. The surface defects are holes, granular discharge, surface layer peeling.
d. Wearing.
e. Overweight.
f. Decrease in former utility cultivation

2.3 DGH Method

One of the methods used to analyze the value of pavement road conditions is the DGH method issued by the Directorate General of Highways measures to obtain the road condition values described in this method are as follow:

Table 1. LHR Determine the value of traffic

	LHR (unit of passenger car / day)	value of class of traffic
1	<20	0
2	20 - 50	1
3	50 - 200	2
4	200 - 500	3
5	500 - 2000	4
6	2000 - 5000	5
7	5000 - 20000	6
8	20000 - 50000	7
9	>50000	8

source: (Director General of, 1990)

Table 2. determinant of condition value

	cracking	
	Type	Number
1	E. Cracked crocodile	5
2	D. Random	4
3	C. Transverse	3
4	B. Elongated	2
5	A. There	1
	Wide	Number
1	D. -2 mm	3
2	C. 1-2 mm	2
3	B. < 1 mm	1
4	A. There	0
	Extent of	Number
1	D. > 30 %	3
2	C. 10 % - 30 %	2
3	B. -0.1	1
4	A. There	0
	Plot	
	Depth	Number
1	E. - 20 mm	7
2	D. 11 - 20 mm	5
3	C. 6 - 10 mm	3
4	B. 0 - 5 mm	1
5	A. There	0
	Patch	
	Luas	Number
1	D. -30 %	3
2	C. 20 - 30 %	2
3	B. 10 - 20 %	1
4	A. -10 %	0
	Surface Damage	
	Type	Number
1	E. Disintegration	4
2	D. Pelepasan butir	3
3	C. Rough	2
4	B. Fetty	1
5	A. Close texture	0
	Ambles	
	Large	Number
1	D. -5 /M100	4
2	C. 2 - 5/100 m	2
3	B. 0 - 2/100 m	1
4	A. There	0

source: (Director General of, 1990)

Table 3. determining the value of the road condition based on the total number

	Assessment of conditions	Value of Road Condition
1	26 - 29	9
2	22 - 25	8
3	19 - 21	7
4	16 - 18	6
5	13 - 15	5
6	10 - 12	4
7	7 - 9	3
8	4 - 6	2
9	0 - 3	1

source: (Director General of, 1990)

Calculating the priority value of road conditions using the Priority Equation = 17 - (LHR Class / Road Class + Road Condition Value) .....(2.1)

The determination of the road assessment program can be seen in the priority value of the road conditions above, where:

1. Priority order 0 - 3, indicating that the Nerada path in this priority order is included in the upgrade program.
2. Priority order 4 - 6, indicating that roads in the priority order are incorporated into the periodic maintenance program.
3. Priority order ≥ 7, indicating that paths in priority order are incorporated into routine maintenance programs.

Table 4. Priority value of the road conditions [7]

	Urutan prioritas	
1	0 - 3	Improvement program
2	4 - 6	Regular maintenance program
3	≥ 7	Routine maintenance program

Implementation of Priority Sequence (Directorate General of Highways, 1990)

2.4 Estimated costs

Based on the determination of the type of maintenance that has been determined, it can be calculated the volume of construction work. By multiplying the volume of work with the unit price of work, the construction costs (physical costs), supervision fees, and project administration costs will be obtained. The overall cost becomes a requirement of the Budget Plan. Up to this stage, it can be handled the type of maintenance, as well as the cost.

3. Research Methodology

3.1. Research sites

The location of the research was conducted on the A. Rozak/Patal Pusri/Mongosidi national road of Palembang in Fig.1 initial coordinate point X 104.768082, Y -2.950172, final coordinates X 104.798138, Y -2.966020 in Figure 1

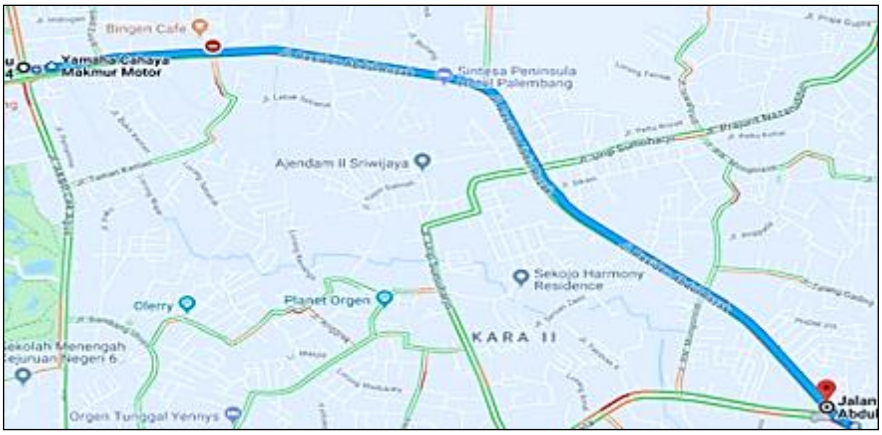
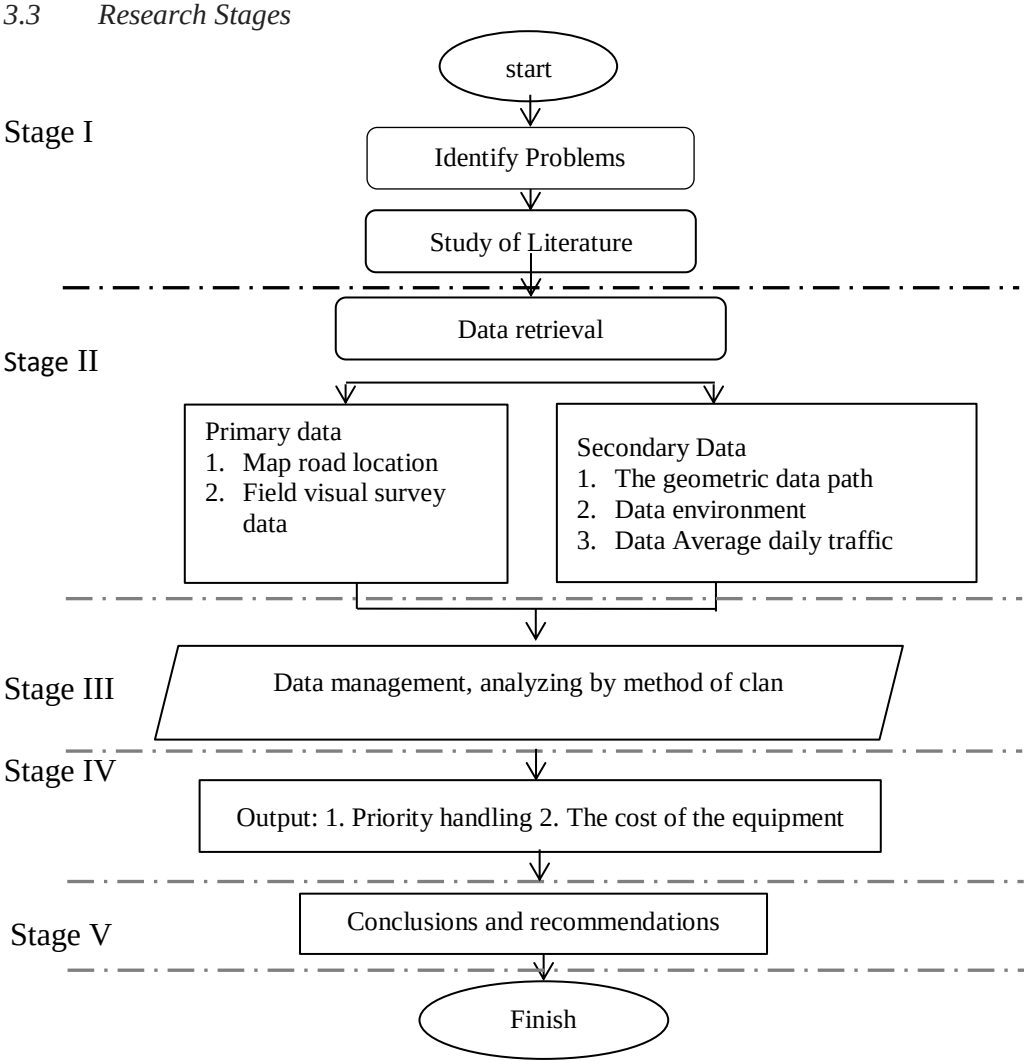


Figure 1. The location of the research (Source: google maps)

3.2 Data retrieval

Methods of data retrieval in the form of visual type of road damage at the location of research activities which is the primary data. While secondary data in the form of data obtained from SNVT Metropolitan Palembang and P2JN Palembang.

3.3 Research Stages



4. Results and Discussion

4.1 Data analysis

In Palembang A. Rozak road segment is a primary arterial road that serves the traffic flow of two-way vehicles, 2 lanes and 4 rows with LHR of 17.693 (u of pc) / day. In the survey the road surface pavement conditions were carried out for each lane (7 m wide left and 7 m right) by dividing the squares 100 meters in length, in each direction of traffic. Early stationing takes 00+000 to the end of stationing along 4.150 km.

Table 5. Recap Data Traffic Survey (ATC)

RECAP DATA TRAFFIC SURVEYS (ATC) BASED ON VEHICLES OF BINA MARGA VEHICLES (American Vehicle Convertible Class Result to Class DGH)										
No. Segment	Traffic Post	segment	Length (KM)	AADT 2012	AADT 2013	AADT 2014	AADT 2015	AADT 2016	AADT 2017	KETERANGAN
004.19K	A00419	**JLN. H. A.ROZK**	4.20	-	21,313	24,598	13,559	-	17,693	V

Data source: P2JN Metropolitan Palembang

Method of DGH

1. The LHR value of the A. Rozak road segment is 17.693 units of passenger cars / day, the table LHR table whereas the average daily traffic (LHR) uses the ATC (automatic traffic control) survey which has converted the American vehicle class to DGH based on the table 5 the value of the path class is 6.

Table 6. Percentage and Value of Road Conditions Left position

No	Km		L/R	Percentage of Damage	Condition value	Priority order value	Priority of Handling
1	0+000,0	0+600,0	L	5,48%	2	9	Routine maintenance
2	0+820,4	1+400,0	L	0,69%	2	10	Routine maintenance
3	1+502,0	2+791,0	L	2,50%	2	9	Routine maintenance
4	2+906,0	3+747,0	L	2,09%	2	9	Routine maintenance
5	3+990,2	4+181,0	L	15,12%	3	8	Routine maintenance
6	0+000,0	2+480,5	R	5,70%	2	9	Routine maintenance
7	2+705,5	3+911,0	R	2,38%	1	10	Routine maintenance

Data source: calculation results

in table 6 routine maintenance the largest percentage 15.12%, while the 0.69%

Table 7. Percentage and Right Condition Conditions of Road

No	Km		L/R	Percentage of Damage	Condition value	Priority order value	Priority of Handling
1	0+631,0	0+800,0	L	2,00%	6	5	periodic maintenance
2	1+403,0	1+495,0	L	0,00%	6	5	periodic maintenance
3	2+813,5	2+890,5	L	0,00%	5	6	periodic maintenance
4	3+814,5	3+883,9	L	20,79%	7	4	periodic maintenance
5	2+505,0	2+700,0	R	29,2%	5	6	periodic maintenance
6	4+022,5	4+181,0	R	34,3%	7	5	periodic maintenance

Data source: calculation results

in table 6 periodic maintenance the largest percentage of 34.3%, while 0.00%

Table 8. Damage Recapitulation Table Routine priority calculation results

No	Km		L / R	Hole (m2)	Groove / Puddle (m2)	Collapse (m2)	Crocodile Crack (m2)	Crack Lines (m2)	Crack lengthwise (m2)	Roughly peeled (m2)	Priority Handling
1	0+216,0	0+600,0	L	2,5	0,0	0,0	0,0	50,0	87,5	90,0	Routine
2	0+820,4	1+400,0	L	16,0	0,0	7,5	52,5	0,0	0,0	183,0	Routine
3	1+502,0	2+791,0	L	112,7	198,0	38,0	0,0	0,0	45,0	142,5	Routine
4	2+906,0	3+747,0	L	24,6	9,6	3,3	35,0	3,0	126,5	0,0	Routine
5	3+990,2	4+181,0	L	9,5	0,0	0,0	0,0	0,0	0,0	308,0	Routine
1	0+300,0	2+480,5	R	195,8	59,5	4,0	0,0	12,8	250,0	475,0	Routine
2	2+705,5	3+911,0	R	39,4	0,0	0,0	105,0	8,8	0,0	63,0	Routine
	Total crash			400,5	267,1	52,8	192,5	74,5	509,0	1261,5	

Data source: calculation results

In table 8 the damage to the largest routine maintenance was the largest / worst coarse 1261.5 m2 and the smallest 52.8 m2 groove / puddle.

Table 9. Damage Recapitulation Table Periodic handling priority calculation results

No	Km		L / R	Hole (m2)	Groove / Puddle (m2)	Collapse (m2)	Crocodile Crack (m2)	Crack Lines (m2)	Crack lengthwise (m2)	Roughly peeled (m2)	Priority Handling
1	0+631,0	0+800,0	L	0,0	0,0	0,0	700,0	29,0	0,0	0,0	Periodically
2	1+403,0	1+495,0	L	5,6	16,0	0,0	0,0	6,0	0,0	97,5	Periodically
3	2+813,5	2+890,5	L	2,0	13,5	0,0	0,0	3,9	0,0	0,0	Periodically
4	3+814,5	3+883,9	L	9,0	0,0	0,0	0,0	85,5	0,0	51,0	Periodically
1	2+505,0	2+700,0	R	8,9	0,0	76,2	245,0	30,0	30,0	19,0	Periodically
2	4+022,5	4+181,0	R	0,0	0,0	0,0	479,5	0,0	0,0	0,0	Periodically
Total crash				25,5	29,5	76,2	1424,5	154,4	30,0	167,5	

Data source: calculation results

In Table 9 the damage to the largest periodical maintenance was the largest / highest coarse 1424.5 m2 and the smallest 25.5 m2 hole.

Table 10. Recapitulation of L/R routine cost.

No	Maintenance type	Volume (m2)	Price/unit	Total
1	Hole (m2)	400.50	Rp 176,718.59	Rp 70,775,794.29
2	Groove / Puddle (m2	267.10	Rp 165,277.68	Rp 44,145,668.23
3	Collapse (m2)	52.80	Rp 203,322.02	Rp 10,735,402.75
4	Crocodile Crack (m2)	192.50	Rp 35,369.24	Rp 6,808,578.70
5	Crack Lines (m2)	74.50	Rp 19,891.71	Rp 1,481,932.40
6	Crack lengthwise (m2)	509.00	Rp 19,891.71	Rp 10,124,880.39
7	Roughly peeled (m2)	1,261.50	Rp 20,423.35	Rp 25,764,056.03
Total				Rp169,836,312.78

Data source: calculation results

Table 11. Rekapitulasi estimasi biaya berkala L/R

Maintenance type	Volume	price/unit	Total
Hole (m2)	25,49 m2	Rp 189.297,85	Rp 4.825.202,20
Groove / Puddle (m2	29,50 m2	Rp 189.297,85	Rp 5.584.286,58
Collapse (m2)	76,20 m2	Rp 305.618,30	Rp 23.288.114,46
Crocodile Crack (m2)	1424,50 m2	Rp 189.297,85	Rp 269.654.787,33
Crack Lines (m2)	154,40 m2	Rp 189.297,85	Rp 29.227.588,04
Crack lengthwise (m2)	30,00 m2	Rp 189.297,85	Rp 5.678.935,50
Roughly peeled (m2)	167,50 m2	Rp 189.297,85	Rp 31.707.389,88
Overlay AC- BC dan AC-	5326,30 m2	Rp 313.500,52	Rp 1.669.797.806,89
Total			Rp 2.039.764.110,86

Sumber data: hasil perhitungan

5. Conclusion

Based on the results of observations and analysis taken conclusion:

a. In the primary road segment A. Rozak from the result of calculating the value of the priority road condition of the first treatment with regular and periodic maintenance.
b. The routine handling of the cost calculation analysis is 169,836,312.78 rupiahs of the cost value for working on a roughly peeled asphalt of 1,261,5 m2, crack lengthwise 509,0 m2, hole 400,5 m2, puddle flow 267,1 m2, crack crocodiles 192.5 m2, cracked lines of 74.5 m2, and a slope of 52.8 m2.
c. As for the periodic handling of the calculation of the cost of 2,039,764,110,086 rupiah. to work on the asphalt surface with cracked crocodile 1,424,5 m2, crack lengthwise 167,5 m2, cracked line 154,4 m2, vanished 76,2 m2, cracked line 30,0 m2, groove 29,5 m2 and hole 25, 49 m2.

d. To restore road elevation conditions based on field surveys and calculation data analysis re-lined along 760.9 m 'road width 7 m total area 5326.3 m2 first layer AC-BC thickness 5 cm and 4 cm AC-WC wear layer.

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