Analysis of Road Damage Using The Bina Marga Method (Case Study Of The Balirejo Road Section, Special Region of Yogyakarta)

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ABSTRACT
Roads are land transportation infrastructure that includes all parts of the road and road damage is defined as a condition that describes road conditions that cannot function optimally. Road damage is classified into several such as cracks, distortions and surface defects. This research was conducted on the Balirejo road in the city of Yogyakarta. This study has several objectives, namely to determine the dominant type of damage that occurs on the Balirejo road, Yogyakarta City, to determine the value of the largest and smallest damage conditions on the researched road, to determine the amount of traffic volume in a certain time unit and to determine the priority value of handling and road repair. Based on the research and the results of data analysis using the Bina Marga method, the results showed that the type of damage that often occurs on the Balirejo road is cracked damage with a total damage of 33,875 cm². The biggest damage value is crack damage with a damage value of 33,875 cm². The total traffic volume is 501.2 pcu/hour and the priority value for handling or repairing the Balirejo Yogyakarta road section is a priority value of 9.33 which is categorized into routine maintenance program roads.

Keywords: *road damage, Bina Marga method, traffic volume, repair priority value.*

1. INTRODUCTION

The highway is a land transportation infrastructure that is very important in facilitating economic relations activities, both between one city and another, between cities and villages, between one village and another. Good road conditions will facilitate the mobility of the population in conducting economic relations and other social activities. Meanwhile, if there is damage to the road, it will result not only in the obstruction of economic and social activities, but also accidents can occur. [1] In Government Law No. 34 of 2006 roads are land transportation infrastructure which includes all parts of the road including complementary buildings and equipment intended for traffic that is on the ground above ground level, below ground level. land and or water surface, as well as above the water surface, except for railroads, lorry roads and cable roads. Damage to road infrastructure that is burdened by high and repeated traffic volumes will cause a decrease in road quality. As an indicator, it can be seen from the condition of the road surface, both structural and functional conditions that have been damaged [2]. A study on how the condition of the road surface and other parts of the road is needed to determine the condition of the damaged road surface. Initial research on the condition of the road surface is by conducting a visual survey which means by seeing and analyzing the damage based on the type and level of damage to be used as a basis for carrying out maintenance and repair activities [1][3]. Research purposes. To determine the type of damage to the dominant road that occurs on the Balirejo Yogyakarta road section, to determine the value of the largest and smallest damage conditions on the Balirejo Yogyakarta road section, to determine the the value of traffic volume on each road section of Balirejo Yogyakarta in units of passenger cars/hour (SMP/hour), knowing the value of the priority order of road handling and repair.

2. METHODS

Literature Review

Handoyo [4], University of Muhamadiyah Purworejo "Urban Road Damage Analysis Using the Highways Method" (a case study of Wonosobo district). The research objectives include: To determine the type of damage that is most dominant in urban roads in Wonosobo Regency, to assess the condition of the largest and smallest damage to the roads being studied, to know the order of priority for handling and repairing the highest and lowest roads. Based on the results of research and data analysis, various conclusions can be drawn as follows: Of the 13 road sections studied, the total volume of road damage is 1,339,688 m2. Consist ofsome types of damage as follows: Crack = 1,254,629 m2, Hole = 74.151 m2, Subside = 4.428 m2, Groove = 4,428 m2 . So the dominant damage found on urban roads in Wonosobo Regency is cracks with an area of 1,254,629 m2, the road that has the largest condition value is not always the main priority for handling, because to find out the priority order is also based on the slope value, road shoulder and LHR class value. - Each road segment obtained the largest condition value is Serayu road, Tirtoaji road and Sumbing road, namely 6.00. While the smallest condition value on the RSU road is 2.75, the order of priority with the lowest sequence value is 7 Serayu roads and Tirtoaji roads with a sequence value of the highest priority order value, namely the Beteng Sari road segment with a sequence value of 11. M. Rondi [5] Universitas Muhamadiyah Surakarta "Evaluation of Road Pavement According to the PCI (Pavement Condition Index) Method and alternative handling" Case study of the Danliris Blulukan-Tohudan Colomadu Karanganyar road section. Based on the results of the research that has been done, the conclusions are as follows: Jalan Danliris Blulukan-Tohudan from STA 0 + 000 to 1 + 250 has several types of surface damage, namely holes (2.98%), patches (0.67%), cracks crocodile skin (1.19%), longitudinal cracks (0.01%), subsidence (6.63%), loose grain (100%), the results of the analysis of the Highways Method have the result that UP = 3 (included in the road improvement program). While the PCI method has the result that the value of the level of damage is 2.66 (the road is categorized as failed), the comparison between the Bina Marga Method and the PCI Method lies in the LHR calculation used by Highways and the use of graphs for each type of damage to the PCI, and according to the final result, both this method has recommendations for handling which tend to be the same, the type of maintenance that can be done on this road to improve services and structural and functional feasibility is in the form of reconstruction using the CTRB (Cement Treated Recycling Base) method.

J. Dwijoko [6] researched on "Analysis of Damage to the Klaten Independence Pioneer Road Using the Highways Method". The results showed that the most common types of road damage were longitudinal cracks with a percentage of 50.52% and fillings with a percentage of 22.67%. While the value of road conditions shows the number 6 in the BM guideline, it means that it includes a priority order of 4, namely periodic maintenance. From these results, it is recommended that the thickness of the pavement layer for current traffic conditions is 12 cm of laston for the surface layer, 20 cm of upper laston for the foundation layer and 10 cm of sirtu/pitrun for the sub-base layer. With a plan life of 10 years for a service period until 2026 [7]

Research Methods

This research was conducted on the Balirejo road in the Yogyakarta City area. Due to the large number of urban roads in the city of Yogyakarta, the Balirejo road was taken as the research location with a section width of 5 meters and because the authors found some damage and heavy traffic activity on these roads, and also for roads with a width of 5 m. can be passed by car and can cross smoothly. Road damage survey is carried out on flexible pavement layers.

3. RESULTS AND DISCUSSION

This Damage Condition Research Results
Road damage survey data

1. Segment division on the Balirejo road section To simplify the calculation of the value of damage, the roads to be studied are divided into several segments. The number of segments on the Balirejo Yogyakarta road section is shown in the following table.

Table 1 Segment Division

Section name : Jl. Balirejo, Yogyakarta Length : 635.1 m width : 5m	
No.	**Segment Split**
1	0+0-0+100
2	0+100-0+200
3	0+200-0+300
4	0+300-0+400
5	0+400-0+500
6	0+500-0+638.1

Source: data analysis

2. Types of damage There are
   several types of damage that are seen from the results of direct research on the Balirejo Yogyakarata road including: Types of crack damage, Types of hole damage, Types of damage to sinks/legs.
3. Road condition survey data
   The road condition survey was conducted to generate or obtain road damage data on the Balirejo Yogyakarta road section. From the survey results obtained data as shown in the following table.

Table 2 Details of the damage value of the Balirejo road

BALIREJO ROAD DAMAGE VALUE DETAILS						
NO	**Segment**	**Damage type**	**Damage area**	**Damage peroentage**	**Damage value**	**Total value damage**
1	0+0-0+100	Hole	500	0.008		2
		Cracked	1412	0.024		
2	0+100-0+200	Hole	1559	0.026		3
		Cracked	5820	0.097		
		Legokan	5100	0.085	1	
3	0+200-0+300	Hole	2472	0.041	1	3
		Cracked	6018	0.100	1	
		Legokan	3570	0.060	1	
4	0+300-0+400	Hole	2821	0.047	1	2
		Cracked	5321	0.089	1	
5	0+400-0+500	Hole	5921	0.099	1	3
		Cracked	8698	0.145	1	
		Legokan	1736	0.03	1	
6	0+500-0+635.1	Hole	4491	0.075		3
		Cracked	6766	0.113		
		Legokan	2356	0.04	1	
TOTAL		HOLE	17764	0.296	TOTAL	
		CRACKED	34035	0.567		
		LEGOKAN	12762	0.213		

Source: data analysis

4. Pavement condition value
   Value of Road Pavement Condition is the value of the level of pavement damage in a road segment. This value is obtained from the total score of the total value of all segments on the road divided by the number of segments on that road segment. From the calculation results, the data obtained are as presented in the following table, the more detailed calculation data for the Road Segment Assessment can be seen in table 3 below.

Table 3 Assessment of road pavement

ROAD PADDING ASSESSMENT					
NO SEGMENT		ROAD DAMAGE VALUE			AMOUNT
		SLOPE SHOULDER DAMAGE			
1	0-100	2	1	1	4
2	100-200	3	1	1	5
3	200-300	3	1	1	5
4	300-400	2	1	1	4
5	400-500	3	1	1	5
6	500-635.1	3	1	1	5
AVERAGE DAMAGE VALUE					4.67

Source: data analysis

Average daily traffic is the average traffic volume in one day. To obtain the data used 2 ways as follows

a. Annual average daily traffic (LHRT)
   LHRT is the average number of vehicular traffic that passes one lane of the road for 24 hours and is obtained from data for a full year.
b. Average daily traffic
   To be able to calculate the LHRT, data on the number of vehicles must be available continuously for 1 full year. Considering the costs involved and comparing with the accuracy achieved and not all places in Indonesia have traffic volume data for 1 year, then for this condition the LHR unit can be used.

LHR is the quotient of the number of vehicles obtained during the observation by the length of the observation. To determine the LHR class the traffic volume results obtained are multiplied by the EMP (Passenger Car Equivalent) (see Table 4.4 EMP for Undivided Urban Roads) to then determine the LHR class (see Table 3.6 traffic classes for maintenance work).

From the results of the survey and the calculation of the value of road conditions then prioritized for handling needs. To determine the priority order of handling, data on the value of road conditions and data on the LHR class (Average Daily Cross) are needed for each road section studied. The LHR class data obtained from the traffic survey are included in Tables 4 and 5 below.

Table 4 Traffic survey results

TRAFFIC SURVEY RESULTS				
NO	MORNING TIME MOTORCYCLE	LIGHT VEHICLE	HEAVY VEHICLE	
	07:00-07:15	316	62	3
	07:15-07:30	319	29	3
	07:30-07:45	305	47	4
	07:45-08:00	294	63	6
TOTAL		1234	201	16
NO DAY TIME MOTORCYCLE	LIGHT VEHICLES	HEAVY VEHICLES		
	12:00-12:15	143	18	1
	12:15-12:30	159	21	0
	12:30-12:45	138	15	0
	12:45-13:00	165	12	1
TOTAL		605	66	2
NO TIME AFTERNOON MOTORCYCLES	LIGHT VEHICLES	HEAVY VEHICLES		
	15:30-15:45	211	29	1
	15:45-16:00	211	32	0
	16:00-16:15	207	31	4
	16:15-16:30	225	44	3
TOTAL		854	136	0

Source: traffic survey

Table 5 LHR value on the Balirejo road

NO	VEHICLE TYPE	EMP	TRAFFIC VOLUME	
			KEN/HOUR	SMP/HOUR
1	Motorcycle (MC)	0.4	897.67	359.1
2	Light vehicle (LV)	1.0	134	134.3
3	Heavy vehicle (HV)	1.3	6	7.8
TOTAL			1038	501.2

Source: data analysis results

Based on the data and results of calculations and discussions on Jalan Balirejo Yogyakarta, it can be categorized as Class LHR = 3 (obtained from table 3.6) and the value of road conditions = 4.67 (obtained from calculations in table 5.3). So it can be entered into the following formula. The assessment of road pavement damage in the Bina Marga method is categorized into 4 types, namely potholes, bends/collapses, cracks and wheel ruts. From the results of research on the Balirejo road Yogyakarta, the most dominant damage occurred was cracks with a percentage of damage = 0.567% and for comparison with other types of damage such as, legok / sinking, wheel ruts and cracks, we can see in the following table and graph.

Table 6 Total damage value on the Balirejo road section

TOTAL DAMAGE VALUE			
NO	DAMAGE AREA OF	DAMAGE PERCENTAGE	
1	Hole	17764	0.296
2	Crack	34035	0.567
3	Legokan	12762	0.213
4	Groove ruts	0	0

Source: data analysis

Meanwhile, to find out the comparison of each type of road damage on the Balirejo road section Yogyakarta can be seen in the following graph.

Figure 1 Graph of the percentage of each type of damage

4. CONCLUSION

Based on the results of research and data analysis, the following conclusions are obtained; The type of damage that often occurs on the Balirejo road is cracked damage with total damage 34,035 cm², From the survey results obtained the largest damage value, crack damage with a value of damage is 34,035 cm², while the value of hole damage is 17,764 cm², lego damage is 12,762 cm² and wheel rut damage is 0 cm². From the results of the traffic survey, the average daily traffic volume results, motorcycles MC 359.1 pcu/hour, light vehicles LV 134, 3 junior high school/hour and heavy vehicle HV 7.8 junior high school/hour. From these results, the total traffic volume is 501.2 pcu/hour. For the priority value for handling or repairing the Balirejo Yogyakarta road section, the priority value is 9.33, categorized into routine maintenance program roads.

ACKNOWLEDGMENT

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