Analysis of Road Damage Management Using the Bina Marga Method on the Access Road of Politeknik Negeri Lampung

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Abstract. Access roads at Politeknik Negeri Lampung (Polinela) support mobility for students, lecturers, and staff. The quality of these roads, particularly the level of damage, is a serious concern as it disrupts accessibility for students and staff. Additionally, this condition hinders academic activities and the overall operations of the campus. Adequate and appropriate repair efforts are necessary to ensure comfort and safety within the campus environment, thereby better supporting academic activities.The Bina Marga Method is an approach used to assess the level of road damage. The assessment is conducted using specific established criteria, such as road classification and the severity of damage. The data collected is then analyzed to determine the priority order for repairs and maintenance plans.
The access road to Polinela Campus is 1,616.4 meters long and has an average daily traffic volume of 1,011.5 passenger car units per hour, classifying it into traffic class 4. Based on the results of the analysis, the condition rating of the Polinela Campus road is 6, indicating that the priority order for road management is 7. Under these conditions, routine maintenance is required. The routine maintenance needed in this case includes patching holes and resurfacing the pavement.

Keywords: roads, damage, Bina Marga method

INTRODUCTION

Roads are one of the vital land transportation infrastructures that play an essential role in the movement of people [1]. The progress of development and the economy in an area is greatly influenced by road infrastructure. Roads serve as connections between regions or places to meet various user needs. This situation increases the volume and load of goods and services transported by roads [2]. Well-maintained roads reduce the risk of accidents, traffic congestion, and fuel consumption [3].

Many factors contribute to the deterioration of road pavement conditions worldwide. Flooding is a primary cause of declining road pavement quality in the Slovak Republic and Bangladesh [4][5]. In Jordan, there has been a significant increase in traffic volume on major roads over the past decade, resulting in severe damage to road infrastructure [6]. In Indonesia, the high mobility of vehicles traversing the roads and increased vehicle volume have led to a decline in road quality [7]. Furthermore, traffic loads exceeding planned limits also damage pavement [8].

One of the main issues caused by declining road quality is congestion [7]. The level of road damage also affects the speed of passing vehicles. The greater the damage to the road, the lower the vehicle speed [9]. Poorly maintained pavements also increase road maintenance costs, making it essential to inspect road conditions to determine the appropriate handling at the right time [10].

At the Politeknik Negeri Lampung (Polinela), road access is a crucial factor in supporting the mobility of students, lecturers, and staff. As the number of students, lecturers, and staff engaging in activities on the Polinela campus increases, there has been a rise in vehicle volume and load, leading to a decline in the quality of campus roads. The quality of road access is a serious concern as it is a crucial factor in the accessibility of students and staff. Additionally, damaged roads can hinder academic activities and campus operations. Effective repair and management efforts are necessary to ensure comfort and safety in campus mobility and support academic activities.

METHODS

Assessing pavement conditions is crucial in pavement management. The results of this assessment help determine whether the pavement still meets the required standards and identify the appropriate timing for repairs to the pavement layers [11]. Evaluating the surface condition of roads is essential for addressing road issues, both on roads that have reached their planned lifespan and on those experiencing damage [12].

One method for assessing road damage is the Bina Marga Method. This method was developed in Indonesia and produces a prioritization sequence and recommendations for maintenance actions based on that prioritization [13]. Types of road damage that need to be considered in the implementation of road damage surveys using the Bina Marga Method include surface roughness, potholes, patches, cracks, ruts, and subsidence [14]. This method employs a visual survey approach to assess road conditions, which includes observing traffic volume and the damage occurring in the field. The assessment of road conditions is conducted by summing the scores and values assigned to each type of damage identified [1].

In the Bina Marga method, it is necessary to conduct an average daily traffic survey to indicate the classification of traffic classes, as shown in **TABLE 1** below:

TABLE 1. Traffic Class for Maintenance Work

Traffic Class	Average Daily Traffic (passenger car units/hour)
0	<20
1	20 – 50
2	50 – 200
3	200 – 500
4	500 – 2,000
5	2,000 – 5,000
6	5,000 – 20,000
7	20,000 – 50,000
8	>50,000

In addition, data on the types and levels of road damage is also required, obtained through visual surveys of the assessed roads. The types of road damage that occur are then categorized into classes of road damage, as shown in **TABLE 2** below:

TABLE 2. Road Condition Index Based on Types of Road Damage

Cracks	
Type	**Number**
E. Alligator	5
D. Random	4
C. Transverse	3
B. Longitudinal	2
A. None	1
Width	**Number**
D. > 2 mm	3
C. 1 – 2 mm	2
B. < 1 mm	1
A. None	0

Amount of Damage	
Width	**Number**
D. > 30 %	3
C. 10 – 30 %	2
B. < 10 %	1
A. 0	0
Ruts	
Depth	**Number**
E. > 20 mm	7
D. 11 – 20 mm	5
C. 6 – 10 mm	3
B. 0 – 5 mm	1
A. None	0
Patches and Potholes	
Area	**Number**
D. > 30 %	3
C. 20 – 30 %	2
B. 10 – 20 %	1
A. < 10 %	0
Surface Roughness	
Type	**Number**
E. *Disintegration*	4
D. Ravelling	3
C. *Rough (Hungry)*	2
B. *Fatty*	1
A. *Close Texture*	0
Subsidence	
Area	**Number**
D. > 5/100 mm	4
C. 2 – 5/100 mm	2
B. 0 – 2/100 mm	1
A. None	0

Each number for all the road damages is then summed to obtain the road condition index based on **TABLE 3** below:

TABLE 3. Pavement Condition Value

Number	Value
26 – 29	9
22 – 25	8
19 – 21	7
16 – 18	6
13 – 15	5
10 – 12	4
7 – 9	3
4 – 6	2
0 – 3	1

The next step is to calculate the Priority Order (PO), which is determined based on the Average Daily Traffic (ADT) class value, the road condition obtained from the surface assessment, and the level of damage [11]. The Priority Order (PO) can then be calculated using the formula:

$$\text{Priority Order (PO)} = 17 - (\text{ADT Class} + \text{Road Condition Value}) \quad (1)$$

Where:

ADT Class = the value assigned according to the average daily traffic (see Table 1)

Road Condition Value = the value assigned according to the road condition (see **TABLE 3**)
The assessment results of the Priority Order are then grouped into criteria, including their handling, as shown in **TABLE 4** below:

TABLE 4. Priority Order and Handling Criteria

Priority Order	Handling
0 – 3	Improvement
4 – 6	Periodic Maintenance
7	Routine Maintenance

RESULTS AND DISCUSSION

The average daily traffic value is obtained after conducting surveys during peak hours of campus academic activities, specifically in the morning (from 6:30 AM to 7:30 AM) and in the afternoon after academic activities (from 3:30 PM to 4:30 PM), as shown in **TABLE 5** below:

TABLE 5. Average Daily Traffic Value

Time	Number of Vehicles per Category (vehicle/hour)			Volume (pcu/h)
	LV = 1,00	HV = 1,3	MV = 0,5	
Monday	151	0	1,721	1,011.5
Tuesday	84	0	949	558.5
Wednesday	80	0	617	388.5
Thursday	73	0	595	370.5
Friday	77	0	1,473	813.5
Total	465	0	5,355	3,142.5

Based on the table above, it can be seen that the highest average daily traffic value occurs on Monday, with a value of 1,011.5 pcu/hour. This traffic value falls into the category of roads with an Average Daily Traffic (ADT) range of 500 – 2,000 pcu/hour. This value indicates that the campus road at Polinela is classified as traffic class 4.

Road damage on the Polinela campus includes potholes and patches, alligator cracks, transverse cracks, and ravelling.

FIGURE 1. Type of Road Damage

The percentage of damage occurring on the Polinela campus road is presented in **TABLE 6** below:

TABLE 6. Recap of Road Damage

No	Type of Road Damage	Area of Damage (m^2)	Percentage of Damage
1	Transverse Cracks	19.10	0.27%
2	Alligator Cracks	77.24	1.10%
3	Patches and Potholes	283.35	4.05%
4	Ravelling	6,620.31	94.58%

The most common type of road damage is grain detachment, with a value of 94.58%, as nearly the entire pavement surface has experienced ravelling. In contrast, the least common type of damage is transverse cracks, with a value of 0.27%.

Based on the type and extent of the damage, the next step is to calculate the road damage value, as presented in **TABLE 7.**

TABLE 7. Road Damage Value

1	**Cracks**					
	Type	**Number**	**Width**	**Number**	**Area**	**Number**
	Transverse Cracks	**3**	> 2 mm	**3**	< 10%	**1**
	Alligator Cracks	**5**	-	-	< 10%	**1**
2	**Patches and Potholes**					
	Type	**Area**	**Number**			
	Patches and Potholes	< 10%	**0**			
3	**Surface Roughness**					
	Type	**Number**				
	Ravelling	**3**				
TOTAL		**16**				

The calculation results indicate that the road damage value for the Polinela campus is 16. According to Table 7, this value falls into the pavement condition range of 6.

The Priority Order value is then calculated using Formula 1, resulting in the following:

Priority Order (PO) = 17 – (ADT Class + Road Condition Value)
= 17 – (4 + 6)
= 17 – 10
= 7

A Priority Order value of 7, according to Table 4, categorizes this road under the Routine Maintenance Program, with the handling involving patching holes and resurfacing the pavement using cold mix asphalt.

CONCLUSIONS

The conclusions that can be drawn based on the survey results and analysis of the road damage at the Polinela campus road are:

1. The types of damage on the Polinela campus roads include alligator cracks, transverse cracks, patches and potholes, and ravelling.
2. The most common damage is ravelling, accounting for 94.58%.
3. The Priority Order (PO) value for handling the Polinela campus road is 7.
4. The necessary actions include implementing routine maintenance by patching potholes and resurfacing the pavement using cold-mix asphalt.

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