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THE ANALYSIS OF DETERIORATION OF VILLAGE ROAD: A CASE OF PALASAH-MAJALENGKA

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ABSTRACT

They are raising international issues related to road maintenance and repair. Road damage occurring in various countries, includ ing cracks, potholes, and surface deformation, significantly im pacts transportation safety and efficiency. Many roads in certain regions experience damage, such as cracks, potholes, and surfa ce deformation due to increased traffic loads and extreme weather conditions. This paper aims to analyze road damage in Karamat Village according to Bina Marga standards to identify and understand the causes and effects of such damage. Primary data is collected from field observations at the study site, referred to as primary or first-hand data. The road damage found on Pajaten Road in Karamat Village, Majalengka Regency, includes patches, cracks, disintegration, potholes, and waves. Routine maintenance aims to improve the surface layer quality without increasing structural strength. The Pajaten road section in Karamat Village, Majalengka Regency, has conditions of loose stones, cracks, patches, potholes, and waves. The Directo rate General of Highways states that the calculation results have a priority order 10, placing it in the priority group > 7. According to Bina Marga, road damage is addressed through a routine maintenance schedule. Patching is recommended and suggested for repairing road cracks, ruts, and collapses.

INTRODUCTION

Raise international issues related to road maintenance and repair. Road damage in various countries, including cracks, potholes, and surface deformations, significantly impacts transportation safety and efficiency. Road damage can result in problems beyond authorized government agencies' scope so road users can suffer direct losses (Sinambela & Rifai, 2024). Various factors, such as overloading, changes in weather patterns, inadequate drainage systems resulting in waterlogging, heavy traffic volumes, incorrect planning, implementation that deviates from pre-existing plans, and lack of monitoring of road conditions, can cause road damage (Isradi, 2021) Many roads in certain regions have suffered damage such as cracks,

potholes, and surface deformations due to increased traffic loads and extreme weather conditions. The Bina Marga Standard provides guidelines for assessing and repairing such damage to improve road safety and comfort. By following Bina Marga's guidelines, best practices in road maintenance that comply with international standards are expected to be applied, thereby improving the quality of road infrastructure globally. This highlights regional issues related to road infrastructure maintenance in various regions. Due to increased traffic loads and extreme weather conditions, many roads in certain areas have suffered damage, such as cracks, potholes, and surface deformations. According to Bina Marga standards, evaluating road conditions requires a comprehensive assessment method to identify the type and extent of damage. In many countries, road damage affects mobility and local and national economies, with increased repair and maintenance costs and decreased transportation productivity (Dardak, 2020). By following Bina Marga's guidelines, it is hoped that best practices in road maintenance can be applied by international standards, thereby improving the quality of road infrastructure globally

Highlight regional issues related to road infrastructure maintenance in various regions. Due to increased traffic loads and extreme weather, many roads in certain areas have suffered damage, such as cracks, potholes, and surface deformations. The Bina Marga Standard provides guidelines for evaluating and repairing damage to improve the safety and comfort of road users. Roads are expected to provide comfortable, safe, and efficient transportation services for the community (Wincent, 2022). In some areas, a lack of budget and resources is a significant challenge in making improvements that meet standards. Therefore, road damage analysis that follows Bina Marga's guidelines is essential to ensure that road maintenance efforts are carried out effectively and efficiently, thereby supporting mobility and economic growth. In addition, roads also provide a good solution for the smooth flow of traffic, which impacts the smooth delivery from one area to another (Barus and Rifai, 2020).

Road user safety is a crucial aspect of effective transportation infrastructure management. Good road management not only considers the physical condition of the road but also prioritizes factors that affect user safety. Road safety is a major global health issue, as most accidental injuries are caused by traffic accidents (Heydari, 2019). Some factors that affect road user safety include the geometric design of the road, vehicle speed, visibility, and traffic density levels. The influence of inadequate road infrastructure conditions on mobility is a significant concern in urban and rural transportation management. China One of the results of higher revenues is the skyrocketing ownership and use of motor vehicles in both countries (Pucher, 2018). Poor road conditions such as cracks, potholes, or surface unevenness can hinder the movement of motorized and non-motorized vehicles, directly impacting the mobility of the population. The increase in travel time and vehicle operational costs is one of the main impacts road users feel. In addition, accessibility to essential services such as education, health, and markets can also be disrupted due to poor road conditions, especially in rural areas that rely on land transportation networks. It is hoped that timely and focused road infrastructure improvements will increase population mobility, facilitate the flow of goods and services, and improve connectivity between regions. In the urban context, good mobility also positively impacts economic productivity and people's living standards.

The influence of road infrastructure conditions on the local economy is very significant in the context of a region's development and economic growth. Good, well-maintained highways increase more than just the flow of products and services; they also facilitate the flow of transportation and the distribution of local products. This means that logistics costs can be kept down, allowing local businesses to expand their market reach. In addition, adequate road conditions also increase the attractiveness of investment in the area because good accessibility

is one of the essential elements that investors consider. On the other hand, poor roads can lead to high transportation costs, especially regarding vehicle maintenance and more significant fuel costs due to slow and winding journeys. This impact is felt by business actors and the general public, who use the road every day. Therefore, investment in the maintenance and development of effective and sustainable road infrastructure is a strategic step to increase the competitiveness of the local economy, increase employment opportunities, and improve the community's living standards. One of the world's most ambitious infrastructure investment projects is the Belt and Road Initiative (BRI) in history, which represents tremendous potential to stimulate regional economic growth in Asia, Europe, and Africa (Wang, 2020).

We are raising national issues related to the condition of road infrastructure, which is very important for mobility and the country's economy. In the development of the construction world, an efficient highway infrastructure network is a determining factor in encouraging the socio-economic development of a country and region (Salsabila, 2022). Widespread road damage, such as cracks, potholes, and deformations, negatively impacts road user safety and transportation efficiency. The Bina Marga Standard provides comprehensive guidelines for evaluating and dealing with this damage to ensure roads remain in good condition. However, in Indonesia, challenges such as budget and resource constraints often hinder the implementation of standard improvements. By adopting and implementing road damage analysis by Bina Marga guidelines, Indonesia can improve the quality of national road infrastructure, which ultimately supports economic growth and community welfare. The road network system is one of the most critical needs for the economic development of any country, especially developing countries (Rashid, 2018).

In the short term, the main focus is quick repairs that address pressing issues such as holes, cracks, or uneven surfaces. These measures involve routine maintenance such as patching, replacing worn asphalt layers, and repairing damaged underground structures. On the other hand, the long-term improvement plan aims to carry out a significant update to road infrastructure that may be outdated or unable to bear the increasing traffic load. This could include replacing the undercarriage structure, expanding the road body, increasing the capacity of the road, or developing new roads in line with urbanization and urban development. This long-term plan requires an in-depth analysis of long-term infrastructure needs and adequate budget allocation from the government or other funding sources. Implementing these two plans on an ongoing basis is hoped that the existing road network will remain in optimal condition and support economic growth and community mobility effectively and efficiently. Short-term and long-term road improvement plans are essential to maintain and improve existing road infrastructure conditions. These conditions increase the pressure on existing urban road infrastructure and require substantial maintenance, often expanding inter-village-urban roads and local roads as the mobility of people and goods increases (Handayani, 2018).

One of the latest technologies adopted is smart road sensors that monitor real-time road conditions. These sensors can detect damage, such as microcracks or uneven surfaces before they develop into more severe problems. In addition, GIS (Geographic Information System) technology is used to collect, manage, and analyze geographic data related to road conditions. This allows for more strategic maintenance planning by prioritizing areas that need more urgent improvements based on the analysis of the collected data. Drone technology has also been applied for accurate aerial surveys, allowing for faster and broader surveillance of vast road networks. Implementing these technologies will likely reduce road maintenance costs in the long term while improving safety and comfort for road users. The transportation system has become the fundamental basis for the economic growth of all countries (Guerrero, 2018).

Community participation in the planning and maintenance of road infrastructure has a vital role in ensuring the success and sustainability of these projects. Engaging the community from the beginning can increase understanding of local needs and problems faced by daily road users. This participation can be in the form of submitting input in public forums, community surveys, or direct consultations with relevant stakeholders. The community will be more represented in voting if they are involved in the needs and expectations of the local community, thereby increasing the acceptance and support for infrastructure projects. In addition, community participation can also help monitor the project's implementation, ensuring transparency and accountability in terms of budget use and the quality of the work carried out. Overall, community participation strengthens the legitimacy of road infrastructure projects, improves the quality of the final result, and positively impacts the local communities that will use the infrastructure. Community services determine the economic sector's development through reforms prioritizing community satisfaction by managing road infrastructure assets (Priyatiningsih, 2020).

Highlight local issues related to the condition of the village's infrastructure. Jalan Karamat suffers from damage such as cracks, holes, and uneven surfaces, which interfere with residents' daily activities." Community activities have proliferated due to the rapid expansion of major cities worldwide, especially in developing countries, resulting in increased community activities (Rifai and Arifin, 2020). The Bina Marga Standard provides the evaluation and improvement methods necessary to address these damages effectively. Highway infrastructure is susceptible to structural degradation due to material damage mainly caused by heavy traffic, adverse weather conditions, aging, poor construction quality, and lack of proper maintenance. However, the limitations of the village budget and technical resources are often an obstacle to the implementation of repairs by the established guidelines. Therefore, to ensure that Jalan Karamat can be returned to Bina Marga standards, the village council and other relevant parties need to collect funds and resources to improve safety and comfort for all road users in Karamat Village. Public-private partnerships are emerging as a modality to increase private financing and expertise in the effective implementation of investments in infrastructure (ports, airports, highways, power plants, water supply, etc.) as well as other sectors that encourage inclusive growth, including tourism, agriculture, health, education, and vocational training (Ranyal, 2022).

This paper aims to analyze road damage in Karamat Village according to Bina Marga standards to identify and understand the causes and impacts of the damage. This paper also seeks to evaluate the effectiveness of the assessment and improvement methods recommended by Bina Marga in the local context. In addition, this study aims to provide practical recommendations for village governments and related parties to overcome the problem of road damage with sustainable and efficient solutions. Thus, this paper is expected to contribute to improving the quality of road infrastructure in Karamat Village, which will ultimately support the mobility and welfare of the local community. Finally, this paper aims to inspire similar efforts in other areas facing similar road infrastructure problems.

RESEARCH METHOD

This research uses the Visual Inspection Method, which involves directly examining the road surface to identify various types of damage, such as cracks, potholes, or deformations. Inspectors use road maps, standard checklists, and measuring devices to record and classify visible damage. Once the data is collected, further analysis can be conducted to determine the severity of the damage and the priority for necessary repairs. Primary data is collected from

field observations at the study site, referred to as primary or first-hand data. Types of road damage, damage thresholds, the amount of damage, and the average daily traffic statistics (ADT) are some of the primary data used in this research. Data processing is carried out using an approach. The stages in the road infrastructure method include Selecting the type and category of the road. Based on the average daily traffic (ADT) values, the type and class of the road are identified. The established road class values are used for tabulating data from road condition surveys, Determining the extent and percentage of damage for each type of damage, Evaluating every kind of damage according to the Damage Condition Determination Table based on the type of damage, To calculate the overall damage and road quality ranking, sum all damage values for each segment and then divide the total by the number of segments, After that, calculate the priority sequence (PS) and select the appropriate handling alternative based on this priority sequence (PS)."

RESULTS AND DISCUSSION

Traffic Survey

Data was collected over three days: Wednesday, Friday, and Sunday. Each day, four hours were spent observing the subjects, divided into two hours in the morning from 06:30 to 08:30 WIB and two hours from 3:30 to 5:30 p.m. WIB.

Table 1. Vehicle Count on Karamat Village Road

Time	Time			
	Vehicle Type			Volume
	LV= 1,00	HV = 1,3	MC = 0,5	(SMP/clock)
	(kind/clock)	(kind/clock)	(kind/clock)	
Wednesday	87	13	221	214.4
Friday	60	22	176	176.6
Sunday	75	19	194	196.7
Total	222	54	591	587.7

Results of Data Processing for Karamat Village Road

Table 1 above shows that 214.4 vehicles/day is the highest daily traffic volume. This ADT data is used for class classification. According to the Directorate General of Highways, 1990, this road segment falls into class 3 with an ADT of 200-500 vehicles/day.

Road Damage Survey

The following is a recap of the damage data for Karamat Village Road

Table 2. Recap of Damage for Karamat Village Road

No	Type of Damage	Area of Damaged Road (m^2)	Total Road Area (m^2)	Percentage

					Damage
1	Patching		74	3000	2.47%
2	Alligator	Cracking	170	3000	5.67%
3	Loose		43	3000	1.43%
4	Potholes		15	3000	0.50%
5	Ruts		0	3000	0.00%
6	Waves		75	3000	2.50%
7	Subsidence		0	3000	0.00%
8	Cracking		0	3000	0.00%
	Total				12.57%

Source: Results of Karamat Village Road Survey"

From the data in Table 2, it can be seen that the most dominant damage is alligator cracking at 170 m² (5.67%), followed by waves at 75 m² (2.50%), patching at 74 m² (2.47%), loose sections at 43 m² (1.43%), and potholes at 15 m² (0.50%). Next, the damage calculation results are determined using the damage values in Table 3 below.

Table 3. Determination of Damage Scores

Cracking		**Patching and Potholes**	
Type	Score	Area	Score
Alligator Cracking	5	<10%	0
Width	**Score**	**Roughness of Surface**	
Not present	0	Type	Score
Area of Damage	**Score**	Grain Release	3
10-20%	2		
Ruts		**Subsidence**	
Depth	Score	Depth	Score
Not present	0	Not present	0
Total			10

According to the Directorate General of Highways, 1990, with a damage score 10, the condition value obtained is 4.
The calculation of the results above is computed using the formula:
Priority Sequence, UP = 17 – (Road Class + Road Condition Value)
= 17 – (3 + 4)
= 10

According to the Directorate General of Highways, 1990, a value above 7 falls into the priority category, including roads requiring routine maintenance.

Repair Strategy

Routine Maintenance

Routine maintenance is carried out annually for a specified period to improve the quality of the surface layer without reinforcing the structure. It involves repairing damage as a protective measure against more severe damage. Among the various types of routine maintenance, the following are targeted:

1. Surface care, such as pothole patching and asphalt resurfacing, etc.
2. Road shoulder maintenance, including grass cutting and removal of eroded shoulder material.
3. Drainage, similar to cleaning ditches to ensure they function during rainfall.

Patching is repairing or resurfacing worn asphalt, which is then covered with cold mix."

CONCLUSION

The Pajaten road segment in Karamat Village, Majalengka Regency, exhibits conditions of loose stones, cracking, spots, potholes, and undulations. The Directorate General of Highways states that the calculated priority sequence is 10, placing it in the priority group > 7. According to the Directorate General of Highways, road damage should be addressed through a routine maintenance schedule. Patching is recommended for repairing road cracks, ruts, and deterioration.

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