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The Perception of User for Road Damage: A Case Majalengka-West Java

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Abstract: *The development of road infrastructure in various countries is growing rapidly in line with the increasing need for more efficient transportation and better road access to various regions. Suppose in a country the road infrastructure is damaged. In that case, it will result in limited access to more efficient transportation, hinder the mobility of road and goods users, and potentially slow down economic growth. This study aims to determine the level of satisfaction of road users with the condition of the pavement on Jl. Pejuang-Sindangkasih, and determine the level of existing damage. This research is located on Jl. Pejuang-Sindangkasih, which is located in Majalengka District, Majalengka Regency, West Java. The data collection technique used is a questionnaire, which is intended to collect data on the level of damage felt, the impact of damage on comfort and safety, and road users' expectations for road repairs. Overall, this data provides a clear picture of the profile of road users on Jl. Pejuang-Sindangkasih and how they see the condition of the road. This information can be an important basis for road repair and maintenance to improve comfort and safety for all road users. Some respondents also emphasized the importance of immediate repairs to road damage to reduce the risk of accidents and vehicle damage. In addition, respondents from younger age groups tend to be more critical of road conditions and show a high awareness of the importance of good road infrastructure. Road damage is very dangerous for road users, especially for motorcycle users, and urgent repairs are needed. Overall, this information provides important information about the planning and implementation of road repairs, with a special emphasis on the most important elements to improve the safety and comfort of road users.*

Keywords: *Pavement, Road Damage, Handling Strategies*

INTRODUCTION

Infrastructure plays a crucial role in determining a country's position in the Global Competitiveness Index (GCI). The rapid development of road infrastructure across nations is driven by the increasing demand for efficient transportation and improved access to various regions. Historically, countries with more advanced road infrastructure have experienced greater prosperity, as it enhances agriculture, trade, industry, and commerce, all of which contribute to sustained economic growth. Many nations are actively working to upgrade their road infrastructure to boost economic development and improve the mobility of people and goods, underscoring the vital role that roads play in supporting human survival and economic progress (Mejía, 2020) (Ng, 2019).

Suppose in a country the road infrastructure is damaged. In that case, it will result in limited access to more efficient transportation, hinder the mobility of road and goods users, and can potentially slow down economic growth. Transportation is one of the means that can be a medium to connect humans with a certain purpose (Andika, 2022). Limited access to transportation can make it difficult for those with

physical or economic limitations to balance subsistence and maintenance activities with family life. No wonder that poor road pavement conditions can cause traffic accidents. This is a very important issue for the safety of road users. The safety of road users is a priority for many countries, especially Indonesia. (Yu, 2021)

The issue of road infrastructure is critical for many countries, including Indonesia, where road networks form the backbone of the transportation system. In rural areas such as Majalengka, road conditions are often poor, with potholes and uneven surfaces due to limited maintenance and frequent heavy vehicle traffic. According to a 2021 report from the Indonesian Ministry of Public Works, more than 40% of roads in rural Indonesia are in suboptimal condition, contributing to a higher risk of accidents. The increasing volume of transportation has exacerbated road pavement deterioration, requiring continuous maintenance and restoration to ensure road safety (Gibbons, 2019). In particular, rural roads in Majalengka are prone to rapid degradation, further emphasizing the need for immediate attention. Road safety improvements, such as enhanced driver awareness and careful driving, are essential measures to protect road users (Sumantri, 2022). The government must allocate sufficient resources to maintain road infrastructure, ensuring that it remains in good condition and safe for public use.

Along with the increasing population growth in Indonesia, the need for transportation has also increased (Sony, 2022). That will put additional pressure on road infrastructure. Good urban planning and investment in road pavement are needed to accommodate the increasing urban mobility, one of which is in the city of Majalengka. However, road surfaces will wear out and deteriorate over time due to factors related to location, age, traffic volume, weather, engineering solutions, and the materials used to build them. The development of new technologies and innovations in road construction can help improve the efficiency, durability, and service life of road pavements. To evaluate the causative factors of road pavement, we need to consider several things, such as weather conditions, traffic loads, construction materials, and maintenance activities. (Arya D. M., 2021)

Road pavement is a layer of construction on top of the ground (subgrade) that has been compacted to support the traffic load, which is then distributed to the road so that the soil does not receive the load due to the allowable soil capacity (Isradi M. R., 2022). To provide a comfortable, safe, and durable road surface. Road infrastructure is considered the most significant factor for the welfare and comfort of the community and road users (Shtayat, 2022). By using traffic management and traffic management techniques, the government strives to make road traffic and transportation safe, serene, smooth, orderly, and efficient (Adiputra, 2022). With good road pavement, it can improve transportation efficiency and reduce vehicle operational costs. There are two types of pavement, namely rigid pavement and flexible pavement, each consisting of concrete as the main material. These two types of pavement have their own advantages and disadvantages, factors such as environmental conditions and traffic loads affect the choice of which type of pavement to use.

The types of damage that often occur on Jl. Pejuang-Sindangkasih are cracks, holes, and deformation of the road surface. Cracks in the pavement can worsen road drainage and cause additional damage due to water infiltration. In addition to increasing the risk of traffic accidents, the potholes that appear as a result of this breakdown increase driving comfort. Highway comfort and safety must be created. (Stefanus, 2022) To maintain road quality and user safety, these damages must be dealt with quickly. Therefore, accurately predicting pavement damage conditions is essential to building an efficient property management system.(Choi, 2019)

Currently, road pavement design plays a critical role in maintaining optimal urban infrastructure performance and ensuring road user safety. However, with the rapid expansion of road pavement projects, environmental sustainability has become a significant concern due to issues such as toxic gas emissions, air pollutants, increased fuel consumption, and noise pollution. Regular and proactive maintenance, which includes crack repair, pothole patching, and surface resurfacing, is essential for prolonging road sustainability. In fact, timely and periodic maintenance can extend the service life of road

pavements by up to 50%. To enhance the effectiveness of these efforts, developed countries have increasingly adopted advanced technologies such as remote sensing, big data analytics, and predictive modeling. These technologies monitor pavement conditions in real time, identify critical areas in need of immediate attention, and optimize maintenance schedules, thus ensuring more efficient, cost-effective, and sustainable urban infrastructure management. (Alaloul, 2021)

The impact of climate change on the performance of road pavements is very influential. An increase in temperature and changes in rainfall patterns can accelerate the degradation of road pavement materials. This is relevant to the global climate challenge due to the high levels of environmental emissions contained in the resources used to build road pavements. Therefore, road pavement design needs to consider environmental factors to increase resilience to climate change. Solutions such as the use of materials that are more resistant to extreme temperatures and the improvement of road drainage systems are essential to reduce damage caused by water and heat. In conclusion, road pavement is a crucial component in the transportation network that requires special attention in its design, construction, and maintenance to ensure the sustainability and efficiency of transportation (Elliot, 2023).

Road infrastructure is an important public asset because it contributes to economic growth and provides significant social benefits. The increase in the number of roads proves the importance of the role of road infrastructure in development in every country (Zulfa, 2022). It connects communities and businesses and provides access to education, employment, social, and health services. As an important part of the transportation hub, the highway not only bears the heavy responsibility of transporting goods but also pays attention to the safety of transportation personnel. Road damage is when the road surface is damaged so that it interferes with its main function as a means of transportation. This damage can be in the form of cracks, potholes, bumps, or other conditions that make the road uncomfortable to pass through and unsafe for the person using it. Not only that, rough surfaces and peeling on road pavements are also included in road damage (Qiao, 2021).

Residents of major cities in Indonesia choose to use motorcycles as their first choice in their daily transportation routines (Hermawan, 2022). Damaged road pavement can affect the comfort and safety of people using the road, especially motorcyclists. Significant traffic loads and extreme weather are the main causes of road damage, such as cracks, potholes, and surface deformations. Damage on Jl. Pejuang-Sindangkasih is very disturbing, reducing the quality of driving and increasing the risk of accidents. For example, cracks in pavements can worsen road drainage and accelerate damage. Cracks are a common nuisance to road pavements that greatly affect road safety and driving safety (Guo, 2022). In addition, unrepaired potholes can cause damage to vehicles and traffic accidents.

Poor pavement technical conditions and road structure defects reduce traffic safety and comfort for road users but also have a negative impact on the operation of motor vehicles (Staniek, 2021). Roads built without a good system have a faster speed of deterioration (Isradi M. P., 2023). Poor road conditions can cause damage to the vehicle, increase fuel consumption, and accelerate the wear of its components. This can also lead to increased vehicle maintenance and repair costs, as well as an increased risk of traffic accidents. To ensure that road conditions remain good and safe for all users, road maintenance and repairs must continue to be carried out. Therefore, to improve user comfort and safety, the recognition and handling of road damage must be a top priority.

Poor materials used, poor construction techniques, and irregular maintenance are the main factors that cause road damage. This problem is exacerbated by Jl. Pejuang-Sindangkasih is affected by the large traffic load, especially by heavy vehicles that often pass by. Constant pressure and extreme temperature changes often cause large holes and cracks. To prevent the damage from spreading further, regular maintenance and repairs are necessary. Road maintenance plays an important role in the socio-economic development of a country. To avoid future damage, better construction methods and the use of high-quality materials should also be considered (Arya D. M., 2022).

In particular, road maintenance is essential in the socio-economic development and smooth day-to-day operations of a country. Handling road damage requires a systematic and comprehensive approach. The first step is to carry out periodic inspections and monitoring of road conditions. Periodic inspections allow for early identification of damage and real-time monitoring with technologies such as sensors and drones. Therefore, damage can be identified and addressed immediately before it becomes a bigger problem (Doshi, 2020).

One very important strategy is to prioritize improvements. Road pavement management, preservation, and rehabilitation strategies are important components in maintaining infrastructure and economic continuity in the long term (Naddaf-Sh M. M., 2019). Road damage should be classified according to how severe it is and how it impacts the safety of road users. To guarantee the safety and comfort of users, the most significant damage must be repaired first. To repair small cracks and holes, quick repair techniques such as patching can prevent further damage before permanent repairs are made. Overlays and resurfacing are also useful for repairing larger but not too deep damage and extending the life of the road at a lower cost.

Roads that have suffered structural damage or significant damage to the road network also require full reconstruction. Although it is more expensive, full reconstruction ensures the safety and reliability of the road in the long run. The sustainability of infrastructure and the economy in the long term depends on the strategy of management, preservation, and rehabilitation of road pavements. The use of high-quality materials when building and repairing roads is essential to reduce the number of repairs made in the future. To prevent standing water that can damage the road surface, regular maintenance of drainage channels ensures a smooth flow of water and can reduce the risk of road damage due to water (Naddaf-Sh S. N.-S., 2020).

In addition, community participation in reporting road damage can improve handling efficiency. The public can help the government detect damage quickly through an online reporting app or system. In Indonesia, independent road authorities associated with sub-national (provincial) units make investment decisions based on a two-stage budgeting process. Sufficient budget should be provided for routine maintenance and repair of roads, as well as finding other ways to obtain funding, such as working with the private sector. To produce more efficient and environmentally friendly road repair solutions, the use of recycled materials and innovative construction techniques is required (Gertler, 2022).

Road infrastructure is included in the city's supporting facilities. Good city facilities will also support economic activities in the city (Dewantoro, 2022). This is very important for road users in Indonesia, especially the city of Majalengka, for the sake of continued sustainability. This study aims to determine the level of satisfaction of road users with the condition of the pavement on Jl. Pejuang-Sindangkasih, and determine the level of existing damage. In addition, this study also aims to assess the impact of road pavement damage on the comfort, security, and safety of road users. To achieve this goal, this study collects opinions, feedback, and suggestions from road users.

MATERIALS AND METHODS

This study employs a qualitative approach to understand road users' perceptions regarding the condition of road pavement damage on Jl. Pejuang-Sindangkasih. Tools commonly used in qualitative data collection, such as interviews, field notes, diary entries, and observations, were utilized to gather comprehensive insights. Qualitative research is suitable for this study because it aims to explore the subjective perspectives of road users in depth. The chosen approach enables the investigation of their experiences and expectations regarding the road conditions.

To enhance the relevance and precision of the findings, the Importance-Performance Analysis (IPA) method was applied. The IPA method was selected because it effectively identifies the gap between users' perceptions of current road conditions and their expectations. This method provides a structured way to

prioritize areas for improvement by assessing both the importance and performance of road attributes. Compared to other methods, IPA is more appropriate in this context, as it allows researchers to not only understand users' experiences but also quantify and rank the most critical factors impacting their satisfaction. The data collection technique, a questionnaire, was designed to capture the perceived level of road damage, its impact on comfort and safety, and users' expectations for road repairs. The inclusion of open-ended questions allows respondents to provide more detailed, qualitative feedback, enriching the overall analysis (Nassaji, 2020) (L. Haven, 2019).

This research is located on Jl. Pejuang-Sindangkasih which is located in Majalengka District, Majalengka Regency, West Java. The location of this study is as follows:

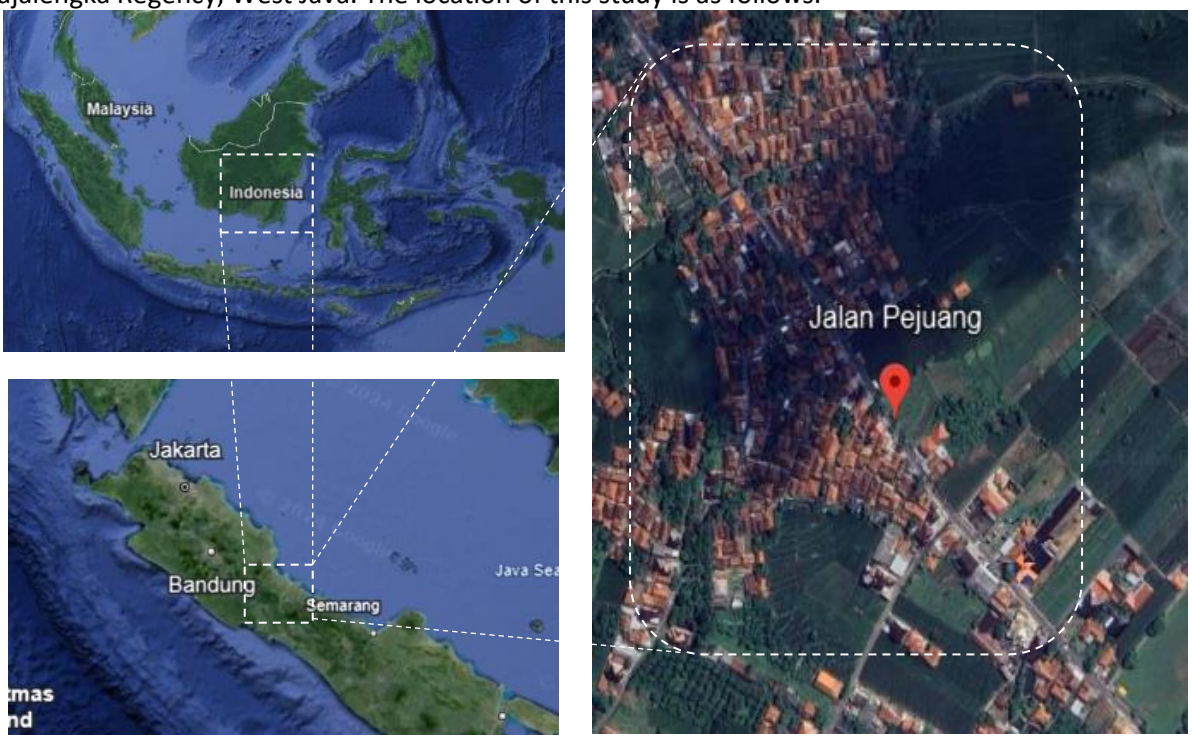

Figure 1. Research Location
Source: Google Earth

The Importance-Performance Analysis (IPA) method is used to analyze the collected data. This method allows researchers to assess the perception of road users by comparing the level of importance and performance of various aspects of road conditions. The analysis process begins by dividing the data into several important variables, such as the level of damage, the impact on comfort, and safety. Furthermore, each variable is assessed based on respondents' perception of its relevance and current performance. The questionnaire data was processed by calculating the important score and average performance for each variable. Then, the science diagram, the matrix created through this analysis is usually divided into four quadrants based on the average score of importance and performance. This helps to identify areas that need repairs, areas that are considered adequate, areas with excessive performance, and areas that are not very important to road users (Sharma, 2023).

The results of the analysis show that road users see the condition of the road pavement on Jl. Pejuang-Sindangkasih as very important but poor performance. Most of the people who answered said that road damage greatly affected their comfort and safety, and many expected quick and continuous repairs. The IPA analysis quadrant shows that authorities should immediately repair road damage as a top priority. This study uses this methodology to provide a systematic framework to understand the

perception of road users and help in developing more targeted policy recommendations for road infrastructure improvement. By using a qualitative approach and science methods, this research can provide rich insights for the planning and implementation of road improvements in the future.

RESULTS AND DISCUSSION

The results of the questionnaire collected from 60 respondents showed differences in age, gender, and type of vehicle used when crossing Jl. Pejuang-Sindangkasih. The results showed that the majority of road users were men, with the most people under the age of 20 crossing the road, while people over 60 were the least likely to cross the road. According to the type of vehicle used by the respondents, motorcycles are the most common. Most road users choose motorcycles because they are practical and efficient in chasing time. Some respondents also use private cars, but the number is much smaller than motorcycle users.

Road users in the age group of 21-40 years are also quite significant, but not as many people under 20 years old. The 41–60 age group has a moderate number of users, not too many but not too few. In terms of gender, female road users also cross Jl. Pejuang-Sindangkasih, although the majority are men. However, there are fewer of them than men. Road users also commented on the condition of the road pavement. Many of them said that road conditions affect driving comfort and safety, especially for those who use motorcycles.

Overall, this data provides a clear picture of the profile of road users on Jl. Pejuang-Sindangkasih and how they see the condition of the road. This information can be an important basis for road repair and maintenance to improve comfort and safety for all road users. Some respondents also emphasized the importance of immediate repairs to road damage to reduce the risk of accidents and vehicle damage. In addition, respondents from younger age groups tend to be more critical of road conditions and show a high awareness of the importance of good road infrastructure. Respondents from older age groups, although less frequently crossing these roads, also provided important input on the importance of improving roads to keep them fit for use by all age groups.

Table 1. Respondent Information

Variable	Category	Frequency	Percent
Gender	Man	34	57%
	Woman	26	43%
Age	≤20	21	35%
	21 - 30	19	32%
	31 - 40	11	18%
	41 - 50	6	10%
	51 - 60	3	5%
Vehicles used	Motorbike	35	58%
	Mobile	16	27%
	Public Transportation	9	15%

Source: Research Results

Importance and Performance Analysis

From the results of the questionnaire, the variable of road damage to traffic safety (4.9) received the highest importance value but also received the lowest satisfaction value (2.21). Meanwhile, the one that received the lowest importance value was road damage to traffic comfort (4.2).

Table 2. Importance and Performance Analysis

NO	Indicator	I	P	G
A1	Road damage to driving comfort	4.2	2.21	-1.99
A2	Road damage to traffic safety	4.9	2.34	-2.56
A3	Road damage to the frequency of road use	4.38	2.42	-1.96
A4	Road damage to travel time	4.21	2.35	-1.86
A5	Road damage to the responsiveness of authorities	4.72	2.49	-2.23
A6	Quality of road repair	4.36	2.52	-1.84

Source: Research Results

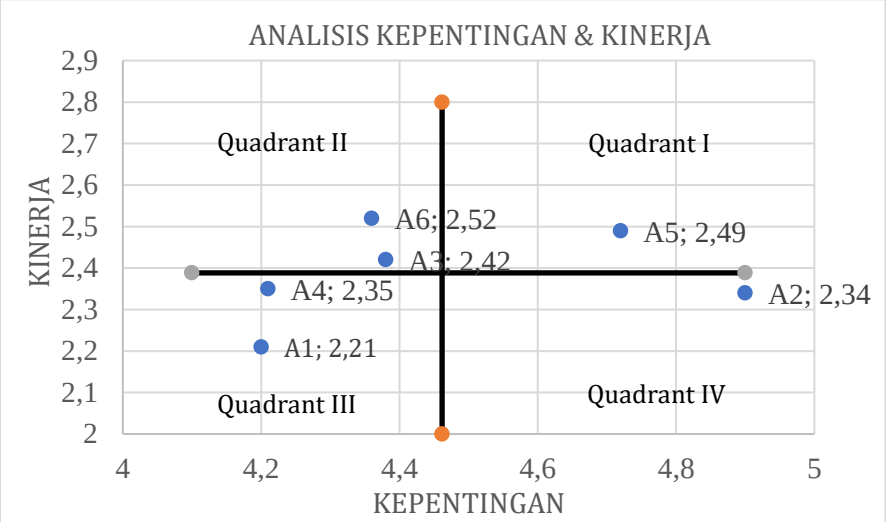

Figure 2. Importance and Performance Analysis Diagram

Source: Research Results

The table above shows the value of the minus gap, which shows that the level of satisfaction of road users has not met expectations. The variables are grouped into four quadrants based on their level of importance and performance according to the Cartesian diagram:

1. Quadrant I: This variable is of high importance and high performance. This means that these aspects are very important for road users and that their performance is adequate. Attention must be paid to maintaining or slightly improving this performance in order to keep meeting expectations.
2. Quadrant II: Variables with low importance but high performance. Although these variables are not considered very important by road users, they still have good performance. No immediate action is required, however, maintaining this performance is important.
3. Quadrant III: The variables in this quadrant do not require high-priority improvements because they are not considered important by road users, are of low importance and have low performance.
4. Quadrant IV is a variable with low performance but a high level of importance. Although these aspects are very important for road users, they do not work well. Therefore, to meet the needs of road users, these variables must be prioritized for immediate improvement.

After collecting data on road users' views on damage on Jl, Pejuang-Sindangkasih, 60 people were asked about the level of influence of road damage on-road performance. Responses were given on a five-level scale, from disagreeing to strongly agreeing. The analysis of this answer is important to assess how

comfortable road users are with crossing Jl. Pejuang-Sindangkasih. This data will also be used as a basis for setting better road repair standards in the future, as well as as evaluation material for improving road infrastructure.

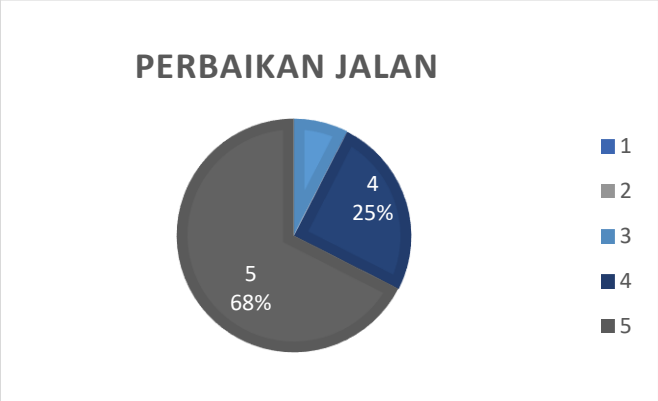

Figure 3. Respondent Diagram of Road Repair
Source: Research Results

The Road Lighting Improvemen diagram shows that 68% of the answer scale strongly agrees. This shows that road users are really looking forward to improvements on Jl. Pejuang-Sindangkasih to improve their safety and security.

CONCLUSION

Data from 60 respondents about road conditions on Jl. Pejuang-Sindangkasih were analyzed using the Importance-Performance Analysis (IPA) method, which compares the importance and performance of various road elements, such as the degree of damage and their impact on comfort and safety. The results indicate that road pavement conditions are considered highly important by users, but the current performance is poor. The variable concerning road damage and its impact on traffic safety received the highest importance score (4.9) and the lowest satisfaction score (2.21), highlighting an urgent need for repairs, especially due to the heightened danger posed to motorcycle users. Most respondents were men under 20 years old who primarily use motorcycles.

The IPA analysis further suggests that low-importance but high-performing variables do not require immediate action. However, critical variables with high importance but low performance fall into the quadrant that demands urgent attention. To improve the safety and comfort of road users, especially motorcyclists, the authorities should prioritize immediate repairs to the road surface, focusing on sections with significant damage that directly impacts traffic safety. These findings should guide a structured approach to planning and implementing road improvements, ensuring that resources are allocated to address the most crucial issues effectively.

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