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*RESEARCH ARTICLE*

# ANALYSIS OF CRITERIA AND PRIORITY ALTERNATIVES FOR ROAD MAINTENANCE BASED ON PROVINCIAL/DISTRICT ROAD MANAGEMENT SYSTEM AND AHP–PSI INTEGRATION IN JAYAWIJAYA REGENCY

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## *Abstract*

This study aims to analyze the criteria and alternatives for road handlin g priorities in Jayawijaya Regency using the integration of the Provinci al/Regency Road Management System (PKRMS), Analytical Hierarchy Process (AHP), and Preference Selection Index (PSI). The study uses descriptive quantitative and analytical approaches to evaluate the physical condition of the road, determine the priority of handling, and assess the level of road stability. The results of the study show that the availability of budget and resources, road conditions, access to public s ervices, access to potential areas, and road connectivity are important factors in determining handling priorities. The integration of PKRMS, AHP, and PSI results in a more transparent, objective, and accountable approach in road handling decisions in Jayawijaya Regency.



## Introduction:-

Road infrastructure has a strategic role in supporting economic growth, strengthening social connectivity, and accelerating regional development(Fobosi& Malima, 2024; Krupík, 2026). The existence of adequate roads allows the mobility of goods and services to run smoothly while expanding people's access to basic services, such as education, health, and government(Kahangirwe&Vanclay, 2024; Mtweve et al., 2025). As mandated in Law Number 38 of 2004 concerning Roads, the sustainability of road functions is one of the important factors in supporting the equitable distribution of community welfare.

The equitable distribution of community welfare related to road infrastructure has limitations that need to be realized, namely that every road construction has a plan life that causes the physical condition of the road to decline over time(Sivilevičius & Žuraulis, 2025; Välilä, 2025). If not handled through the right maintenance system, the deterioration of road conditions can cause social and economic losses, both for the government and road users(Gorzelańczyk&Sokolovskij, 2026; Hasanli & Safarova, 2026; Topcu&Coruh, 2025). On the other hand, road maintenance requires large costs, careful planning, and accurate data support to make decisions more effective and efficient(Cai etal., 2025; Hamalainenetal., 2025; Zhangetal., 2026).

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Jayawijaya Regency faces more complex challenges than other regions due to its geographical characteristics located in the highlands of Papua Mountains with extreme topography, unstable geological conditions, and high rainfall. These factors accelerate road degradation and increase construction and maintenance costs. Based on data from the Public Works and Spatial Planning Office (DPUPR) of Jayawijaya Regency, there are 80 district roads with a total length of around 178.805 km that require sustainable management. In practice, the determination of priority for road handling in Jayawijaya Regency still faces various challenges. The decision-making process is often influenced by non-technical considerations, such as political interests, peer pressure, or responses to momentary public issues. This condition causes the budget allocation to not be fully based on technical needs and strategic benefits of the road, so that it has the potential to increase the disparity in development between regions.

The government has actually utilized the Provincial/Regency Road Management System (PKRMS) application to support the analysis of road conditions. The system is designed to assist in the preparation of road preservation strategies through an integrated database and systematic technical analysis. However, the use of PKRMS in Jayawijaya Regency is still not optimal, especially in the aspect of determining the priority of road maintenance programs that comprehensively consider various factors. Because road priority decisions are not only influenced by technical conditions, a multi-criteria approach is needed that is able to accommodate strategic, socio-economic, traffic, and cost-efficient aspects. Therefore, the integration of the Analytical Hierarchy Process (AHP) and Preference Selection Index (PSI) methods is a relevant alternative. The AHP method is used to determine the priority weight based on the level of importance of each criterion, while the PSI helps to objectively generate alternative rankings.

The implementation of the combination of PKRMS with the AHP-PSI method is expected to be able to produce a more rational, transparent, and data-based decision support system in determining the priorities of road handling in Jayawijaya Regency. With this approach, local governments are expected to optimize budget limitations while ensuring that road construction and maintenance provide maximum benefits for the community and support equitable distribution of regional development.

## Literature Review:-

This research on the priorities of road handling generally departs from the concept of Pavement Management System (PMS) or road management system which emphasizes the systematic management of road assets based on data on conditions, traffic, costs, and infrastructure preservation needs(Famewo&Shokouhian, 2025; Han et al., 2026; Jiang et al., 2025). In the Indonesian context, this approach is widely implemented through the Provincial/Regency Road Management System (PKRMS) application, which functions as a tool in planning, programming, and budgeting for regional road maintenance. PKRMS provides technical analysis based on road condition indicators such as Treatment Trigger Index (TTI), Surface Distress Index (SDI), traffic, and estimated handling costs, so that it can produce technical priorities for road handling objectively (Manual for Road and Bridge Sector Number 04/M/BM/2021)(Gargetal., 2025; Li etal., 2025; Mohamedetal., 2025). However, this approach still focuses on technical aspects and has not fully accommodated strategic factors, socio-economic, and regional policy preferences.

Previous studies have shown that the Analytical Hierarchy Process (AHP) method is often used to overcome these limitations through a multicriteria decision-making approach(Borahetal., 2025; Ngoieetal., 2025). Research by (Farida etal., 2025; Tri Ade Putra etal., 2024; Zuhri etal., 2025)in North Konawe shows that the integration of AHP with PKRMS is able to produce a more comprehensive road handling priority than technical analysis alone. AHP is used to determine the priority weight of various criteria such as road conditions, connectivity, traffic volume, accessibility, regional development, and public service facilities. The results of the study show that each region has different priority characteristics, depending on geographical conditions, service needs, and the direction of regional development.On the other hand, the Preference Selection Index (PSI) method was developed as an alternative ranking approach in a multicriteria decision-making system that is more objective and efficient, especially in cases with a large number of alternatives. Research by (Lillasari&Helilintar, 2021; Saputra et al., 2022)proving that the PSI method is effectively used in determining the priority of road repairs because it is able to produce a sequence of priorities based on a combination of various indicators systematically. In addition, the research (Obeida et al., 2023)suggests that PSI can support AHP in simplifying the decision-making process with many alternatives, so that the integration of the two methods becomes more adaptive in the context of complex decisions.

Although various studies have combined PKRMS and AHP in determining road priorities, most studies are still limited to weighting criteria without integrating more objective alternative ranking methods such as PSI. In addition,

previous research was generally conducted in areas with relatively different geographical characteristics and development costs compared to Jayawijaya Regency which has extreme topography, high rainfall, budget constraints, and complex accessibility challenges. Therefore, this study fills the research gap through the integration of PKRMS, AHP, and PSI to produce a support system for priority decisions for road handling that is more rational, measurable, and in accordance with the needs of road infrastructure management in Jayawijaya Regency.

**Research Method:-**

This study uses a quantitative approach with descriptive and analytical research types to determine the priorities of road handling in Jayawijaya Regency, Mountainous Papua Province. The location of the study is focused on roads under the authority of the Jayawijaya Regency Government based on the regent's decree on the determination of the status of district roads, with the object of the research covering 13 priority road sections. The quantitative approach was chosen because the research utilizes numerical data, such as road conditions, traffic volume, and the results of weighting criteria that are systematically analyzed using the PKRMS application and multicriteria decision-making methods.

The research method was carried out through the collection of primary and secondary data using documentation studies, field surveys, and the distribution of questionnaires to experts or related stakeholders. Road technical data was obtained from the PKRMS application and the results of field observations, while priority assessment data was obtained through a questionnaire using the Analytical Hierarchy Process (AHP) method to determine the weight of the criteria, which was then combined with the Preference Selection Index (PSI) method in the process of ranking road handling priorities. Thus, this study not only describes the condition of the road factually, but also produces recommendations for handling priorities that are objective, measurable, and support decision-making for road infrastructure development in Jayawijaya Regency.

## Results and Discussion:-

**Provincial/Regency Road Management System(PKRMS) Analysis**

**Table 4.1. Road Pavement Type Data**

| No. Streets | Field Name | Segment Length (km) | Pavement Type (km) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Asphalt/Hot Mix | Lapen/ Macadam | Concrete Pavement | Telford/ Kerikil | Ground/Unpenetrated |
| 006 | Gatot Subroto Street | 1,501 | 1,451 | 0,000 | 0,000 | 0,05 | 0,000 |
| 011 | Jenderal Ahmad Yani Street | 1,625 | 1,625 | 0,000 | 0,000 | 0,000 | 0,000 |
| 013 | Kama Street | 0,864 | 0,000 | 0,864 | 0,000 | 0,000 | 0,000 |
| 015 | Kampus II Yapis-J. B. Wenas Street | 0,718 | 0,000 | 0,315 | 0,158 | 0,245 | 0,000 |
| 016 | Kapitan Pattimura Street | 1,441 | 0,849 | 0,399 | 0,000 | 0,000 | 0,193 |
| 022 | Wesaput Ring Street | 0,597 | 0,000 | 0,597 | 0,000 | 0,000 | 0,000 |
| 023 | Location III Street | 0,605 | 0,000 | 0,605 | 0,000 | 0,000 | 0,000 |
| 032 | Safri Darwin Street | 0,605 | 0,605 | 0,000 | 0,000 | 0,000 | 0,000 |
| 039 | Sulawesi Street | 0,327 | 0,327 | 0,000 | 0,000 | 0,000 | 0,000 |
| 067 | Megapura-Minimo Street | 0,927 | 0,000 | 0,000 | 0,000 | 0,927 | 0,000 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 049 | Aikima-Tulem Street | 5,456 | 0,000 | 1,925 | 0,000 | 3,531 | 0,000 |
| 072 | Pelebaga-Landia-Wukahilapok Street | 7,050 | 3,5 | 0,000 | 0,000 | 3,55 | 0,000 |
| 082 | Waga Waga-Umpakalo Street | 3,208 | 1,15 | 0,000 | 0,000 | 2,058 | 0,000 |

**Source: Database: D:\PKRMS_Tesis\Aplication\FormDBPKRMS-33375101-260201100516, 2026**

**Table 4.2. Road Network Condition Data**

| No. Streets | Field Name | Segment Length (km) | Pavement Type | Road Conditions | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Good | | Medium | | Minor Damage | | Severely Damaged | |
| | | | | KM | % | KM | % | KM | % | KM | % |
| 006 | Gatot Subroto Street | 1,501 | Asphalt, Gravel | 0,908 | 60,493 | 0,100 | 6,662 | - | - | 0,493 | 32,845 |
| 011 | Jenderal Ahmad Yani Street | 1,625 | Aspal | 1,125 | 69,231 | 0,500 | 30,769 | - | - | - | - |
| 013 | Kama Street | 0,864 | Macadam | - | - | - | - | - | - | 0,864 | 100,000 |
| 015 | Kampus II Yapis-J. B. Wenas Street | 0,718 | Macadam, Ground | 0,173 | 24,095 | 0,100 | 13,928 | - | - | 0,445 | 61,978 |
| 016 | Kapitan Pattimura Street | 1,441 | Asphalt, Soil | 0,800 | 55,517 | 0,049 | 3,400 | - | - | 0,592 | 41,083 |
| 022 | Wesaput Ring Street | 0,597 | Macadam | - | - | - | - | - | - | 0,597 | 100,000 |
| 023 | Location III Street | 0,605 | Macadam | - | - | - | - | - | - | 0,605 | 100,000 |
| 032 | Safri Darwin Street | 0,605 | Aspal | 0,406 | 67,107 | - | - | - | - | 0,199 | 32,893 |
| 039 | Sulawesi Street | 0,327 | Aspal | - | - | - | - | 0,100 | 30,581 | 0,227 | 69,419 |
| 067 | Megapura-Minimo Street | 0,927 | Pebbles | - | - | - | - | - | - | 0,927 | 100,000 |
| 049 | Aikima-Tulem Street | 5,456 | Macadam, Kerikil | - | - | - | - | 0,125 | 2,291 | 5,331 | 97,709 |
| 072 | Pelebaga-Landia-Wukahilapok Street | 7,050 | Asphalt, Gravel | 3,500 | 49,645 | - | - | - | - | 3,550 | 50,355 |
| 082 | Waga Waga-Umpakalo Street | 3,208 | Asphalt, Gravel | 1,150 | 35,848 | - | - | - | - | 2,058 | 64,152 |

**Source: Database:D:\PKRMS_Tesis\Aplication\FormDBPKRMS-33375101-260201100516, 2026**

Based on the results of the AHP method, Budget and Resource Availability (21.45%) became the most dominant criterion. These findings are relevant to field conditions that show a variety of pavement types and a fairly high level of road damage. Some sections are still in the form of lapen, makadam, gravel, and have not even been handled optimally, such as Kama Street, Wesaput Ring Street, Location III Road, Megapura-Minimo Street, as well as the Aikima-Tulem and Pelebaga-Landia-Wukahilapok sections which mostly still have macadam or gravel pavement. These conditions show that the need for cost and resource capacity is the main factor because road handling requires different budgets according to the type of pavement, the level of damage, and the type of intervention needed. The second criterion, namely Road Condition (15.77%) was also proven to have a significant effect because the results of the PKRMS survey showed that there were sections with a dominant level of heavy damage. For example, Kama Street, Wesaput Ring Street, Location III Road, and Megapura-Minimo Street were recorded to have 100% severe damage, while Sulawesi Street had 69.42% severe damage and Kapitan Pattimura Road 41.08%. On the other hand, some sections such as Jenderal Ahmad Yani Street have relatively better conditions with 69.23% in good condition. This variation in conditions shows that the level of road damage is an important consideration in determining the urgency of handling. Furthermore, Access to Public Service Facilities (13.00%), Access to Potential Areas (10.15%), and Road Connectivity (7.75%) received high weight because the function of roads in Jayawijaya Regency was not only seen from its physical condition, but also its role in supporting community mobility, access to public services, and connectivity between regions. Thus, the results of AHP show that the priority of road handling is not solely influenced by technical damage, but also considers funding capabilities, connectivity benefits, and support for regional social and economic activities.

**Combination Analysis of the AHP-PSI Method:-**

**Table 4.11. Road Handling Priorities Based on PKRMS in Combination with the AHP-PSI Method**

| Road Name | TPI Score | Priority Order |
|---|---|---|
| Sulawesi Street | 191,9 | 1 |
| Kampus II Yapis-J. B. Wenas Street | 87,7 | 2 |
| Kapitan Pattimura Street | 61,0 | 3 |
| Gatot Subroto Street | 57,8 | 4 |
| Safri Darwin Street | 52,5 | 5 |
| Jenderal Ahmad Yani Street | 19,7 | 6 |
| Kama Street | 15,6 | 7 |
| Location III Street | 1,3 | 8 |
| Wesaput Ring Street | 0,0 | 9 |
| Megapura-Minimo Street | 0,0 | 10 |

**Source: Database: D:\PKRMS_Tesis\Aplication\FormDBPKRMS-33375101-260201100516, 2026**

Based on the analysis that has been carried out based on the 3 (three) methods above, a comparison of the priority order of road handling is shown in the following table:

**Table 4.12. Comparison of Road Handling Priorities**

| Road Alternatives | PKRMS | | AHP-PSI | | PKRMS AHP-PSI combination | |
|---|---|---|---|---|---|---|
| | TPI Score | Priority Order | PSI Weight | Priority Order | TPI Score | Priority Order |
| Gatot Subroto Street | 36,3 | 3 | 0,816 | 5 | 57,8 | 4 |
| Jenderal Ahmad Yani Street | 12,4 | 6 | 0,942 | 1 | 19,7 | 6 |
| Kama Street | 7,5 | 7 | 0,762 | 6 | 15,6 | 7 |
| Kampus II Yapis-J. B. Wenas Street | 42,0 | 2 | 0,739 | 8 | 87,7 | 2 |
| Kapitan Pattimura Street | 31,5 | 5 | 0,844 | 4 | 61,0 | 3 |
| Wesaput Ring Street | 0,0 | 9 | 0,630 | 10 | 0,0 | 9 |
| Location III Street | 0,9 | 8 | 0,756 | 7 | 1,3 | 8 |
| Safri Darwin Street | 33 | 4 | 0,874 | 2 | 52,5 | 5 |
| Sulawesi Street | 100,4 | 1 | 0,849 | 3 | 191,9 | 1 |
| Megapura-Minimo Street | 0,0 | 10 | 0,685 | 9 | 0,0 | 10 |

**Source: Researcher Analysis, 2026**

**Analysis of the Suitability of Strategic Plan Targets with Achievement Realization:-**

In order to implement the regional vision and mission, as well as support the achievement of regional development goals, the Jayawijaya Regency DPUPR has set specific goals, targets, and targets for road implementation in 2025. The determination is formally outlined in the Strategic Plan (Renstra) document of the Jayawijaya Regency DPUPR for the 2024-2026 period, the details of which are as follows:

**Tabel 4.3. Purpose and objectives DPUPR JayawijayaRegency**

| No. | Purpose | Objectives | Indicator | Target 2025 (%) |
|---|---|---|---|---|
| 1 | Improve the underlying infrastructure | Improving the quality of roads and bridges | Percentage of road and bridge length in good condition | 41,260 |

**Source: Jayawijaya Regency DPUPR Strategic Plan, 2025**

**Table 4.14. Program Performance Indicators, Target Groups and Indicative Ceilings of the Jayawijaya Regency DPUPR**

| No. | Programs/ Activities/Sub-Activities | Objectives | Indicator | Target 2025 (%) |
|---|---|---|---|---|
| 1 | Road maintenance program | Improved road quality | The percentage of district roads is in stable condition | 32,371 |

**Source: Jayawijaya Regency DPUPR Strategic Plan, 2025**

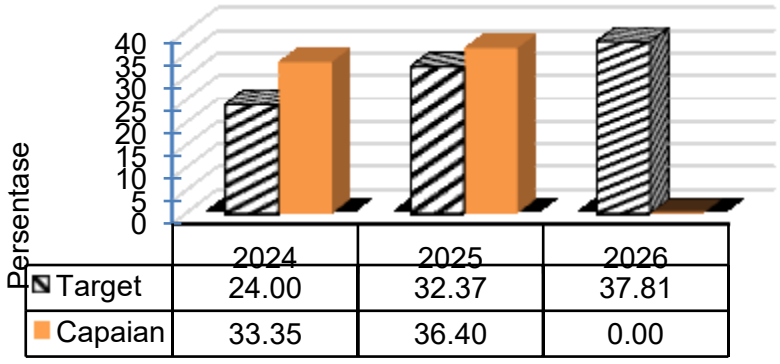
**Table 4.15. Performance Achievements of the Public Works and Spatial Planning Office of Jayawijaya Regency**

| No. | Indicator | Target 2025 (%) | Reach (%) | Performance (%) |
|---|---|---|---|---|
| 1 | The percentage of district roads is in stable condition | 32,371 | 36,396 | 112,43 |

**Source: Researcher Analysis, 2026**

Based on data recorded in the Strategic Plan (Renstra) document for the 2024-2026 period, the target for the stable condition of the district road network in 2025 is set at 32.371%. The realization of achievements by the end of 2025 has managed to reach 36.396%, so that the performance of the road implementation program reaches an achievement percentage of 112.43% (Table 4.35), which shows that the set target has been exceeded. This achievement signifies the success of the efforts of the Jayawijaya Regency DPUPR in improving the connectivity and stability of the district road network by 2025. The main factor that drives the achievement of stable conditions is the improvement of the quality of several road sections from gravel pavement to asphalt pavement which strategically supports the selected corridor in stable conditions, especially on the Albert Dien Street section, Kama-Wesama Street, and Yapis-J Campus II Street. B. Wenas, SMK Lapago Street, Sumba Street, Autakma-Okilik Street, Hom Hom-Gunung Susu Street , Pelebaga-Landia-Wukahilapok Street, and Hesatum-Maima Street.

**Graph 4.1. Performance Year Achievement 2025**




**Resource: Research Analysis , 2026**

## Conclusion:-

In order of priority criteria for road handling based on the AHP method, it can be seen that the Availability of Budget and Resources is the criterion with the highest priority (21.45%), followed by Road Conditions (15.77%), Access to Public Service Facilities (13.00%), Access to Potential Areas (10.15%), Road Connectivity (7.75%), Pavement Age (7.52%), Regional/Regional Development (6.83%), Accident Rate (6.18%), Traffic (3.84%), Environmental Conditions (3.80%) and Policy (3.71%).

Based on the results of the analysis of the priority of handling road sections using the PKRMS application with the default MCA parameters (road conditions and traffic volume), Sulawesi Street has the highest priority with a TPI value of 100.4. Next was followed by Kampus II Yapis-J. B. Wenas Street (TPI 42.0), Gatot Subroto Street (TPI 36.3), Safri Darwin Street(TPI 33.0), Kapitan Pattimura Street(TPI 31.5), Jenderal Ahmad Yani Street (TPI 12.4), Kama Street(TPI 7.5), Jenderal Location III Street(TPI 0.9), LingkarWesaput Street(TPI 0.0), and finally Megapura-Minimo Street(TPI 0.0). Based on the results of priority analysis using the AHP-PSI method, Jenderal Ahmad Yani Street ranks at the top with a global priority weight value of 0.942. Followed by Safri Darwin Street(0.874), Sulawesi Street(0.849), Kapitan Pattimura Street(0.844), Gatot Subroto Street (0.816), Kama Street(0.762), Location III Street (0.756), Kampus II Yapis-J. B. Wenas Street (0.739), Megapura-Minimo Street

(0.685). Meanwhile, the Wesaput Ring Street is in last position with a weight value of 0.630. This prioritization indicates the level of relative importance of each road section based on the criteria evaluated in the AHP-PSI method.

Based on the results of priority analysis using the PKRMS application combined with the AHP-PSI method and MCA parameters, the order of priority of road sections was obtained as follows: Sulawesi Street occupies the highest priority with a TPI value of 191.9, followed by Kampus II Yapis-J. B. Wenas Street (TPI 87.7), Kapitan Pattimura Street(TPI 61.0), Gatot Subroto Street (TPI 57.8), Safri Darwin Street(TPI 52.5), Jenderal Ahmad Yani Street (TPI 19.7), Kama Street(TPI 15.6),Location III Street (TPI 1.3), Wesaput Ring Street (TPI 0.0) and Megapura-Minimo Street(TPI 0.0) have lower priorities according to their respective TPI values.

The fulfillment of the achievement targets contained in the Strategic Plan of the Public Works and Spatial Planning Office of Jayawijaya Regency on the value of road stability is an absolute must to be met. In the 2024-2026 Strategic Plan document, the road stability target in 2025 is set at 32.371%. The results of the above study show that, in the implementation of district road handling in 2025, 36.396% of results/achievements were obtained. This data shows that the stability of the roads in Jayawijaya Regency has exceeded the target that has been set. The main supporting factor for the achievement of stable conditions is the improvement in the quality of several road sections from gravel pavement to asphalt pavement which strategically supports the selected corridor in stable condition, especially on the Albert Dien Street section, Kama-Wesama Street, and Yapis-J Campus II Street. B. Wenas, SMK Lapago Street, Sumba Street, Autakma-Okilik Street, Hom Hom-Gunung Susu Street, Pelebaga-Landia-Wukahilapok Street, and Hesatum-Maima Street .

## Recommendations:-

**In light of the findings and conclusions, the following recommendations are given:**

1. Optimization of priority-based budget allocation. Local governments need to focus the allocation of the road handling budget on the sections with the highest priority level based on the results of the integration of the AHP-PSI and PKRMS methods, so that the use of resources is more effective and has a maximum impact on improving road stability.
2. The application of the AHP-PSI method as a decision support. Relevant agencies are advised to use the AHP-PSI method combined with PKRMS as a supporting instrument for priority decision-making for road handling because it is able to consider many criteria more comprehensively than the default MCA parameters.
3. Increased attention to the strategic segment of public services. The handling of roads that support access to public service facilities and potential economic areas needs to be prioritized in a sustainable manner, considering that both aspects have a significant weight of influence in determining priorities.
4. Periodic maintenance to maintain the achievement of road stability. Considering that the achievement of road stability has exceeded the target of the 2025 Strategic Plan, a routine and preventive maintenance program is needed so that the condition of the road is maintained and does not deteriorate in quality quickly.
5. Periodic evaluation and update of priority data. Local governments are advised to conduct periodic evaluations of road condition data, traffic, budget, and other indicators so that the order of handling priorities can adjust to changes in field conditions and regional development needs.

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