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

***Abstract**:*

This study aims to analyze the criteria and alternatives for road handling priorities in Jayawijaya Regency using the integration of the Provincial/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 services, 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.

Key words:-

AHP, Priority road handling, PKRMS, PSI, Jayawijaya Regency

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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 et al., 2025; Hamalainen et al., 2025; Zhang et al., 2026).

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)(Garg et al., 2025; Li et al., 2025; Mohamed et al., 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(Borah et al., 2025; Ngoie et al., 2025). Research by (Farida et al., 2025; Tri Ade Putra et al., 2024; Zuhri et al., 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	Jalan Gatot Subroto	1,501	1,451	0,000	0,000	0,05	0,000
011	Jalan Jenderal Ahmad Yani	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	Jalan Kampus II Yapis-J. B. Wenas	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 Road	0,597	0,000	0,597	0,000	0,000	0,000
023	Road Location III	0,605	0,000	0,605	0,000	0,000	0,000
032	Safri Darwin Road	0,605	0,605	0,000	0,000	0,000	0,000
039	Sulawesi Road	0,327	0,327	0,000	0,000	0,000	0,000
067	Megapura-Minimo Road	0,927	0,000	0,000	0,000	0,927	0,000
049	Aikima-Tulem Road	5,456	0,000	1,925	0,000	3,531	0,000
072	Jalan Pelebaga-Landia-Wukahilapok	7,050	3,5	0,000	0,000	3,55	0,000
082	Waga Waga-Umpakalo Road	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	Jalan Gatot Subroto	1,501	Asphalt, Gravel	0,908	60,493	0,100	6,662	-	-	0,493	32,845
011	Jalan Jenderal Ahmad Yani	1,625	Aspal	1,125	69,231	0,500	30,769	-	-	-	-
013	Kama Street	0,864	Macadam	-	-	-	-	-	-	0,864	100,000
015	Jalan Kampus II Yapis-J. B. Wenas	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 Road	0,597	Macadam	-	-	-	-	-	-	0,597	100,000
023	Road Location III	0,605	Macadam	-	-	-	-	-	-	0,605	100,000
032	Safri Darwin Road	0,605	Aspal	0,406	67,107	-	-	-	-	0,199	32,893
039	Sulawesi Road	0,327	Aspal	-	-	-	-	0,100	30,581	0,227	69,419

067	Megapura-Minimo Road	0,927	Pebbles	-	-	-	-	-	-	0,927	100,000
049	Aikima-Tulem Road	5,456	Macadam, Kerikil	-	-	-	-	0,125	2,291	5,331	97,709
072	Jalan Pelebaga-Landia-Wukahilapok	7,050	Asphalt, Gravel	3,500	49,645	-	-	-	-	3,550	50,355
082	Waga Waga-Umpakalo Road	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 Road, Location III Road, Megapura-Minimo Road, 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 Road, Location III Road, and Megapura-Minimo Road were recorded to have 100% severe damage, while Sulawesi Road had 69.42% severe damage and Kapitan Pattimura Road 41.08%. On the other hand, some sections such as Jalan Jenderal Ahmad Yani 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 Road	191,9	1
Jalan Kampus II Yapis-J. B. Wenas	87,7	2
Kapitan Pattimura Street	61,0	3
Jalan Gatot Subroto	57,8	4
Safri Darwin Road	52,5	5
Jalan Jenderal Ahmad Yani	19,7	6
Kama Street	15,6	7
Road Location III	1,3	8
Wesaput Ring Road	0,0	9

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

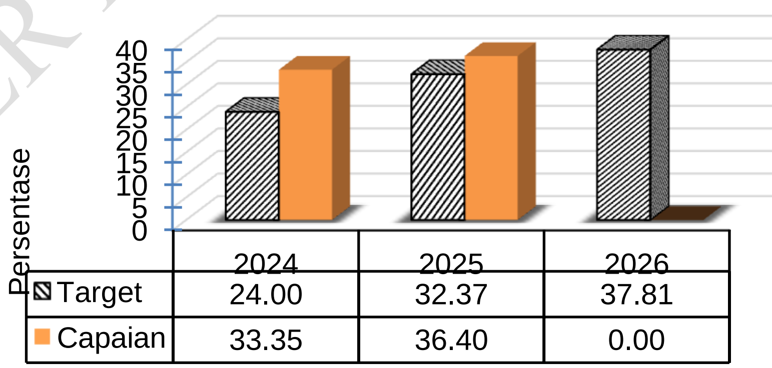
Table 4.15. Performance Achievements of the Public Works and Spatial Planning Office of Jayawijaya Regency

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, Jalan SMK Lapago, Jalan Sumba, Jalan Autakma-Okilik, Jalan Hom Hom-Gunung Susu, Jalan Pelebaga-Landia-Wukahilapok, and Jalan Hesatum-Maima.

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), Jalan Sulawesi has the highest priority with a TPI value of 100.4. Next was followed by Jalan Kampus II Yapis-J. B. Wenas (TPI 42.0), Jalan Gatot Subroto (TPI 36.3), Jalan Safri Darwin (TPI 33.0), Jalan Kapitan Pattimura (TPI 31.5), Jalan Jenderal Ahmad Yani (TPI 12.4), Jalan Kama (TPI 7.5), Jalan Jenderal Location III (TPI 0.9), Jalan Jalan Lingkar Wesaput (TPI 0.0), and finally Jalan Megapura-Minimo (TPI 0.0). Based on the results of priority analysis using the AHP-PSI method, Jalan Jenderal Ahmad Yani ranks at the top with a global priority weight value of 0.942. Followed by Jalan Safri Darwin (0.874), Jalan Sulawesi (0.849), Jalan Kapitan Pattimura (0.844), Jalan Gatot Subroto (0.816), Jalan Kama (0.762), Jalan Lokasi III (0.756), Jalan Kampus II Yapis-J. B. Wenas (0.739), Megapura-Minimo Road (0.685). Meanwhile, the Wesaput Ring Road 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: Jalan Sulawesi occupies the highest priority with a TPI value of 191.9, followed by Jalan Kampus II Yapis-J. B. Wenas (TPI 87.7), Jalan Kapitan Pattimura (TPI 61.0), Jalan Gatot Subroto (TPI 57.8), Jalan Safri Darwin (TPI 52.5), Jalan Jenderal Ahmad Yani (TPI 19.7), Jalan Kama (TPI 15.6), Jalan Lokasi III (TPI 1.3), Wesaput Ring Road (TPI 0.0) and Jalan Megapura-Minimo (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, Jalan SMK Lapago, Jalan Sumba, Jalan Autakma-Okilik, Jalan Hom Hom-Gunung Susu, Jalan Pelebaga-Landia-Wukahilapok, and Jalan Hesatum-Maima.

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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