



Determining Road Management Priorities Using PKRMS and Analytical Hierarchy Process (AHP): A Case Study of Palembang, Indonesia

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Abstract: Road management strategies, as a key component of road preservation and an essential part of road management asset programs, is not only carried out to enhance the physical condition of the road infrastructure, but also to ensure that roads can support mobility, safety, and socio-economic development in the region. Limited financial resources for road management programs hinder the optimal management strategies of all road segments in a region. This study evaluates the effectiveness of road management strategies using the Provincial / Kabupaten Road Management System (PKRMS) method and identifies priority road segments through the Analytical Hierarchy Process (AHP) method. The research integrates the PKRMS approach with a questionnaire-based AHP analysis to identify priority road segments requiring management and to determine suitable management strategies. The AHP criteria employed in this study consist of regional development, road condition, traffic volume, policy, accessibility, land use, and economic aspects. The study was conducted on five road segments in Palembang, namely Jalan Sultan M. Mansyur, Jalan Noerdin Pandji, Jalan MP. Mangkunegara, Jalan Pangeran Ratu – Pasar Induk – Sp. Jalan Pendidikan, and Jalan Lettu Karim Kadir (Gandus) – Bts. Kab. Banyuasin. The results reveal that, based on the AHP method, Jalan Noerdin Pandji (Palembang) is identified as the highest-priority road segment. Furthermore, the PKRMS analysis indicates that the most appropriate management strategy for this segment consists of routine maintenance (PR) and routine condition maintenance (RK). The results showed that the first priority with the highest value of 0.679 in the road management was for Jalan Noerdin Pandji (Palembang) and requires managements such as routine maintenance and condition-based routine works, with a total management cost of IDR 4,572.03 million.

Keywords: Road Management Strategies, Provincial / Kabupaten Road Management System (PKRMS), Analytical Hierarchy Process (AHP), Road Prioritization, Multi-Criteria Analysis (MCA).

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Introduction

Road infrastructure functions as an essential driver of mobility and connectivity, underpinning regional economic growth. Road infrastructure is a fundamental component of land transportation systems, providing essential services for mobility and connectivity while significantly contributing to regional productivity and economic growth (Hastuti et al., 2016). Effective connectivity within road networks enhances the movement of people, goods, and services, thereby accelerating regional development. However, without appropriate maintenance strategies, road conditions will deteriorate over time, reducing their service life and performance (Marietta & Yosritzal, 2022).

Indonesia is recognized as the largest island-based country in the world, consisting of over 17,000 islands, relies heavily on transportation infrastructure, especially roads, to support interregional connectivity. According to statistics released by the Central Statistics Agency (BPS) in 2023, Indonesia's road network has shown continuous improvement in extent, contributing to economic growth and mobility. Nevertheless, Indonesia's road infrastructure continues to face several challenges, including deterioration caused by heavy traffic, constraints in maintenance funding, and a lack of an optimal system for road prioritization.

South Sumatra Province is a strategic region located in the southern part of Sumatra Island, functioning as an interprovincial link and a key corridor for national logistics distribution (Ministry of Transportation, 2026). In the context of South Sumatra Province, which demonstrates considerable development potential alongside continuous population growth, the demand for reliable and sustainable road networks is increasingly critical (Amelia, 2021).

As the capital of South Sumatra Province, Palembang frequently attracts public attention for its economic and governmental functions, and its development as a growing metropolitan area. Given this strategic role, the condition of road infrastructure has become a critical concern. Road deterioration is commonly observed on the pavement surface and is mainly attributed to repetitive traffic loading, which accelerates when vehicles exceed prescribed load limits (Saputro et al., 2025). Inadequately maintained or deteriorated roads often lead to public complaints, hinder mobility, and adversely affect the overall quality of life.

Despite the road network achieving a condition performance level of 90.89% in 2025, the inevitable deterioration of road conditions over time, coupled with budgetary constraints, poses substantial challenges to maintaining optimal service levels. Consequently, the development of effective and efficient road management strategies is essential to ensure long-term infrastructure performance. This situation suggests that the management of road infrastructure remains challenging, especially in maintaining the infrastructure quality.

In accordance with Republic of Indonesia Law Number 38/2004 on Roads, roads have a strategic role not only in the transportation sector, but also in supporting development in the fields of economy, socio-culture, environment, defense, and security. In practice, government planning, program structuring, and budget management (PPP) activities often rely on policy-based decision-making, prioritizing interventions accordingly (Hargi et al., 2018). To address these challenges, a systematic approach to planning,

program structuring, and budget management (PPP) is required to ensure efficient resource allocation.

This study employs the Provincial/Kabupaten Road Management System (PKRMS) as a comprehensive road asset management framework, integrated with the Analytical Hierarchy Process (AHP) as a multi-criteria decision-making framework. This combined method enables a systematic evaluation of both technical factors, derived from field surveys, and non-technical factors, obtained through stakeholder perceptions, to support rational prioritization of road management programs (Halich et al., 2023).

This research focuses on provincial road segments in Palembang, a strategic urban center with high traffic intensity and diverse vehicle compositions, which significantly contribute to accelerated road deterioration. This research aims to formulate strategies and determine priority management for provincial road segments in Palembang in order to improve budget allocation efficiency, maintain road service levels, and support sustainable connectivity and regional growth. The novelty of the research stems from the integration of PKRMS and AHP in identifying priority actions for road management, with emphasis on Palembang. This study not only utilizes technical data from field surveys but also incorporates non-technical data based on stakeholder perceptions, resulting in more comprehensive and contextual recommendations compared to previous studies.

Statement of the Problem

In the context of transportation planning, transportation infrastructure not only serves as a means of mobility, but also as an instrument for directing regional development (Tamin, 1997). According to The Republic of Indonesia's Minister of Public Works Regulation Number 13/PRT/M/2011 on the procedures for maintaining and inspecting roads, road maintenance or treatment is the responsibility of the road authority. Consequently, appropriate road management strategies are essential to sustain the service level of road infrastructure. Road infrastructure management should be conducted through a systematic and data-driven asset management approach. The application of quantitative methods, enhances forecasting accuracy and supports organizations in formulating effective strategies through data-driven analysis (Atmaja et al., 2024). This research is needed on strategies management and prioritization of provincial road segments in Palembang as an effort to address community needs, improve the efficiency of budget allocation, support connectivity and sustainable growth.

This study aimed to:

1. Determine appropriate road management strategies using the PKRMS program.
2. Establish the priority order of road management through a multi-criteria analysis using the Analytical Hierarchy Process (AHP).

In conclusion, this study aims to support effective and efficient decision-making in road management by integrating technical analysis and priority assessment, thereby optimizing resource allocation in road infrastructure management.

Theoretical Framework

Provincial / Kabupaten Road Management System (PKRMS)

Provincial / Kabupaten Road Management System (PKRMS) is a support tool developed by the Directorate General of Highways to facilitate the planning, program structuring, and budget management (PPP) for road management at the district and provincial levels. This approach serves as the foundation for the development of road management systems such as PKRMS. Its implementation is driven by the limited fiscal capacity of local governments, thereby necessitating a system that enhances the effectiveness and efficiency of road management based on actual road conditions and rational considerations.

In accordance with the Director General of Highways Letter Number 22/SE/Db/2021 on the guidelines for the Provincial/Regency Road Management System (PKRMS), the planning, program structuring, and budgeting (PPP) process includes data survey (inventory, condition, traffic), analysis of road management needs, estimated cost and priority program.

PKRMS functions as an integrated planning system that combines road condition data, inventory, historical records, project data, and spatial information. Consequently, it serves as a reliable reference for decision-making in road management and preservation, enabling more optimal allocation of limited resources.

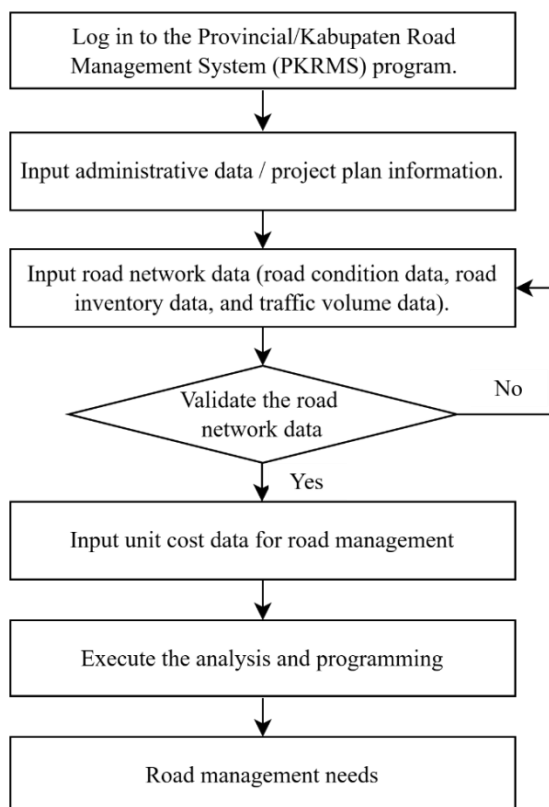


Figure 1. Analytical Procedure of PKRMS

Source: Director General of Highways Letter Number 22/SE/Db/2021 on the guidelines for the PKRMS

Based on Figure 1, the final output of the PKRMS analysis assists in determining the road management strategies and provides crucial information to support the planning and design processes.

Furthermore, the PKRMS program facilitates budget projections and enables the identification of potential efficiency gains.

Decision Support System

Road infrastructure requires optimal management and maintenance to achieve the desired level of service. However, limited regional budgets often prevent all road segments from receiving adequate management, necessitating the establishment of priority scales based on appropriate criteria. The prioritization of road management is a decision-making process aimed at allocating limited resources to achieve specific objectives (Marietta & Yosritzal, 2022).

Decision Support Systems (DSS) refers to a computer-based framework that assist decision-makers in solving semi-structured problems by integrating relevant information to support specific decisions-making (Rashidi et al., 2017). In contrast to basic decision-making methods, Multi-Criteria Decision Making (MCDM) incorporates more detailed information and manages more complex relationships among factors (Belton & Stewart, 2022). One widely used method within DSS is the Analytical Hierarchy Process (AHP), which is based on three main principles: hierarchy structuring, priority setting, and consistency (Padmowati in Mubarak & Rosmiati, 2016). According to Saaty (1986), AHP functions as a measurement technique that produces ratio scales from pairwise comparisons involving both discrete and continuous elements., enabling the formulation of problems into criteria that generate relative priority scales. The use of Multi-Criteria Analysis (MCA) methods is widespread to overcome the complexity decision makers face when handling extensive information (Solomonov et al., 2022).

The Analytical Hierarchy Process (AHP) is a systematic method for establishing priorities when dealing with problems involving multiple factors (Bernasconi et al., 2010). The Analytical Hierarchy Process (AHP) is AHP is an organized method used to support decision-making processes that is considered capable of breaking down unstructured problems into several component parts, conducting subjective comparisons and determining the value of each variable, organizing variables into a hierarchical structure, and synthesizing them as considerations to identify the variable with the highest priority (Handayani et al., 2023). In psychophysical scaling, respondents assign numerical values to sensation magnitudes produced by stimuli. Analysts then interpret these values as mathematical data to derive subjective scale measurements of sensations such as feelings, preferences, or judgments (Saaty, 1977).

The Analytical Hierarchy Process (AHP) presents an alternative method for evaluating various scale functions and formulating guidance on how these scales should be applied. The method relies on basic analytical functions and accounts for the number of criteria in the decision-making process (Goepel, 2017). In this study, the *Analytical Hierarchy Process* (AHP) is applied to accommodate criteria that are not adequately captured by the PKRMS program. This method provides a robust framework for decomposing complex and unstructured problems into hierarchical components, facilitating systematic pairwise comparisons, assigning relative values to decision variables, and synthesizing these evaluations to determine the most prioritized alternative (Handayani et al., 2023).

AHP has been extensively applied in various decision-making contexts, including resource allocation, cost-benefit analysis, alternative ranking, and the prioritization of development strategies in complex problem settings (Saaty, 1980). As noted by Saaty (1993), the *Analytical Hierarchy Process* (AHP) offers several advantages in supporting decision-making. This method is both flexible and intuitive, making it suitable for addressing complex and unstructured problems, capable of capturing interdependencies among elements without imposing linear assumptions. AHP integrates a systematic deductive approach while reflecting natural human reasoning in structuring and grouping decision elements across hierarchical levels.

The Identification of Criteria and Sub-Criteria in the Analytic Hierarchy Process (AHP) Framework

The determination of AHP criteria and alternatives was carried out by considering several previous studies to establish the priority ranking of road management. In general, the selection of criteria and alternatives in this study refers to prior studies carried out by Astana (2013), Irawan et al. (2016), Putri (2023), Masagung

(2023), and Hargi et al. (2023). The selection of references from previous studies as the basis for determining the AHP criteria and sub-criteria is grounded in the consideration that these studies share a similar context, namely in the field of road prioritization. The criteria employed in those studies have undergone empirical and methodological analysis, and are therefore considered relevant and valid for application in this research.

Furthermore, the use of multiple references aims to provide a more comprehensive set of criteria, enabling the representation of various important aspects of road management. This approach is also intended to minimize subjectivity in selecting criteria and to ensure that the hierarchical structure developed in the AHP method is supported by a strong theoretical and empirical foundation. In addition, the identification of criteria was grounded on the similarity of regional characteristics between Palembang and the study areas examined in prior research, as well as informed by expert judgment from stakeholders within the South Sumatra Provincial Department of Public Works, Highways, and Spatial Planning.

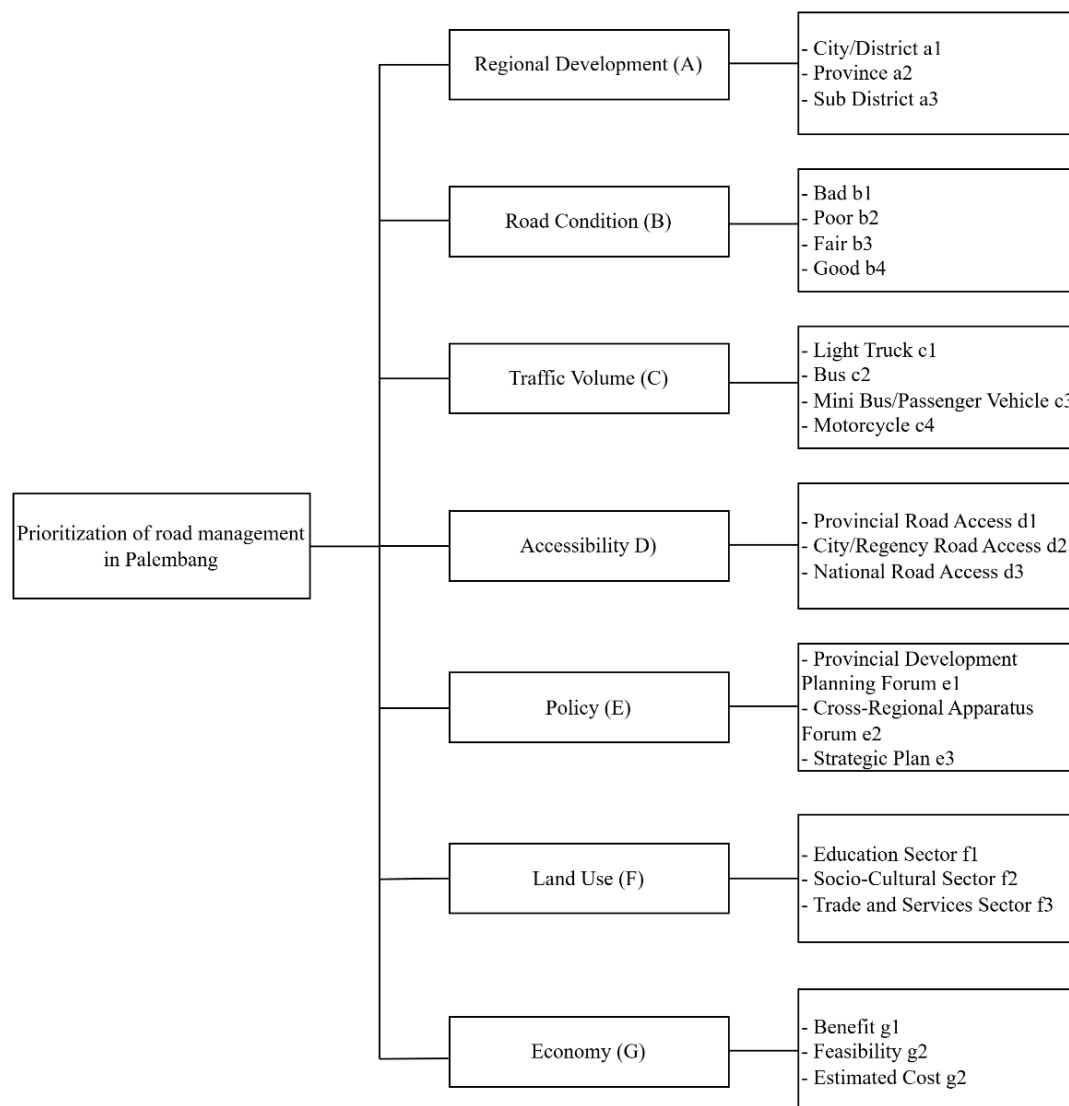


Figure 2. Hierarchical Structure of Provincial Road Management Priorities in Palembang, Indonesia

Based on Figure 2, all criteria and sub-criteria encompass technical, spatial, social, economic, and policy dimensions, which are essential in determining priority road segments for intervention. In the AHP method, all criteria and sub-criteria are valued according to their level of importance, resulting in more objective and systematic decision-making.

All criteria and sub-criteria must be evaluated through pairwise

comparisons at every level of the hierarchy in order to derive the relative importance of each element in the form of qualitative judgments. Subsequently, these qualitative judgments are quantified using a numerical scale, where the value 1 denotes equal significance, whereas 9 indicates maximum importance. In decision-making, appropriate consideration must be given to the data collection process, as the data obtained are expected to closely represent the actual conditions (Irawan, 2016).

Table 1. Pairwise Comparison Scale

Level	Definition	Description
1	Equally important	Both elements have the same level or degree of importance
3	Slightly important	The decision slightly favors one element over another
5	Moderately important	The decision favors one element over another
7	Very important	The decision strongly favors one element over another
9	Extremely important	The decision indicates that one element is absolutely more important than another
2,4,6,8	Intermediate values between two adjacent judgments	Used when a compromise is needed between two judgments

Source : Mubarak & Rusmiati, 2016

The questionnaire data are processed through the Analytical Hierarchy Process (AHP), which involves the following stages:

1. Construct a hierarchical structure diagram to represent the objectives, criteria, and alternatives.
2. Develop a pairwise comparison matrix.

The valuation process is conducted by summing each row of the matrix to obtain the eigenvector values, which are then used to determine the priority elements for road management across the alternative hierarchy up to the goal hierarchy.

3. Derive the criteria value.
4. Assess Consistency Index (CI) and Consistency Ratio (CR).

This step is carried out to verify that the respondents' judgments are sufficiently reliable.

$$CI = \frac{(\lambda_{\max} - n)}{(n - 1)}$$

Where CI denotes the Consistency Index, $\lambda_{\max}$ refers to the highest eigenvalue, and n indicates the total number of elements.

$$CR = \frac{CI}{RI}$$

Where CR denotes the Consistency Ratio, RI represents the Random Index. The questionnaire can be redistributed if the respondents' consistency ratio (CR) exceeds 0.1 during the evaluation process.

5. Calculate the value at each hierarchical level and determine the overall priority.
6. Make decisions based on the overall priority.

Results and Discussion

The analysis in PKRMS integrates quantitative norms for routine maintenance with calculations of road requirements for maintenance activities, structural improvements, and road capacity expansion. To optimize the limited budget used to road management, the PKRMS program is capable of accommodating various criteria, commonly referred to as Multi-Criteria Analysis (MCA).

The criteria accommodated within PKRMS include:

1. Technical Criteria
 - Road Condition
 - Traffic Volume
2. Non-Technical Criteria
 - Connectivity
 - Regional development
 - Primary road network
 - Social service facilities

Road management strategies must consider both technical and non-technical aspects in order to achieve an optimal level of service (Riza, 2015). In this study, the analysis for determining the prioritization of road management through the application of the Analytical Hierarchy Process (AHP) method was conducted to accommodate the limitations of the PKRMS program, which is restricted to a limited range of criteria. In the context of this research, PKRMS is employed to generate optimal road intervention programs based on condition survey data, while the prioritization of road segment interventions is determined through a multicriteria decision-making framework that employs the Analytical Hierarchy Process (AHP). The integration of these methods can provide a robust basis for road management,

particularly in supporting the planning, program structuring, and budget management (PPP).

This study incorporates additional criteria that are not encompassed by the PKRMS, specifically policy and economic criteria. In this study, the selection of policy aspects referring to the Provincial Development Planning Forum (Musrenbang), Cross-Regional Apparatus Forum (Forum PD/Lintas PD) and the Strategic Plan (Renstra) is considered more appropriate to the planning structure implemented by the Government of South Sumatra Province, and ensures that the priority order of road management is aligned with the proposals within the applied system.

The selection of economic criteria related to benefits, feasibility, and estimated cost is suitable for establishing the priority order for road management in Palembang. The benefit sub-criterion

measures the impacts of road management; the feasibility sub-criterion helps ensure that road management priorities are directed toward appropriate and realistic projects; and the cost estimation sub-criterion assesses budget requirements. These three sub-criteria can yield values that reflect a balance between benefits and costs to determine the priority order for road management.

Analysis and Programming of PKRMS

Provincial roads have the function to serve transportation between regencies/cities within a province and to connect regencies/cities roads with the national road network or with other regencies/cities roads. The Directorate General of Highways on Decree Number 77/1990, classifies the road network into two categories, namely stable roads and unstable roads.

Table 2. Summary of Road Conditions in 2025

Road Section Name	Survey Length (km)	Pavement Condition				Stable (km)	Unstable (km)	Stable (%)	Unstable (%)
		Good (km)	Fair (km)	Poor (km)	Bad (km)				
Jln. Sultan M. Mansyur (Palembang)	4.22	4.02	0.20	0.00	0.00	4.22	0.00	100%	0.00%
Jln. Pangeran Ratu - Pasar Induk - Sp. Jl. Pendidikan (Palembang)	5.10	3.00	1.70	0.40	0.00	4.70	0.40	92%	7.84%
Jln. MP. Mangkunegara (Palembang)	2.58	2.48	0.10	0.00	0.00	2.58	0.00	100%	0.00%
Jln. Lettu Karim Kadir (Gandus) - Bts. Kab. Banyuasin	12.00	11.30	0.70	0.00	0.00	12.00	0.00	100%	0.00%
Jln. Noerdin Pandji (Palembang)	5.25	5.15	0.10	0.00	0.00	5.25	0.00	100%	0.00%
TOTAL	29.14	25.94	2.80	0.40	0.00	28.74	0.40	98.63%	1.37%

Source: South Sumatra Provincial Department of Public Works, Highways, and Spatial Planning, 2025

The table above presents the results of the 2025 road condition survey conducted by the South Sumatra Provincial Department of Public Works, Highways, and Spatial Planning using the percentage of road condition stability as the indicator.

Based on the 2025 road condition survey data, all road segments are classified in good (stable) condition, with an average percentage 98.63% and a poor (unstable) condition value 1.37%.

The road segment that is identified as being in unstable condition is Jln. Pangeran Ratu – Pasar Induk - Sp. Jl. Pendidikan (Palembang).

The road condition data needs to be analyzed using the PKRMS program by selecting the analysis and programming options in the PKRMS menu to calculate road management requirements based on the input data. The results obtained from the analysis and programming using the PKRMS program are shown in the table 3.

Table 3. Summary of Road Management Analysis Using PKRMS

Road Section Name	Length (km)	Type of Management	Condition-based routine Maintenance (RK) (km)	Routine Maintenance (km)	Periodic Maintenance (km)	Rehabilitation (km)
Jln. Sultan M. Mansyur (Palembang)	4.22	PR + RK	4.22	4.22	0.00	0.00
Jln. Pangeran Ratu - Pasar Induk - Sp. Jl. Pendidikan (Palembang)	5.10	PB + REH + PR + RK	5.10	5.10	0.50	0.40
Jln. MP. Mangkunegara (Palembang)	2.58	PR + RK	2.58	2.58	0.00	0.00
Jln. Lettu Karim Kadir (Gandus) – Bts. Kab. Banyuasin	12.00	PR + RK	12.00	12.00	0.00	0.00
Jln. Noerdin Pandji (Palembang)	5.25	PR + RK	5.25	5.25	0.00	0.00
TOTAL	29.15		29.10	29.10	0.50	0.40

The table above presents the required types of road management, which are routine maintenance (PR), condition-based routine maintenance (RK), rehabilitation (REH) and periodic maintenance

(PB). Based on the PKRMS analysis, Jln. Pangeran Ratu - Pasar Induk - Sp. Jl. Pendidikan (Palembang) requires all types of management.

Table 4. Summary of Road Management Cost Analysis Using PKRMS

Road Section Name	Periodic Maintenance Cost (Rp Million)	Rehabilitation Cost (Rp Million)	Condition-based routine Maintenance Cost (Rp Million)	Routine Maintenance Cost (Rp Million)	Total Maintenance Cost (Rp Million)
Jln. Sultan M. Mansyur (Palembang)	0.00	0.00	929.00	152.68	1081.68
Jln. Pangeran Ratu - Pasar Induk - Sp. Jl. Pendidikan (Palembang)	472.95	2089.89	3712.61	138.77	6414.22
Jln. MP. Mangkunegara (Palembang)	0.00	0.00	337.40	114.93	452.33
Jln. Lettu Karim Kadir (Gandus) – Bts. Kab. Banyuasin	0.00	0.00	3.281.60	327.70	3.609.3
Jln. Noerdin Pandji (Palembang)	0.00	0.00	4443.65	128.38	4572.03
TOTAL	472.95	2089.89	12704.20	862.50	16129.50

The table number 4 presents the total estimated cost of road management for all of the road segments is IDR 16,129.50 million, with the highest estimated cost identified on the Jln. Pangeran Ratu - Pasar Induk - Sp. Jln. Pendidikan (Palembang).

Prioritization of Road Segment Management Based on Questionnaire-Based Assessment

The prioritization of road segment management was initiated through the distribution of questionnaires to 13 expert respondents from the South Sumatra Provincial Department of Public Works, Highways, and Spatial Planning. The questionnaires were distributed directly to the expert respondents, followed by

explanations and discussions regarding the purpose of the study. The respondents completed the questionnaire by selecting numerical values that represented the comparison scale for each criterion and sub-criterion.

All criteria and sub-criteria are analyzed to calculate their value in order to obtain the maximum value for determining the priority ranking of road segment management using the AHP method. After the criterion of values was obtain, further analysis was conducted using pairwise comparisons within a comparison matrix. The Eigenvector (λ_i), row sums, and W_i values are presented in the following table.

Table 5. Eigenvector Values of Criteria

	A	B	C	D	E	F	G	JB	wi	Xi
A	1.000	0.240	0.750	0.528	0.933	0.985	1.679	0.146	0.760	0.097
B	4.172	1.000	2.231	3.066	3.106	1.776	3.293	518.569	2.442	0.311
C	1.333	0.448	1.000	2.172	2.602	2.904	1.792	17.559	1.506	0.192
D	1.894	0.326	0.460	1.000	1.904	1.820	1.047	1.032	1.004	0.128
E	1.071	0.322	0.384	0.525	1.000	1.274	1.523	0.135	0.751	0.096
F	1.016	0.563	0.344	0.550	0.785	1.000	1.573	0.134	0.750	0.096
G	0.596	0.304	0.558	0.955	0.656	0.636	1.000	0.040	0.632	0.081
Σ									7.846	1.000

Table 6. Summary of Criteria Values

Criteria	Weight
Regional Development (A)	0.0969
Road Condition (B)	0.3113
Traffic Volume (C)	0.1919
Accessibility (D)	0.1280
Policy (E)	0.0958
Land Use (F)	0.0956
Economy (G)	0.0805

From the table above, the mathematical calculation of the criterion value derived from respondent assessments indicates that the road condition criterion has the highest value, followed by traffic

volume, accessibility, regional development, policy, land use, and economic criteria.

Table 7. Eigenvector Values of Regional Development Sub-criteria

	City/District (a1)	Province (a2)	Sub District (a3)	JB	wi	Xi
City/ District (a1)	1.000	0.984	2.796	2.751	1.401	0.415
Province (a2)	1.016	1.000	3.347	3.402	1.504	0.445
Sub District (a3)	0.358	0.299	1.000	0.107	0.475	0.140
Σ					3.380	1.000

Table 8. Eigenvector Values of Road Condition Sub-criteria

	Bad (b1)	Poor (b2)	Fair (b3)	Good (b4)	JB	wi	Xi
Bad (b1)	1.000	5.787	6.989	7.890	319.121	4.227	0.670
Poor (b2)	0.173	1.000	2.883	3.788	1.887	1.172	0.186
Fair (b3)	0.143	0.347	1.000	1.698	0.084	0.539	0.085
Good (b4)	0.127	0.264	0.589	1.000	0.020	0.375	0.059
Σ						6.312	1.000

Table 9. Eigenvector Values of Traffic Volume Sub-criteria

	Light Truck (c1)	Bus (c2)	Mini Bus/Passenger Vehicle (c3)	Motorcycle (c4)	JB	wi	Xi
Light Truck (c1)	1.000	1.078	2.335	3.182	8.012	1.682	0.366
Bus (c2)	0.927	1.000	2.712	2.845	7.154	1.635	0.356
Mini Bus/ Passenger Vehicle (c3)	0.428	0.369	1.000	3.356	0.530	0.853	0.186
Motorcycle (c4)	0.314	0.351	0.298	1.000	0.033	0.426	0.093
Σ						4.597	1.000

Table 10. Eigenvector Values of Accessibility Sub-criteria

	Provincial Road Access (d1)	City/ Regency Road Access (d2)	National Road Access (d3)	JB	wi	Xi
Provincial Road Access (d1)	1.000	1.723	0.698	1.202	1.063	0.337
City/ Regency Road Access (d2)	0.581	1.000	0.489	0.284	0.657	0.209
National Road Access (d3)	1.434	2.043	1.000	2.929	1.431	0.454
Σ					3.151	1.000

Table 11. Eigenvector Values of Policy Sub-criteria

	Provincial Development Planning Forum/ Musrenbang (e1)	Cross- Regional Apparatus Forum/ Forum PD/Lintas PD (e2)	Strategic Plan (e3)	JB	wi	Xi
Provincial Development Planning Forum/ Musrenbang (e1)	1.000	0.667	1.711	1.142	1.045	0.322
Cross- Regional Apparatus Forum/ Forum PD/ Lintas PD (e2)	1.498	1.000	2.798	4.192	1.612	0.496
Strategic Plan (e3)	0.584	0.357	1.000	0.209	0.593	0.183
Σ					3.251	1.000

Table 12. Eigenvector Values of Land Use Sub-criteria

	Education Sector (f1)	Socio-Cultural Sector (f2)	Trade and Services Sector (f3)	JB	wi	Xi
Education Sector (f1)	1.000	1.483	0.478	0.710	0.892	0.268
Socio-Cultural Sector (f2)	0.674	1.000	0.348	0.235	0.617	0.185
Trade and Services Sector (f3)	2.090	2.874	1.000	6.008	1.818	0.546
Σ					3.327	1.000

Table 13. Eigenvector Values of Economy Sub-criteria

	Benefit (g1)	Feasibility (g2)	Estimated Cost (g3)	JB	wi	Xi
Benefit (g1)	1.000	2.559	2.871	7.346	1.944	0.575
Feasibility (g2)	0.391	1.000	1.123	0.439	0.760	0.225
Estimated Cost (g3)	0.348	0.891	1.000	0.310	0.677	0.200
Σ					3.381	1.000

Maximum Eigenvalue Calculation

The maximum eigenvalue is obtained by multiplying the initial matrix with the eigenvector value of each matrix as shown in the example below.

	A	B	C	D	E	F	G		Xi		
A	1.000	0.240	0.750	0.528	0.933	0.985	1.679	x	0.097	=	1.073
B	4.172	1.000	2.231	3.066	3.106	1.776	3.293		0.311		0.997
C	1.333	0.448	1.000	2.172	2.602	2.904	1.792		0.192		1.100
D	1.894	0.326	0.460	1.000	1.904	1.820	1.047		0.128		1.126
E	1.071	0.322	0.384	0.525	1.000	1.274	1.523		0.096		1.052
F	1.016	0.563	0.344	0.550	0.785	1.000	1.573		0.096		0.994
G	0.596	0.304	0.558	0.955	0.656	0.636	1.000		0.081		0.959

Eigen Maximum (λ_{max}) = $\sum a_{ij} \cdot X_i = 7.301$

The maximum eigenvalue was calculated for each sub-criterion.

CI Control Value (Consistency Index Control Value)

Calculate the Consistency Index (CI):
 $CI = (\lambda_{max} - n) / (n - 1)$, where n is the number of criteria = 7

$$CI = (7.301 - 7) / (7 - 1)$$

$$CI = 0.053$$

Calculate the Consistency Ratio (CR):

$CR = CI / RI$, where RI represents the random index defined according to the matrix order, $RI = 1.32$ (for a matrix of order 7)

$$CR = 0.053 / 1.32$$

$$CR = 0.040 < 0.10 \text{ (Consistent)}$$

Priority Hierarchy Calculation

After the values of the criteria and sub-criteria were compiled, the prioritization of road management was established using the AHP method, and subsequently calculated through a mathematical

model. As an example, the Priority Hierarchy Calculation of Jalan Sultan M. Mansyur (Palembang) is presented below.

$$X = A (a1.x1 + a2.x2 + a3.x3) + B (b1.x1 + b2.x2 + b3.x3 + b4.x4) + C (c1.x1 + c2.x2 + c3.x3 + c4.x4) + D (d1.x1 + d2.x2 + d3.x3) + E (e1.x1 + e2.x2 + e3.x3) + F (f1.x1 + f2.x2 + f3.x3) + G (g1.x1 + g2.x2 + g3.x3)$$

$$X = (0.097 (0.415 \times 1 + 0.445 \times 1 + 0.140 \times 0)) + (0.311 (0.670 \times 0 + 0.186 \times 0 + 0.085 \times 1 + 0.059 \times 1)) + (0.192 (0.366 \times 1 + 0.356 \times 0 + 0.186 \times 1 + 0.093 \times 1)) + (0.128 (0.337 \times 1 + 0.209 \times 1 + 0.454 \times 1)) + (0.096 (0.322 \times 0 + 0.496 \times 1 + 0.183 \times 1)) + (0.096 (0.268 \times 1 + 0.185 \times 1 + 0.546 \times 1)) + (0.081 (0.575 \times 1 + 0.225 \times 1 + 0.200 \times 1))$$

$$= 0.622$$

Table 14. Summary of Road Management Priority Value

Road Section Name	Value (X)
Jalan Noerdin Pandji (Palembang)	0.690
Jalan Pangeran Ratu – Pasar Induk – Sp. Jalan Pendidikan (Palembang)	0.679
Jalan Sultan M. Mansyur (Palembang)	0.622
Jalan MP. Mangkunegara (Palembang)	0.622
Jalan Lettu Karrim Kadir (Gandus) – Bts. Kab. Banyuasin	0.622

The same computational procedure was applied to other road segments, and the results were coded as X. Based on the calculation, the highest value of 0.679 was obtained for the road section Jalan Noerdin Pandji (Palembang). The calculation results show that the road condition criterion has the greatest influence on the final road management priority ranking, in consistent with the criteria value ranking results.

The findings of this study reveal that appropriate road management strategies were successfully formulated using the PKRMS program, which identified the required types of road management study, such as routine maintenance (PR), condition-based routine maintenance (RK), rehabilitation (REH) and periodic maintenance (PB), based on road condition data.

In addition, the Analytical Hierarchy Process (AHP) was effectively applied to establish a prioritization of road segments based on multiple technical and non-technical criteria. The integration of PKRMS and AHP methods produced a comprehensive decision-making framework. Overall, the study demonstrates that combining PKRMS with AHP provides a more systematic, objective, and efficient approach for strategic analysis and prioritization of provincial roads in Palembang.

The findings confirm the effectiveness of AHP in structuring complex decision problems into hierarchical models and generating consistent priority rankings. Road condition remains the most influential criterion, followed by traffic volume and accessibility, consistent with previous studies.

The result of the research using Analytical Hierarchy Process (AHP) in the determination of road management priority hierarchy showed that the first priority with the highest value of 0.679 in the

road management was for Jalan Noerdin Pandji (Palembang). Based on the strategic analysis using PKRMS, Jalan Nurdin Panji requires management such as routine maintenance (PR) and condition-based routine works (RK), with a total management cost of IDR 4,572.03 million.

This study has a key strength in integrating the PKRMS and AHP methods, enabling the combination of technical and non-technical analyses within a more comprehensive multi-criteria framework. It also incorporates stakeholder perceptions through questionnaires, resulting in prioritization outcomes that are contextual, measurable, consistent ($CR < 0.1$), and applicable for practical decision-making by government agencies. However, this study also has several limitations, including a relatively small number of respondents, which may introduce bias; a scope limited to only five road segments, limiting the generalizability of the findings; reliance on subjective judgments in the AHP; and the limitations of PKRMS in directly accommodating certain non-technical criteria.

Conclusion

This study demonstrates that the integration of the Provincial/Kabupaten Road Management System (PKRMS) and the Analytical Hierarchy Process (AHP) offers an effective and comprehensive method for determining road management strategies and priorities in Palembang, thereby enhancing the multi-criteria decision-making framework through the combination of data-driven technical analysis and stakeholder judgment.

Unlike conventional approaches that rely solely on technical indicators such as road condition and traffic volume, this research incorporates non-technical criteria, including regional development, accessibility, policy, land use, and economic factors.

As a result, the proposed model offers a more comprehensive, context-sensitive approach to road prioritization, reflecting the multidimensional nature of infrastructure management challenges.

From a practical standpoint, this research provides a decision-making tool that can be directly implemented by government agencies, to manage limited road maintenance budgets more effectively. The integration of PKRMS and AHP enhances budget allocation efficiency, supports evidence-based decision-making by combining quantitative data with expert judgment, ensures alignment with regional development planning through policy criteria, and enables the selection of appropriate, cost-effective maintenance strategies (PR, RK, PB, REH). Furthermore, the framework is flexible and can be adapted for implementation in other regions, supporting scalability at the national level.

Further research is recommended to expand the scope of analysis by incorporating additional criteria and sub-criteria to enhance the reliability and comprehensiveness of the findings, as well as to increase the number of respondents and stakeholders and broaden the study area to improve the representativeness of the results.

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