

## THE INFLUENCE OF ROAD GEOMETRY ON THE CENTRAL GOVERNMENT POLICY FOR THE TRANS PAPUA ROAD SEGMENT IV JAYAPURA–ELELIM–WAMENA

**Mexan Andry Rumagit, Bahtiar, Dewi Ana Rusim, Mujiati, Bernathius Julison**  
Universitas Cenderawasih, Indonesia

mexan.rumagit@gmail.com, bahtiarpati2015@gmail.com, dewianarusim@yahoo.co.id,  
muji\_js@yahoo.com, bjulison@ft.uncen.ac.id

### ABSTRACT

The Trans Papua road network spans 3,259.45 km, comprising 58.24% national roads (1,898.32 km) and 41.76% strategic roads (1,361.13 km). A specific issue arises on the Trans Papua Segment IV (*Jayapura–Elelim–Wamena*), where the geometric design of the road does not align with the standards set in the Ministry of Public Works and Housing Regulation No. 5 of 2023 regarding technical requirements for road design. This non-compliance poses risks of traffic accidents and impacts travel time, particularly for essential vehicles like fuel supply trucks, which cannot navigate certain segments due to the road's steep gradient (*overgrade*). This study aims to analyze the compliance of the geometric design on the *Jayapura–Elelim–Wamena* road segment with the established technical standards and its alignment with the central government's policy to enhance the local economy and ensure equitable pricing in mountainous regions. The research findings reveal that while road handling in Segment IV *Jayapura–Elelim–Wamena* has been managed by the *BPJN Jayapura* and *BPJN Wamena*, the existing geometric conditions do not meet the requirements of *Permen PUPR* No. 5 of 2023. The current policy focuses on maintaining the functionality of the road through preservation work packages rather than addressing the design deficiencies. This study underscores the need for more comprehensive upgrades to meet regulatory standards for safe and efficient road use.

**Keywords:** Trans Papua, road geometry, policy implementation, technical standards, preservation work

This article is licensed under [CC BY-SA 4.0](https://creativecommons.org/licenses/by-sa/4.0/) 

### INTRODUCTION

As an institution directly involved in the provision of infrastructure, the Ministry of Public Works and Public Housing, through the Directorate General of Highways as the organizational unit responsible for road and bridge infrastructure, conducts geometric adjustments to the strategic work plan, which will later be implemented by its three technical implementation units: the National Road Implementation Centers in Papua Province, namely *BPJN Jayapura*, *BPJN Merauke*, and *BPJN Wamena* (Velasquez et al., 2022; Veza et al., 2023; Zekhnini et al., 2021; Zijm et al., 2019; Zulkifli et al., 2024). These units have constructed roads in Papua Province with a total length of 2,636.73 km, categorized as national roads (*SK Jalan Nasional*). Of this total, 1,138.81 km are primary arterial roads (*JAP*), 1,497.92 km are primary collector roads (*JKP-I*), while the strategic road section measures 2,974.64 km. The composition of road segments along the Trans Papua route consists of 1,898.32 km (58.24%) of national roads and 1,361.13 km (41.76%) of strategic roads, making the total length of

Trans Papua 3,259.45 km (Samanta et al., 2023; Sharma et al., 2022; Sienkiewicz-Małyjurek & Szymczak, 2024; Stank et al., 2019a; Tseng, 2024).

The researcher's observation of the Trans Papua Segment IV from *Jayapura* to *Elelim* to *Wamena* reveals issues with road geometry that do not meet the standards set by *Permen PUPR* No. 5 of 2023 on Road Technical Requirements and Road Planning (Chen et al., 2022; Chopra & Meindl, 2021; Dani, 2021; Domínguez et al., 2023; Elkourchi et al., 2023). The non-compliance with these geometric requirements poses potential risks for traffic accidents and affects travel time. Furthermore, some types of vehicles, which are crucial for supply purposes, such as fuel supply vehicles, are unable to pass through certain segments due to excessive gradients (*overgrade*) that do not meet the required specifications. Based on this description, the researcher is interested in conducting a study on the Trans Papua Segment IV *Jayapura–Elelim–Wamena* to evaluate the compliance with the required road geometric standards in relation to the central government's policy on Trans Papua, which aims to advance the economic development of communities along the route and ensure fair pricing in the mountainous regions (Phumchusri & Sirimak, 2024; Quesada et al., 2019; Rahmadini et al., 2023; Rizqi et al., 2021; Rizqi & Khairunisa, 2020).

Previous research studies have explored road infrastructure issues and technical requirements in Indonesia. The first study by Setiawan et al. (2020) focuses on the condition of road geometries in rural areas, particularly in relation to the safety and functionality of national roads (Banthao et al., 2021; Cedolin et al., 2024; Cevallos-Torres & Botto-Tobar, 2019; Stank et al., 2019b). The study identified several critical road sections where non-compliance with technical standards led to frequent accidents and prolonged travel times, but it failed to explore how such issues specifically affect logistical operations, especially for essential services like fuel supply. While this research highlights the importance of road geometries, it overlooks the specific needs of the supply chain, which this study aims to address (Kurniawan et al., 2022; Maitra et al., 2023; Mansur et al., 2020; Ordila, 2020; Otia, 2023). The second study by Hidayatuloh et al. (2023) analyzes the impact of road geometry on road users, emphasizing road capacity and traffic flow. However, it lacks an in-depth analysis of the Trans Papua region, particularly in terms of local socio-economic development and the specific challenges faced by the supply vehicles used in remote areas. This gap is significant as it affects the development of infrastructure that directly supports the region's economic growth and access to essential resources (Hofmann et al., 2019; Isotupa & Samanta, 2013; Ivanov et al., 2022; Kholil, 2022; Kolková, 2024). This study, therefore, aims to fill these gaps by examining the Trans Papua Segment IV *Jayapura–Elelim–Wamena*, focusing specifically on road geometry issues that affect both safety and the movement of supply vehicles, and assessing the alignment of these issues with the technical road requirements set forth by the Indonesian Ministry of Public Works and Public Housing (*Permen PUPR* No. 5/2023).

The purpose of this research is to evaluate the road geometry on the Trans Papua Segment IV *Jayapura–Elelim–Wamena* and to assess the compliance with the technical requirements outlined in *Permen PUPR* No. 5/2023. The findings are expected to provide essential insights that could inform future infrastructure development projects and contribute to advancing the economy in the mountainous regions of Papua, ensuring better access to essential resources and fair pricing for the local population.

## **METHOD**

The research was descriptive in nature, intending to describe and analyze the characteristics of the data in a specific context. The population of this study consisted of experts and professionals in the field related to the research title, including relevant authorities from institutions such as the *BPJN Jayapura* office. A purposive sampling technique was used to select the sample, focusing on individuals with substantial knowledge and experience in the domain under study. This targeted sampling ensured that the data collected was relevant and rich in information, contributing to the study's objectives.

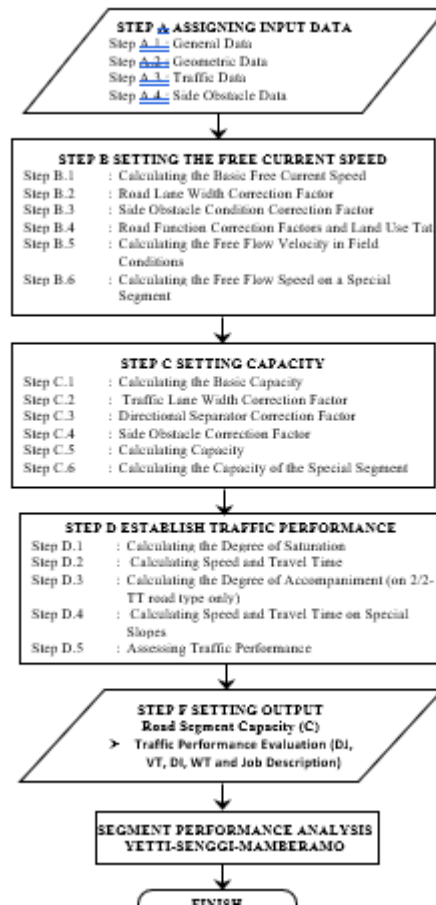
Data was collected using a combination of primary and secondary sources. Primary data was gathered through interviews with experts in the field, offering direct insights and firsthand knowledge. Secondary data was sourced from official reports and surveys, such as those related to road conditions and infrastructure management from the *BPJN Jayapura* office. The data collection process was structured to ensure reliability and validity. A well-defined research instrument, consisting of interview guides and survey forms, was developed to ensure consistency across data collection methods. The instruments were validated through expert review, and a pilot test was conducted to assess their clarity and relevance. Reliability was ensured by standardizing the procedures and ensuring the repeatability of the research process.

For data analysis, software such as *SPSS* or *NVivo* was utilized to assist in processing and interpreting the collected data. Qualitative data analysis focused on identifying patterns, themes, and trends, allowing for a comprehensive understanding of the research findings. The data analysis technique included coding and thematic analysis, where the data was categorized into meaningful groups. The findings were validated through triangulation, comparing primary and secondary data to cross-check results. This approach guaranteed that the conclusions drawn were credible and well-supported by the collected data.

## **RESULTS AND DISCUSSION**

### **Analysis of the Existing Geometric Conditions of the Trans Papua Segment IV Jayapura-Elelim-Wamena Road**

The data on the existing geometric conditions of the Yetti-Senggi-Mamberamo road serve as input for the capacity evaluation, as shown in flowchart 2. The analysis was conducted using the Indonesian Road Capacity Guidelines (09/P/BM/2023).



**Figure 1. Research Analysis**

## Research Decision

The research decision regarding the impact of the Trans Papua Segment IV Jayapura-Elelim-Wamena road geometry on the central government’s policy is outlined below:

- 1) The handling of the Trans Papua road sections in Segment IV (Jayapura-Elelim-Wamena) has been well executed by the technical implementation units, namely the BPJN Jayapura and BPJN Wamena. Currently, the road serves as a connection between the city of Jayapura and the city of Wamena via Elelim, which is also connected to other Trans Papua segments at the Usilimo junction leading to the city of Karubaga and several other district capitals beyond that.
- 2) The existing conditions of the Yetti-Senggi-Mamberamo road segment show that:
  - a. The Degree of Saturation (DS) for this segment is 0.018, meaning the segment is still highly capable of accommodating the current traffic volume.
  - b. The traffic flow speed (vT) in km/h, represented by the average speed of passenger vehicles (vMP) obtained from the diagram, is 47.8 km/h (flat). This speed is 12.2 km/h slower than the technical road requirements for primary road network segments (Permen PUPR 5/2023), which is 60 km/h. The results show that traveling the Yetti-Senggi-Mamberamo road segment, which is 153.97 km long, takes 3.22 hours (3 hours 13 minutes 12 seconds). To reach Elelim, which is 314.51 km from Sp.3 Yetti (the starting point of Segment IV), it takes 6.58 hours (6 hours 34 minutes 48 seconds).

To reach the final junction point in Wamena, which is 441.58 km from Yetti, it takes 9.24 hours (9 hours 14 minutes 24 seconds).

- c. The Degree of Congestion (DC), according to the results from the diagram in Figure 4.5, shows a value of 0.06, indicating a very low occurrence of congestion, which correlates with the data from the 3 x 24-hour traffic count.

- 3) The central government's strategy regarding the development of Trans Papua has been well implemented by the relevant technical units to operationalize Segment IV. However, it has yet to achieve the primary goal of the policy, which is to promote economic growth along the route and normalize prices at the final junction point in Wamena.

## CONCLUSION

This research found that the existing geometric conditions of the Trans Papua Segment IV Jayapura–Elelim–Wamena road, particularly the Yetti–Senggi–Mamberamo segment, were still adequate for current traffic volumes, as indicated by a low degree of saturation (0.018) based on the Indonesian Road Capacity Guidelines (09/P/BM/2023), meaning the road could accommodate traffic without congestion. However, the average traffic speed remained below technical requirements, leading to longer travel times—especially for critical supply vehicles—due to geometric limitations. Although the implementation of the Trans Papua Road policy by technical units has been successful, it has not yet fully realized its goals of fostering economic growth and fair pricing in the Wamena region. Future research should focus on improving road geometry to meet technical standards, particularly in segments vital for logistics, and further investigate the impact of such improvements on local economic development.

## REFERENCES

- Banthao, J., Boonyanusith, W., Buransri, N., Sophatai, P., & Thankrathok, P. (2021). Saline Inventory Management with Simulation Techniques. *ASEAN Journal of Scientific and Technological Reports*, 24(2), 58–69.
- Cedolin, M., Orhan, D., & Genevois, M. (2024). Statistical and Artificial Intelligence Based Forecasting Approaches for Cash Demand Problem of Automated Teller Machines. *Academic Platform Journal of Engineering and Smart Systems*, 12(1), 21–27.
- Cevallos-Torres, L., & Botto-Tobar, M. (2019). Case study: Probabilistic estimates in the application of inventory models for perishable products in SMEs. In *Problem-Based Learning: A Didactic Strategy in the Teaching of System Simulation* (pp. 123–132).
- Chen, L., Jia, F., Steward, M. D., & Schoenherr, T. (2022). The role of technology in enabling circular supply chain management. *Industrial Marketing Management*, 106, A1–A6.
- Chopra, S., & Meindl, P. (2021). *Supply Chain Management: Strategy, Planning, and Operation* (7th ed.). Pearson.
- Dani, S. (2021). *Food Supply Chain Management and Logistics: Understanding the Challenges of Production, Operation and Sustainability in the Food Industry*. Kogan Page Publishers.
- Domínguez, J. G. C., Camacho, G. P., & Juárez, S. K. P. (2023). Inventory Control in MSMEs Using Monte Carlo Simulation. In *EUROSIM Congress* (pp. 44–58). Springer Nature Switzerland.
- Elkourchi, A., El Oualidi, M. A., & Ahlaqqach, M. (2023). Demand forecast of pharmaceutical products during COVID-19 using holt-winters exponential smoothing. In *International Conference on Artificial Intelligence & Industrial Applications* (pp. 427–437). Springer Nature Switzerland.
- Hidayatuloh, S., Winati, F. D., Samodro, G., Qisthani, N. N., & Kasanah, Y. U. (2023). Inventory Optimization in Pharmacy Using Inventory Simulation-Based Model During

- the Covid-19 Pandemic. *Jurnal INTECH Teknik Industri Universitas Serang Raya*, 9(2), 110–116.
- Hofmann, E., Sternberg, H., Chen, H., Pflaum, A., & Prockl, G. (2019). Supply chain management and Industry 4.0: conducting research in the digital age. *International Journal of Physical Distribution & Logistics Management*, 49(10), 945–955.
- Isotupa, K. S., & Samanta, S. K. (2013). A continuous review (s, Q) inventory system with priority customers and arbitrarily distributed lead times. *Mathematical and Computer Modelling*, 57(5–6), 1259–1269.
- Ivanov, D., Dolgui, A., & Sokolov, B. (2022). Cloud supply chain: Integrating Industry 4.0 and digital platforms in the “Supply Chain-as-a-Service.” *Transportation Research Part E: Logistics and Transportation Review*, 160, 102676.
- Kholil, M. (2022). Inventory control of vegetable oil products using continuous review system (Q) approach and periodic review system (P) methods in retail companies: A case study of Indonesia. *International Journal of Scientific and Applied Research (IJSAR)*, 2(4), 11–16.
- Kolková, A. (2024). Data Analysis in Demand Forecasting: A Case Study of Poetry Book Sales in the European Area. *Central European Business Review*.
- Kurniawan, S., Saragih, M. H., & Angelina, V. (2022). Inventory Control Analysis with Continuous Review System and Periodic Review System Methods at PT. XYZ. *Business Economic, Communication, and Social Sciences Journal (BECOSS)*, 4(2), 97–109.
- Maitra, S., Mishra, V., & Kundu, S. (2023). *A Novel Approach with Monte-Carlo Simulation and Hybrid Optimization Approach for Inventory Management with Stochastic Demand*. arXiv preprint arXiv:2310.01079.
- Mansur, A., Mar’ah, F. I., & Amalia, P. (2020). Platelet inventory management system using monte carlo simulation. In *IOP Conference Series: Materials Science and Engineering* (Vol. 722, Issue 1, p. 012004). IOP Publishing.
- Ordila, R. (2020). Efficiency Of STMIK Hang Tuah Pekanbaru Stationery Inventory Office Using Monte Carlo Method. *Journal of Applied Engineering and Technological Science (JAETS)*, 1(2), 77–84.
- Otia, R. K. (2023). *Inventory management on organisational productivity: case analysis of Guinness Cameroon SA*.
- Phumchusri, N., & Sirimak, W. (2024). *Time Series and Machine Learning Hybrid Models for Food Condiment Demand Forecasting: A Case Study in Thailand*.
- Quesada, H., Adhikari, S., Bond, B., & Grushecky, S. T. (2019). Analysis of hardwood lumber grade yields using Monte Carlo simulation. *BioResources*, 14(1), 2029–2050.
- Rahmadini, N., Supian, S., & Napitupulu, H. (2023). Inventory Control of Vaccine Products in Pharmaceutical Company Using The Economic Order Quantity Model and Monte Carlo Simulation. *International Journal of Global Operations Research*, 4(4), 229–234.
- Rizqi, Z. U., & Khairunisa, A. (2020). Integration of deterministic and probabilistic inventory methods to optimize the balance between overstock and stockout. In *IOP Conference Series: Materials Science and Engineering* (Vol. 722, Issue 1, p. 012060). IOP Publishing.
- Rizqi, Z. U., Khairunisa, A., & Maulani, A. (2021). Financial assessment on designing inventory policy by considering demand, lead time, and defective product uncertainties: A monte carlo simulation. In *Indonesian Scholars Scientific Summit Taiwan Proceeding* (Vol. 3, pp. 36–42).
- Samanta, S. K., Isotupa, K. S., & Verma, A. (2023). Continuous review (s, Q) inventory system at a service facility with positive order lead times. *Annals of Operations Research*, 331(2), 1007–1028.
- Sharma, M., Mittal, N., Mishra, A., & Gupta, A. (2022). Analytical machine learning for medium-term load forecasting towards agricultural sector. In *Proceedings of Second*

- Doctoral Symposium on Computational Intelligence: DoSCI 2021* (pp. 581–592). Springer Singapore.
- Sienkiewicz-Małyjurek, K., & Szymczak, M. (2024). Understanding public service supply chain management: a systematic literature review. *Management Review Quarterly*, 74(3), 1879–1943.
- Stank, T., Esper, T., Goldsby, T. J., Zinn, W., & Autry, C. (2019a). Toward a digitally dominant paradigm for twenty-first century supply chain scholarship. *International Journal of Physical Distribution & Logistics Management*, 49(10), 956–971.
- Stank, T., Esper, T., Goldsby, T. J., Zinn, W., & Autry, C. (2019b). Toward a digitally dominant paradigm for twenty-first century supply chain scholarship. *International Journal of Physical Distribution & Logistics Management*, 49(10), 956–971.
- Tseng, C. S. (2024). *Demand forecasting with Machine Learning*.
- Velasquez, C. E., Zocatelli, M., Estanislau, F. B., & Castro, V. F. (2022). Analysis of time series models for Brazilian electricity demand forecasting. *Energy*, 247, 123483.
- Veza, O., Setyabudhi, A. L., Arifin, N. Y., & Agustini, S. (2023). Simulation Modeling System in Determining the Amount of Oil Inventory. *Journal of Computer Networks, Architecture and High Performance Computing*, 5(1), 110–119.
- Zekhnini, K., Cherrafi, A., Bouhaddou, I., Benghabrit, Y., & Garza-Reyes, J. A. (2021). Supply chain management 4.0: a literature review and research framework. *Benchmarking: An International Journal*, 28(2), 465–501.
- Zijm, H., Klumpp, M., Heragu, S., & Regattieri, A. (2019). Operations, logistics and supply chain management: definitions and objectives. In *Operations, logistics and supply chain management* (pp. 27–42).
- Zulkifli, M. Z., Abbas, N. M., Abd Razak, A. N., & Yusoff, N. (2024). Managing Inventory in Maintenance Department of Building Services Company with ABC Analysis and Monte Carlo Simulation. *International Journal of Business and Technology Management*, 6(S2), 249–257.