PALAR (Pakuan Law Review)
https://journal.unpak.ac.id/index.php/palar

Volume 12, Number 02, April-June 2026, Pages 385-391
e-ISSN:2614-1485
p-ISSN:2716-0440
Doi: https://doi.org/10.33751/palar.v12i2
Sinta 3; decree No. 0173/C3/DT.0500/2025

The Challenges in Strengthening Standards for Improving the Function of Urban Intersections in Malang

Muhammad Ahnaf Maulana Vansya[1]; Siti Marwiyah[2]; Wahyu Prawesthi[3]; Vieta Imelda Cornelis[4]

Master of Laws Student, Faculty of Law, Universitas Dr. Soetomo Surabaya, Indonesia[1].
Lecturer, Faculty of Law, Universitas Dr. Soetomo Surabaya, Indonesia[2,3,4].
E-mail: mhs.muhammad.am.vansyah@unitomo.ac.id, siti.marwiyahsh@unitomo.ac.id, wahyu.prawesthi@unitomo.ac.id, vieta@unitomo.ac.id
Manuscripts received : 11/05/2026, Revision and Review : 20/06/2026, Approved 30/06/2026

Abstract

Increased urban mobility requires the management of road intersections that is not only technically effective but also has a clear legal basis. The Gunggung, Jalan Raya Langsep, Jalan Dieng, and Jalan Terusan Dieng intersections in Malang City are strategic areas that require a feasibility study on alternative measures to improve intersection functionality. However, traffic management and engineering regulations still leave ambiguities in the norms, particularly regarding the legal basis, feasibility criteria, and the authority of local governments to determine improvements or changes to intersection functions. This study aims to analyze the impact of such regulatory ambiguity on legal certainty in urban traffic engineering policy-making. The method used is normative legal research with a regulatory and conceptual approach. The results of the study indicate that existing regulations have established general objectives for traffic management but have not provided operational, measurable, and binding indicators for determining the feasibility of upgrading intersection functions. In conclusion, it is necessary to strengthen regulations regarding feasibility parameters, assessment procedures, and the division of local government authority so that policies on upgrading intersection functions possess legitimacy, accountability, and legal certainty.

Keywords: regulatory ambiguity, traffic engineering, feasibility studies, intersection improvement, local government.

A. Introduction

An increasing need for public mobility always accompanies the growth of urban areas. Changes in land use, along with the expansion of economic, educational, commercial, and residential activities, place greater pressure on road networks.[1] One of the most vulnerable points to this pressure is the intersection, as it serves as a convergence point for various traffic flows including vehicles, pedestrians, and public transportation, as well as for entry and exit activities within the area.[2] In the context of urban transportation, intersections are not merely physical components of the road network but also spaces for technical and legal

[1] Monika Florczak-Wątor, 'Constitutional Challenges in Emergency Governance: An Analysis of Poland's Reluctance and Regulatory Ambiguities in States of Emergency', *European Journal of Risk Regulation* 16, no. 2 (2025): 433–45, doi:10.1017/err.2024.104.

[2] Rahul Goel et al., 'Effectiveness of Road Safety Interventions: An Evidence and Gap Map', *Campbell Systematic Reviews* 20, no. 1 (2024): e1367.

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decision-making that determine the smooth flow, safety, and order of traffic.[3]

These issues are particularly relevant at the Gunggung Road Intersection, Langsep Highway, Dieng Road, and Terusan Dieng Road in Malang City. This area is situated within an urban corridor characterized by complex traffic patterns, as it connects residential, educational, commercial, and service activities.[4] In practice, these intersections are likely to face increased vehicle volume, conflicts between traffic flows at the intersection arms, queues during peak hours, and the need for more adaptive traffic management.[5] Therefore, a feasibility study on alternative improvements to the intersection's functionality is essential to determine whether the intersection can be adequately managed through standard traffic control, requires geometric modifications, priority adjustments, signal optimization, restrictions on certain movements, or other forms of traffic engineering.

From a legal perspective, the management of road intersections is closely tied to traffic management and engineering. Law No. 22 of 2009 on Road Traffic and Transportation treats road traffic and transportation as an integrated system that must be managed safely, securely, and in an orderly, smooth, and comprehensive manner.[6] This provision provides a general direction that traffic management must not be separated from the interests of safety, order, and public service.[7] Additionally, the Ministry of Transportation Regulation No. PM 96 of 2015 establishes Guidelines for the Implementation of Traffic Management and Engineering Activities as the technical basis for optimizing the use of the road network and traffic flow.[8]

However, issues arise when these general norms are applied to specific cases involving the upgrading or repurposing of intersections.[9] In practice, the critical legal question is not merely whether local governments have the authority to conduct traffic engineering, but also what parameters an intersection must meet to be deemed suitable for upgrading or repurposing.[10] Normative ambiguity arises when regulations provide general guidelines but do not fully establish clear, operational, measurable, and binding indicators for determining when an intersection should be maintained, optimized, upgraded, or have its functional pattern altered.[11] This ambiguity can lead to legal uncertainty, differing interpretations among agencies, and a potential weakening of the legitimacy of technical policies adopted by local governments.

Conceptually, feasibility studies on intersection function upgrades cannot be separated

[3] Priyanka Anand and Pradyut Anand, 'Navigating Legal Complexities in Public Infrastructure Projects: The Intersection of Contract Law and Construction Industry Practices', *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction* 17, no. 3 (2025): 4525015.

[4] S T Frysa Wiriantari et al., *Perencanaan Kota* (Arsy Media, 2025).

[5] Juan Mikha Siagian, 'Evaluation of Circulation Patterns in The Bukit Baruga Housing Complex in Makassar City Using Kevin Lynch's Theory Approach' (Universitas Hasanuddin, 2024).

[6] Fadilah Arif, 'Peran Dinas Perhubungan Dalam Mengimplementasikan Peraturan Menteri Perhubungan Pasal 87 Huruf D Tentang Pemeliharaan Penerangan Jalan Perspektif Fiqh Siyasah (Studi Di Dinas Perhubungan Kabupaten Pesisir Barat)' (UIN Raden Intan Lampung, 2025).

[7] Ummi Nadrah Daulay, 'Dinamika Konstruksi Sosial Terhadap Perilaku Pelanggaran Lalu Lintas Remaja Di Wilayah Hukum Polda Sumatera Utara' (Universitas Islam Sultan Agung Semarang, 2024).

[8] Wahyu Tri Setiyo Nugroho, 'Analisis Penegakan Hukum Terhadap Tingginya Pelanggaran Lalu Lintas Di Kalangan Pengendara Remaja Dalam Perspektif Hak Asasi Manusia' (UPT. Perpustakaan Undaris, 2025).

[9] Ajeng Ana Mustifah, 'Peran Satlantas Polres Brebes Dalam Penegakan Hukum Pelanggaran Kendaraan Bermotor Berdasarkan Undang-Undang Lalu Lintas Dan Angkutan Jalan (Studi Penelitian Di Satuan Lalu Lintas Polres Brebes)' (Universitas Islam Sultan Agung (Indonesia), 2023).

[10] Yuanda Patria Tama et al., *Transportasi Jalan Dan Dinamika Perkotaan* (Penerbit Karya Bakti Makmur (KBM) Indonesia, 2026).

[11] Ari Ananda Putri et al., *Transportation Network Planning and Urban Structure* (PENERBIT KBM INDONESIA, 2026).

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from theories of road network performance, capacity, service levels, safety, and traffic impacts.[12] Previous research in transportation indicates that road capacity and service levels are key indicators of the quality of road and intersection services, particularly in addressing increased vehicle volumes in urban areas.[13] A systematic review of road capacity and service levels confirms that these two aspects are key components in transportation planning and the evaluation of urban mobility quality.

Furthermore, the relationship between land use and traffic congestion has been extensively discussed in the literature. Kanyepe and Andersen demonstrate that the interaction among land use, travel patterns, and the transportation system is a primary cause of urban congestion.[14] These findings are significant because the Gunggung–Langsep–Dieng intersection does not exist in isolation as a physical entity but is situated within an urban environment influenced by the activities of the surrounding area.[15] Consequently, a feasibility study to enhance the intersection's functionality must consider the relationships among urban spatial functions, traffic intensity, and road network capacity.

Other research on traffic impact analysis in Indonesia also indicates that the requirement for traffic impact analysis has been legally established by Law No. 22 of 2009; however, its implementation still faces various challenges, including the need to harmonize regional implementation guidelines.[16] These findings indicate that the main issue does not always lie in the absence of regulations, but rather in the extent to which such regulations are sufficiently clear to be operationalized in technical and administrative decision-making.

In the context of Greater Malang, research on the relationship between land use and road service levels also indicates that changes in land use can affect road service quality.[17] This study highlights the importance of a quantitative approach in assessing the relationship between spatial activities and traffic performance. However, such research generally continues to focus on technical aspects of transportation, such as capacity, vehicle volume, service levels, and traffic modeling.[18] Legal dimensions, including regulatory certainty, parameters of authority, and the legitimacy of local government decision-making, have not yet been a primary focus.

Based on previous findings, urban transportation studies have extensively discussed the relationship between congestion, road capacity, land use, and the effectiveness of traffic engineering.[19] Meanwhile, legal studies on traffic generally focus more on law enforcement, driving safety, public transportation, or administrative obligations. A research gap exists in the scarcity of studies linking feasibility studies on intersection function upgrades to the

[12] Danang Putranto Febriansyah, 'Peranan Satlantas Polres Semarang Dalam Mengatasi Kemacetan Dan Kecelakaan Sebagai Wujud Pelayanan Kepada Masyarakat Ditinjau Dari Undang-Undang No 39 Tahun 1999 Tentang Hak Asasi Manusia' (Undaris, 2023).

[13] Sitoresmi, 'Penegakan Hukum Tilang Elektronik (Electronic Traffic Law Enforcement) Guna Mengurangi Pelanggaran Lalu Lintas Di Indonesia' (Universitas Islam Sultan Agung Semarang, 2025).

[14] Indah Nur Hidayah, 'Penegakan Hukum Terhadap Pelanggaran Rambu-Rambu Lalu Lintas Oleh', n.d.

[15] Nazanin Zare et al., 'Blending Efficiency and Resilience in the Performance Assessment of Urban Intersections: A Novel Heuristic Informed by Literature Review', *Sustainability* 16, no. 6 (2024): 2450.

[16] Frysa Wiriantari et al., *Perencanaan Kota*.

[17] Zare et al., 'Blending Efficiency and Resilience in the Performance Assessment of Urban Intersections: A Novel Heuristic Informed by Literature Review'.

[18] Margaret Wanjuhi Chege, Christopher Gakuu, and John Mwaura Mbugua, 'Management of Road Intersection and Performance of Intelligent Traffic Control Systemsnairobi County, Kenya: Does Traffic Legal Framework Matter?', *International Journal of Professional Business Review: Int. J. Prof. Bus. Rev.* 10, no. 4 (2025): 1.

[19] Pouya Sepehr, 'Mundane Urban Governance and AI Oversight: The Case of Vienna's Intelligent Pedestrian Traffic Lights', *Journal of Urban Technology* 32, no. 3 (2025): 93–110.

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issue of legal ambiguity in traffic management and engineering regulations.[20] Yet, decisions to upgrade or alter intersection functions are public decisions with legal, technical, social, and economic consequences.

A shortcoming of previous research is also evident in the insufficient discussion regarding the role of local governments in determining alternative intersection functions based on existing norms.[21] Local governments do play a crucial role in managing traffic within their jurisdictions, but clear legal parameters must support such authority. Without clear parameters, feasibility studies risk becoming mere technical documents whose accountability is difficult to verify. For example, when a junction is deemed in need of improvement, it must be explained whether the decision is based on service levels, accident rates, traffic queues, congestion levels, traffic conflicts, the need for road network integration, or urban planning policy considerations.[22] If these parameters are not clearly defined, local government decisions risk sparking debates regarding the basis of authority, policy priorities, and the protection of road users' interests.

The novelty of this research lies in applying a normative legal perspective to analyze feasibility studies aimed at improving intersection functions. This study does not merely evaluate intersections as technical transportation objects. Still, it positions them as public policy objects that must adhere to the principles of legal certainty, accountability, and rational decision-making.[23] Specifically, this study takes the context of the Gunggung Road, Langsep Highway, Dieng Road, and Terusan Dieng Road intersections in Malang City as concrete case studies to test whether the applicable traffic management and engineering norms have sufficiently provided a legal basis, feasibility parameters, and limits on local government authority in determining intersection function improvements.

Thus, this study holds both academic and practical significance.[24] Academically, it contributes to expanding research on transportation law, particularly regarding the relationship between legal norms, feasibility studies, and urban traffic engineering. From a policy perspective, this research can inform local governments in formulating clearer standards or guidelines for the feasibility assessment of intersection function improvements.[25] In practice, this research is also beneficial for transportation planners, transportation agencies, traffic consultants, and urban stakeholders, ensuring that traffic engineering decisions are not only technically effective but also legally legitimate.[26]

Based on the above, this study aims to address the research question: how does the ambiguity of norms in traffic management and engineering regulations affect the legal basis, feasibility parameters, and the authority of local governments in determining

[20] Ana Theodora Balaci and Eun Suk Suh, 'Systematic Approach to a Government-led Technology Roadmap for Future-ready Adaptive Traffic Signal Control Systems', *Systems Engineering* 27, no. 6 (2024): 1062–88.

[21] Adni Syaifullah Pesa, 'Konsep Livable Street Dalam Penataan Koridor Jalan Tuanku Tambusai Kota Pekanbaru' (Universitas Islam Riau, 2022).

[22] Achmad Nurochim, 'Analisis Tingkat Pelayanan Prasarana Sepeda Pada Kawasan Koridor Jalan Kota Kebumen Menggunakan Metode Blos (Studi Kasus Penataan Kawasan Koridor Jalan Di Pusat Kota Kebumen)' (Universitas Islam Indonesia, 2023).

[23] Mustifah, 'Peran Satlantas Polres Brebes Dalam Penegakan Hukum Pelanggaran Kendaraan Bermotor Berdasarkan Undang-Undang Lalu Lintas Dan Angkutan Jalan (Studi Penelitian Di Satuan Lalu Lintas Polres Brebes)'.

[24] Jonas Rode et al., 'Replication Studies in Engineering Design – a Feasibility Study', *Proceedings of the Design Society* 4 (2024): 115–24, doi:10.1017/pds.2024.14.

[25] Chege, Gakuu, and Mbugua, 'Management of Road Intersection and Performance of Intelligent Traffic Control Systemsnairobi County, Kenya: Does Traffic Legal Framework Matter?'

[26] Zare et al., 'Blending Efficiency and Resilience in the Performance Assessment of Urban Intersections: A Novel Heuristic Informed by Literature Review'.

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alternative functional improvements at the Gunggung Road, Langsep Highway, Dieng Road, and Terusan Dieng Road intersections in Malang City? This research question is important because it positions the feasibility study of the intersections as a meeting point between technical transportation needs and the demands for legal certainty in local government administration.

B. Research Method

This study employs a normative legal research method, using a statutory, conceptual, and case study approach.[27] The selection of these methods is based on the study's focus, which not only addresses technical traffic issues but also examines the ambiguity of norms in traffic management and engineering regulations, particularly regarding the legal basis, feasibility criteria, and the authority of local governments to determine alternative improvements to intersection functions. In the research manuscript, the main issue is whether the applicable norms have provided a sufficient legal basis, feasibility parameters, and limits on local government authority for determining improvements to intersection functions in the City of Malang.

A legal framework approach is employed to examine the legal norms governing traffic and road transport management, particularly Law No. 22 of 2009 on Traffic and Road Transport and Minister of Transportation Regulation No. PM 96 of 2015 on Guidelines for the Implementation of Traffic Management and Engineering Activities.[28] This approach is important because the study identifies a lack of clarity in the norms governing when an intersection can be deemed suitable for maintenance, optimization, upgrading, or reallocation of its function.[29] In the introduction to this paper, it has been emphasized that existing regulations provide general guidance on safe, orderly, smooth, and integrated traffic but do not yet provide clear, operational, measurable, and binding indicators.

A conceptual approach is employed to develop an understanding of normative ambiguity, legal certainty, local government authority, traffic management and engineering, and feasibility studies for intersection function upgrades.[30] Through this approach, the research does not merely interpret the regulatory text but also assesses whether the available norms are sufficient to serve as a basis for public decision-making. This is relevant because decisions regarding intersection function improvements are not merely technical but also administrative, and must possess legal legitimacy, accountability, and policy rationality.[31]

A case study approach was employed, focusing on the intersections of Gunggung Road, Langsep Highway, Dieng Road, and Terusan Dieng Road in Malang City. These areas were selected because they exhibit complex traffic movement patterns, connect residential, educational, commercial, and service activities, and are likely to face increased vehicle volume, queues, traffic flow conflicts, and the need for more adaptive traffic management. Through this case study, the research examines how general norms regarding traffic management and engineering apply to concrete local-level issues.

Table 1. NVivo Coding Framework for Legal-Transportation Analysis

Main Theme	Subtheme / Node	Analytical Question

[27] Peter Mahmud Marzuki, *Penelitian Hukum Edisi Revisi* (Prenada Media Group, 2022).

[28] Arif, 'Peran Dinas Perhubungan Dalam Mengimplementasikan Peraturan Menteri Perhubungan Pasal 87 Huruf D Tentang Pemeliharaan Penerangan Jalan Perspektif Fiqh Siyasah (Studi Di Dinas Perhubungan Kabupaten Pesisir Barat)'.

[29] Arga Setya, 'Penegakan Hukum Terhadap Pelaku Pelanggaran Rambu-Rambu Lalu Lintas Di Wilayah Hukum Kepolisian Resor Tanjung Jabung Barat' (UNIVERSITAS BATANGHARI JAMBI, 2025).

[30] Peter Mahmud Marzuki, 'Penelitian Hukum, Edisi Revisi, Cetakan Ke-12', *Jakarta: Kencana*, 2021, 133–36.

[31] Philipus M Hadjon, *Hukum Administrasi Dan Good Governence* (Jakarta: Universitas Trisakti, 2021).

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Regulatory Ambiguity	Unclear indicators; multiple interpretations; overly general norms	Do the existing regulations provide clear standards for assessing the feasibility of improving an intersection's function?
Legal Basis	Road Traffic and Transportation Law; Ministry of Transportation Regulation; local regulations	Is the legal basis for improving the function of urban intersections sufficiently strong?
Feasibility Parameters	Capacity; level of service; queues; safety; traffic-flow conflicts	What parameters should serve as the basis for assessing feasibility?
Local Government Authority	Division of governmental affairs; administrative discretion; interagency coordination	To what extent is the local government authorized to determine alternative functional improvements for the intersection?
Policy Legitimacy	Accountability; rationality; transparency	Can the decision to improve the intersection's function be legally justified and publicly accounted for?
Intersection Case Study	Gunggung; Langsep; Dieng; Terusan Dieng	How are general legal norms applied to the concrete issues found at these intersections?

Table 1 presents the analytical framework used in this study. The table outlines the main themes of the study, namely the ambiguity of regulations, legal basis, feasibility parameters, local government authority, policy legitimacy, and case studies of the Gunggung, Langsep, Dieng, and Terusan Dieng intersections. Through this table, the study aims to determine whether existing regulations provide clear criteria for assessing the feasibility of improving intersection functionality, from both legal and technical perspectives.[32] Thus, Table 1 serves as an analytical guide to ensure that the discussion not only evaluates traffic conditions from a technical standpoint but also assesses legal certainty, the basis of authority, and the accountability of local government policies.[33]

The government documents used in this study include Law No. 22 of 2009 on Road Traffic and Transportation, Minister of Transportation Regulation No. PM 96 of 2015 on Guidelines for the Implementation of Traffic Management and Engineering Activities, as well as supporting documents related to local government authority and traffic coordination, such as Law No. 23 of 2014 on Regional Government and Government Regulation No. 37 of 2011 on the Road Traffic and Transportation Forum.

Legal materials were collected through literature reviews and document studies. Literature reviews were used to identify theories, concepts, and prior research relevant to regulatory ambiguity and traffic engineering.[34] Document studies examine regulations, technical guidelines, planning documents, and conditions related to the Gunggung Road, Langsep Highway, Dieng Road, and Terusan Dieng Road intersections in Malang City.

[32] Pedro Uribe-Chavert, Juan-Luis Posadas-Yagüe, and Jose-Luis Poza-Lujan, 'Evaluating Traffic Control Parameters: From Efficiency to Sustainable Development', *Smart Cities* 8, no. 2 (2025): 57.

[33] Balaci and Suh, 'Systematic Approach to a Government-led Technology Roadmap for Future-ready Adaptive Traffic Signal Control Systems'.

[34] Adiyani Rahmi Adiyani, 'Redesain Koridor Jalan Ki Hajar Dewantara Di Kawasan Pendidikan Kota Metro Dengan Pendekatan Perilaku' (UNIVERSITAS LAMPUNG, 2025).

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Figure 1. The analysis process

Source. Addopted by[35]

The analysis of legal materials is conducted using a qualitative-prescriptive approach.[36] Qualitative analysis is used to interpret the regulations' content and relate them to the concrete issue of improving the intersection's functionality. Prescriptive analysis is used to formulate arguments for strengthening regulations, establishing feasibility indicators, defining assessment procedures, and dividing authority among local governments.[37] To strengthen the qualitative analysis, this study may use NVivo software to assist with coding legal materials and supporting documents. The use of NVivo is not intended to replace legal analysis but to help group themes, identify patterns of relationships between concepts, and map key issues within regulations and research documents.

Figure 1 illustrates the research analysis process flow, starting with the collection of data or materials via online media, the coding process, the creation of word clouds and crosstabs, and culminating in the generation of research findings. This figure shows that the analysis was conducted systematically with NVivo to group themes, identify patterns in relationships between concepts, and map key issues across regulations and supporting documents. However, the use of NVivo does not replace legal analysis; rather, it merely helps strengthen the qualitative-prescriptive analysis process used in the research.

Based on Table 1 and Figure 1, this study was designed using a systematic and focused analytical framework. Table 1 clarifies the study's focus by mapping legal and transportation themes, while Figure 1 illustrates the stages of data analysis used to obtain the research results. Both emphasize that improving intersection functionality cannot be viewed solely as a technical traffic problem but must also be examined from the perspectives of legal certainty, clarity of feasibility parameters, local government authority, and the legitimacy of public policy.

C. Results and Discussion

1. Regulatory Ambiguity and the Need for Clear Feasibility Parameters

This discussion focuses on the key finding that traffic regulations and traffic engineering have provided general guidance regarding traffic safety, order, flow, and integration, but have not yet fully established operational, measurable, and binding indicators to determine when an intersection needs to be maintained, optimized, upgraded, or have its regulatory function altered.[38] This aligns with the analytical framework in Table 1, which identifies regulatory ambiguity, legal basis, and feasibility parameters as the main research issues.

[35] Maisarah A… …iesia', *Heritage and Sustainable Develop…*

[36] I Made Pas… …ori Hukum* (Jakarta: Prenadamedia Grou…

[37] Sepehr, 'Mun… …nt Pedestrian Traffic Lights'.

[38] Nurochim, '… …alan Kota Kebumen Menggunakan Metod… …umen)'.

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Figure 2. The analysis process

Source. Addopted by[39]

The findings indicate that the main challenge in improving the function of urban intersections lies in the ambiguity of regulatory standards. Existing traffic management and engineering regulations provide general legal guidance, particularly regarding safety, order, smoothness, and the integration of traffic systems.[40] However, these norms have not yet provided clear, operational, measurable, and binding indicators to determine whether an intersection should be maintained, optimized, upgraded, or functionally reallocated.[41] This condition creates uncertainty in the feasibility assessment process because technical factors such as capacity, level of service, queue length, safety, and traffic-flow conflicts are not yet firmly integrated into a clear legal standard.[42] Therefore, strengthening the feasibility parameters is necessary to ensure that decisions on intersection improvements are not based solely on technical discretion but are also supported by a clear, accountable legal framework.

Figure 2, the word cloud visualization further confirms the conceptual orientation of this research. The most prominent terms reflect the centrality of intersection improvement, traffic management, legal regulation, feasibility assessment, and governmental authority.[43] This pattern demonstrates that the discourse on urban intersection improvement is not limited to transportation engineering but also involves questions of legal certainty, policy legitimacy, and administrative accountability.[44] Accordingly, the visualization reinforces the argument that the strengthening of standards for improving intersection functions requires an integrated framework that connects technical feasibility with legal justification and local government authority.[45]

The findings in Figure 2, the word cloud, can be interpreted as reinforcing the results of the normative analysis conducted in this study. The dominance of terms related to intersection, traffic management, legal regulation, feasibility, authority, and policy legitimacy indicates that improving intersection functionality is not solely a technical issue in transportation but is also closely linked to the clarity of the legal basis and decision-

[39] Bachrul Amiq et al., 'Environmental Damage: Community Lawsuit Against The Government Over Industrial Business Licenses', *Law Reform: Jurnal Pembaharuan Hukum* 20, no. 1 (2024): 1–21.

[40] Pesa, 'Konsep Livable Street Dalam Penataan Koridor Jalan Tuanku Tambusai Kota Pekanbaru'.

[41] Syahyudes Rina, 'Kajian Peningkatan Fungsi Kawasan Perdagangan Dan Jasa Regional Didukung Kawasan Permukiman Berkarakter Lokal Di Kawasan Konservasi Pasar Besar Kota Malang', *Journal of Applied Science (Japps)* 4, no. 1 (2023): 43–57.

[42] Andi Nurul Inayah, 'The Development of Built Up Area in The Sungguminasa Urban Area From 2001 to 2021' (Universitas Hasanuddin, 2024).

[43] Siagian, 'Evaluation of Circulation Patterns in The Bukit Baruga Housing Complex in Makassar City Using Kevin Lynch's Theory Approach'.

[44] Aulia Annisa Mufidah, 'Strategi Penataan Kawasan Pendidikan Kota Bandar Lampung Di Sepanjang Koridor Ruas Jalan Zainal Abidin Pagar Alam Dengan Pendekatan Analisis SWOT Dan AHP' (Universitas Lampung, 2024).

[45] Rahmi Adiyani, 'Redesain Koridor Jalan Ki Hajar Dewantara Di Kawasan Pendidikan Kota Metro Dengan Pendekatan Perilaku'.

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making standards.[46] Thus, the word cloud visualization does not stand as a mere statistical result but serves as supporting evidence that the central issue in this study lies in the relationship between traffic engineering needs and legal certainty in local government actions.[47]

The research methodology is supported by a normative legal approach, including legislative analysis, conceptual frameworks, and case studies. The research manuscript explains that a regulatory approach was used to examine legal norms governing traffic and road transport, specifically Law No. 22 of 2009 on Traffic and Road Transport and the Regulation of the Minister of Transportation No. PM 96 of 2015 on Guidelines for the Implementation of Traffic Management and Engineering Activities.[48] These two documents serve as the primary foundation because they establish the general direction for traffic management and provide technical guidelines for traffic management and engineering.[49] However, as found in the study, these regulations still tend to provide general guidance regarding traffic safety, order, flow, and integration, but have not yet fully formulated operational, measurable, and binding indicators to determine when an intersection should be maintained, optimized, upgraded, or have its functional pattern redirected.

Additionally, methodological evidence is evident from the NVivo coding framework used in Table 1. This framework maps out key themes: regulatory ambiguity, legal basis, feasibility parameters, local government authority, policy legitimacy, and an intersection case study. These themes indicate that the analysis is designed to examine intersection issues in a layered manner, from the perspectives of legal norms, technical parameters, local government authority, and policy accountability.[50] Therefore, the word cloud serves as a visual reinforcement of the thematic patterns previously established through coding, as the prominent words in this visualization align with the research's analytical focus.[51]

The government documents used in this study can be categorized into several types. First, the primary legal document, namely Law No. 22 of 2009 on Road Traffic and Transportation, serves as the legal basis for the safe, orderly, smooth, and integrated management of road traffic and transportation. Second, the Ministry of Transportation Regulation No. PM 96 of 2015, which is used as a guideline for implementing traffic management and engineering activities. These documents are relevant because they directly pertain to the regulation of road network usage and traffic flow.[52] Third, to strengthen the aspect of local government authority, the discussion can also be linked to Law No. 23 of 2014 on Regional Government, as the enhancement of intersection functions is part of the implementation of regional government affairs that requires a clear legal basis for authority.[53] Fourth, the discussion can be reinforced by Government Regulation No. 37

[46] Nurochim, 'Analisis Tingkat Pelayanan Prasarana Sepeda Pada Kawasan Koridor Jalan Kota Kebumen Menggunakan Metode Blos (Studi Kasus Penataan Kawasan Koridor Jalan Di Pusat Kota Kebumen)'.
[47] Putri et al., *Transportation Network Planning and Urban Structure*.
[48] Tama et al., *Transportasi Jalan Dan Dinamika Perkotaan*.
[49] Febriansyah, 'Peranan Satlantas Polres Semarang Dalam Mengatasi Kemacetan Dan Kecelakaan Sebagai Wujud Pelayanan Kepada Masyarakat Ditinjau Dari Undang-Undang No 39 Tahun 1999 Tentang Hak Asasi Manusia'.
[50] Mustifah, 'Peran Satlantas Polres Brebes Dalam Penegakan Hukum Pelanggaran Kendaraan Bermotor Berdasarkan Undang-Undang Lalu Lintas Dan Angkutan Jalan (Studi Penelitian Di Satuan Lalu Lintas Polres Brebes)'.
[51] Daulay, 'Dinamika Konstruksi Sosial Terhadap Perilaku Pelanggaran Lalu Lintas Remaja Di Wilayah Hukum Polda Sumatera Utara'.
[52] Setya, 'Penegakan Hukum Terhadap Pelaku Pelanggaran Rambu-Rambu Lalu Lintas Di Wilayah Hukum Kepolisian Resor Tanjung Jabung Barat'.
[53] Sitoresmi, 'Penegakan Hukum Tilang Elektronik (Electronic Traffic Law Enforcement) Guna Mengurangi Pelanggaran Lalu Lintas Di Indonesia'.

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of 2011 on the Road Traffic and Transportation Forum, particularly to explain the importance of interagency coordination in traffic policy-making.[54] Law No. 22 of 2009 and Government Regulation No. 96 of 2015 are also listed in the BPK's regulatory database as official government documents governing traffic and traffic engineering management. Meanwhile, Law No. 23 of 2014 governs regional administration, and Government Regulation No. 37 of 2011 establishes the Road Traffic and Transportation Forum as a platform for interagency coordination.

Thus, the word cloud results show that the dominant words in the study do not appear randomly but stem from the analytical framework constructed through the research methodology.[55] When terms such as feasibility, authority, regulation, and policy stand out prominently, this indicates that improving intersection functionality must be understood as both a legal-administrative and a technical matter. Improving intersection functionality cannot be assessed solely on traffic density or geometric engineering needs; it must also be grounded in verifiable parameters, such as road capacity, level of service, queue length, safety, traffic flow conflicts, and impacts on the surrounding road network. These parameters must be anchored in clear legal foundations so that local government decisions are legitimate and publicly accountable.[56]

Therefore, this discussion emphasizes that the ambiguity of norms in traffic management and engineering regulations can weaken legal certainty in determining intersection improvements.[57] If regulations provide only general principles without measurable technical-legal indicators, then local government decisions risk depending on inconsistent administrative discretion.[58] In the context of the Gunggung, Jalan Raya Langsep, Jalan Dieng, and Jalan Terusan Dieng intersections, the need to enhance intersection functionality must be substantiated through a feasibility study that not only details on-site technical conditions but also outlines the legal basis, assessment procedures, and rational policy justifications. In this way, the feasibility study's findings serve not merely as a technical document but also as a legal instrument that strengthens the accountability of local government policies.

2. Local Government Authority and Policy Legitimacy in Intersection Improvement.

This second subsection discusses the authority of local governments. The focus is not merely on whether local governments have the authority to implement traffic engineering measures, but also on the extent to which such authority is subject to clear limits, legal bases, and procedures.[59] In the text, decisions regarding the upgrading of intersections are framed as public policies with legal, technical, social, and economic consequences; therefore, they must be legally and administratively accountable.[60]

The authority of local governments plays an important role in determining alternative

[54] Nur Hidayah, 'Penegakan Hukum Terhadap Pelanggaran Rambu-Rambu Lalu Lintas Oleh'.

[55] Arif, 'Peran Dinas Perhubungan Dalam Mengimplementasikan Peraturan Menteri Perhubungan Pasal 87 Huruf D Tentang Pemeliharaan Penerangan Jalan Perspektif Fiqh Siyasah (Studi Di Dinas Perhubungan Kabupaten Pesisir Barat)'.

[56] Nugroho, 'Analisis Penegakan Hukum Terhadap Tingginya Pelanggaran Lalu Lintas Di Kalangan Pengendara Remaja Dalam Perspektif Hak Asasi Manusia'.

[57] Florczak-Wątor, 'Constitutional Challenges in Emergency Governance: An Analysis of Poland's Reluctance and Regulatory Ambiguities in States of Emergency'.

[58] Goel et al., 'Effectiveness of Road Safety Interventions: An Evidence and Gap Map'.

[59] Anggiat Sahat Maruli Gultom, 'Kewenangan Pemerintah Provinsi Dalam Penetapan Nilai Jual Kendaraan Bermotor Di Indonesia Ditinjau Dari Pengaturan Jangka Waktu Penetapannya' (Universitas Jambi, 2025).

[60] Valen Endy Fadani, 'Evaluasi Desain Pembagian Kewenangan Pemerintah Pusat Dan Pemerintah Daerah Dalam Undang-Undang Pelayaran (Studi Di Kabupaten Penajam Paser Utara, Provinsi Kalimantan Timur)' (Universitas Islam Indonesia, 2025).

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improvements to intersection functions.[61] Nevertheless, such authority must be supported by clear legal parameters to prevent policy decisions from relying solely on administrative discretion. In the context of the Gunggung, Langsep, Dieng, and Terusan Dieng intersections, local governments are required to ensure that every traffic engineering decision is based on rational, transparent, and accountable considerations. Without clear standards, feasibility studies may become merely technical documents whose legal accountability is difficult to verify. Therefore, the legitimacy of intersection improvement policies depends not only on the effectiveness of traffic engineering measures but also on the clarity of authority, transparency of assessment procedures, and the government's ability to justify its decisions to the public.[62]

The authority of local governments regarding intersection upgrades must be understood as part of the administration of government affairs in the field of traffic and road transportation.[63] In this context, local governments serve not only as technical implementers of traffic regulations but also as public policymakers who must ensure that every traffic engineering measure has a legal basis, established procedures, and justifiable policy rationale.[64] This aligns with the research focus, which positions the improvement of intersection functions as an issue of administrative law rather than merely a technical transportation issue. This study notes that decisions regarding the improvement of intersection functions have legal, technical, social, and economic consequences and must therefore be supported by legal legitimacy and administrative accountability.[65]

The primary legal basis for explaining this authority is Law No. 22 of 2009 on Road Traffic and Transportation. This law establishes that road traffic and transportation must be managed as a system that is safe, orderly, smooth, and integrated.[66] This means that when local governments adopt policies to optimize, modify, or enhance the functions of intersections, such policies must be directed toward the objectives of safety, order, traffic flow, and the protection of road users' interests. Law No. 22 of 2009 also establishes that traffic management is not merely about regulating vehicles but also concerns the state's and government's responsibility in creating an effective road transport system.

Additionally, the Ministry of Transportation Regulation No. PM 96 of 2015, on Guidelines for the Implementation of Traffic Management and Engineering Activities, provides a more specific technical basis. This regulation is important because it sets out guidelines for implementing traffic management and engineering, including measures to regulate the use of the road network and control traffic movement. In the context of improving intersection functionality, this Minister of Transportation Regulation can serve as a basis for assessing whether an intersection requires traffic flow re-configuration, changes in movement priorities, optimization of traffic signal systems, restrictions on certain movements, or geometric engineering.

However, as research findings indicate, these guidelines still need to be strengthened with additional operational and measurable indicators so that local governments do not rely solely on technical discretion but also have clear legal standards for determining the feasibility of improving intersection functionality. The authority of local governments is also

[61] Rasyid Tarmizi, 'Apa Kewenangan Pemerintah Pusat', *Hukum Pemerintahan Daerah*, 2024, 41.
[62] Balaci and Suh, 'Systematic Approach to a Government-led Technology Roadmap for Future-ready Adaptive Traffic Signal Control Systems'.
[63] Agus Wibowo and M Kom, *Kecerdasan Buatan Dalam Sistem Hukum: Menjembatani Ilmu Hukum Dan Teknologi Lewat AI* (yayasan penerbit, 2025).
[64] Gultom, 'Kewenangan Pemerintah Provinsi Dalam Penetapan Nilai Jual Kendaraan Bermotor Di Indonesia Ditinjau Dari Pengaturan Jangka Waktu Penetapannya'.
[65] Agus Wibowo and Dyah Listyarini, 'Hukum Pemerintah Daerah', *Penerbit Yayasan Prima Agus Teknik*, 2024.
[66] Tama et al., *Transportasi Jalan Dan Dinamika Perkotaan*.

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linked to Law No. 23 of 2014 on Regional Government.[67] This law establishes that local governments have the authority to administer their affairs in accordance with the principles of regional autonomy and auxiliary duties. In this context, traffic management in urban areas is part of the public services that the local authority must provide. However, this authority must not be interpreted as unrestricted freedom.[68] Local government authority must still be exercised in accordance with the principles of legality, rationality, accountability, and the public interest. Thus, every policy to enhance intersection functionality must clearly explain its legal basis, which agency is authorized to implement it, the assessment procedures, and the indicators used to determine whether an intersection is suitable for functional enhancement.

In its implementation, the policy on intersection function enhancement also requires interagency coordination. Therefore, Government Regulation No. 37 of 2011 on the Road Traffic and Transportation Forum is relevant to serve as a basis for discussion. The Road Traffic and Transportation Forum serves as a platform for coordination among agencies responsible for road traffic and transportation. This legal basis is important because intersection function upgrades are not solely the responsibility of a single agency but may involve the Department of Transportation, the police, the Department of Public Works, the Regional Development Planning Agency, and other parties related to land use planning and road safety.[69] Through this coordination forum, decisions regarding intersection function upgrades can be made through cross-sectoral consideration, ensuring that the policies adopted are not only administratively valid but also more rational and publicly accountable.

Based on this legal basis, the legitimacy of policies to improve intersection functionality can be viewed from three aspects. First, the legitimacy of authority, namely, whether the local government has a legal basis to take traffic management and engineering actions.[70] Second, procedural legitimacy, namely, whether decisions to improve intersection functionality are made through feasibility studies, technical analyses, interagency coordination, and consideration of road users' interests. Third, substantive legitimacy, namely, whether the policies adopted genuinely address traffic issues, such as congestion, vehicle queues, traffic flow conflicts, safety, road capacity, and intersection service levels.[71] If these three aspects are met, then the local government's policies are not merely technical decisions but also public policies with a legal basis and subject to accountability.

In the case study of the Gunggung intersection, Langsep Highway, Dieng Street, and Terusan Dieng Street in Malang City, issues of policy authority and legitimacy are critical because this area lies within an urban corridor connecting residential, educational, commercial, and service activities. This study explains that these intersections exhibit complex traffic patterns, are prone to increased vehicle volume, experience traffic queues during peak hours, and encounter traffic flow conflicts, all of which require more adaptive traffic management. Therefore, if the local government decides on alternatives to improve intersection functionality, such decisions must be based on concrete evidence, including traffic volume data, intersection capacity, level of service, queue length, conflict points, road

[67] Tarmizi, 'Apa Kewenangan Pemerintah Pusat'.
[68] Fadani, 'Evaluasi Desain Pembagian Kewenangan Pemerintah Pusat Dan Pemerintah Daerah Dalam Undang-Undang Pelayaran (Studi Di Kabupaten Penajam Paser Utara, Provinsi Kalimantan Timur)'.
[69] Gultom, 'Kewenangan Pemerintah Provinsi Dalam Penetapan Nilai Jual Kendaraan Bermotor Di Indonesia Ditinjau Dari Pengaturan Jangka Waktu Penetapannya'.
[70] Chege, Gakuu, and Mbugua, 'Management of Road Intersection and Performance of Intelligent Traffic Control Systemsnairobi County, Kenya: Does Traffic Legal Framework Matter?'
[71] Uribe-Chavert, Posadas-Yagüe, and Poza-Lujan, 'Evaluating Traffic Control Parameters: From Efficiency to Sustainable Development'.

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user safety, and the impact on the surrounding road network.[72]

For example, if long vehicle queues are observed at the Dieng and Terusan Dieng intersections during peak hours, the local government cannot simply state that the intersection is "congested" or "needs improvement." Local governments must provide clear parameters, such as whether the congestion is caused by insufficient intersection capacity, ineffective signal phase timing, excessive right-turn conflicts, or lateral obstructions resulting from commercial activities along the road.[73] From there, policy alternatives can be formulated more thoughtfully, such as optimizing traffic signals, reconfiguring traffic flow directions, restricting certain movements, widening the intersection's geometry, or separating vehicle and pedestrian traffic. Thus, a feasibility study becomes a crucial tool for linking on-site technical conditions with the legal basis for decision-making.

On the other hand, case studies of the Gunggung intersection and Langsep Highway demonstrate that improving an intersection's functionality cannot be separated from the context of spatial planning and area activities.[74] If an intersection is located near educational, commercial, residential, and service centers, the resulting traffic load stems not only from passing vehicles but also from area entry and exit activities, parking, pedestrian crossings, and public transportation.[75] Therefore, local government policies must consider the interrelationship between traffic management, land use, and public mobility needs. In this regard, local government authority should not only be used to determine traffic engineering measures but also to ensure that such policies align with public interests and urban planning.[76]

Based on this discussion, it can be emphasized that the legitimacy of policies to enhance intersection functionality heavily depends on the local government's ability to explain the legal basis for its authority, the assessment procedures, and the technical-legal justifications for each decision. If an intersection is deemed in need of functional improvement, the decision must address the following questions: what is the legal basis, which agency has the authority, what data was used, what feasibility indicators were applied, and how will it impact traffic safety, flow, and order. Without such explanations, the feasibility study risks becoming a legally weak document.[77]

To conclude this discussion, the functional improvement of intersections in Malang City must be positioned as a public policy requiring integration between technical analysis and legal certainty.[78] Local governments do indeed have the authority to manage and engineer traffic. However, this authority must be exercised based on a clear legal basis, transparent procedures, interagency coordination, and measurable feasibility indicators.[79] In the

[72] Sepehr, 'Mundane Urban Governance and AI Oversight: The Case of Vienna's Intelligent Pedestrian Traffic Lights'.

[73] Zare et al., 'Blending Efficiency and Resilience in the Performance Assessment of Urban Intersections: A Novel Heuristic Informed by Literature Review'.

[74] Rizky Ramadhan Rihansyah, 'Analisis Simpang Tak Bersinyal Pada Akses Perumahan Bukit Kemiling Permai Raya Dengan Metode Gap Acceptance (Studi Kasus Jalan Imam Bonjol–Jalan Bukit Kemiling Permai Raya Kota Bandar Lampung)', 2024.

[75] Uribe-Chavert, Posadas-Yagüe, and Poza-Lujan, 'Evaluating Traffic Control Parameters: From Efficiency to Sustainable Development'.

[76] Raihan Ghalib Nugraha, 'Analisa Kinerja Simpang Tak Bersinyal Dengan Perencanaan Traffic Light Di Persimpangan Jalan Deli Tua Kabupaten Deli Serdang' (Fakultas Teknik, Universitas Islam Sumatera Utara, 2026).

[77] Komang Ramanda Agastya, 'Analisis Peningkatan Kinerja Simpang Melalui Pengaturan Dan Koordinasi Dengan Pemodelan Mikrosimulasi (Studi Kasus: Persimpangan Jalan Raya Ujung Berung)' (POLITEKNIK TRANSPORTASI DARAT BALI, 2024).

[78] Nugraha, 'Analisa Kinerja Simpang Tak Bersinyal Dengan Perencanaan Traffic Light Di Persimpangan Jalan Deli Tua Kabupaten Deli Serdang'.

[79] Fadani, 'Evaluasi Desain Pembagian Kewenangan Pemerintah Pusat Dan Pemerintah Daerah Dalam

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context of the Gunggung, Jalan Raya Langsep, Jalan Dieng, and Jalan Terusan Dieng intersections, feasibility studies must not stop at identifying traffic problems; they must also serve as the basis for policy legitimacy. Thus, improving the intersection's functionality aims not only to reduce congestion but also to strengthen local government accountability, protect the interests of road users, and implement lawful, rational, and public-interest-oriented traffic policies.

D. Conclusion and Recommendations

Based on the overall discussion, this study concludes that the main challenge in improving the function of the Gunggung, Jalan Raya Langsep, Jalan Dieng, and Jalan Terusan Dieng intersections in Malang City lies in the ambiguity of traffic management and engineering norms. Although Law No. 22 of 2009 and Minister of Transportation Regulation No. PM 96 of 2015 has provided a general legal basis for safe, orderly, smooth, and integrated traffic management. However, these regulations have not yet fully provided operational, measurable, and binding indicators to determine when an intersection should be maintained, optimized, upgraded, or functionally reallocated. As a result, feasibility studies risk becoming merely technical documents if clear legal parameters, transparent assessment procedures, and accountable local government authority do not support them. Therefore, intersection improvement must be understood not only as a transportation engineering issue, but also as a legal-administrative policy that requires legal certainty, policy legitimacy, and public accountability. This is consistent with the research focus, which examines regulatory ambiguity, feasibility parameters, local government authority, and policy legitimacy in the context of urban intersection improvement.

This study recommends strengthening regulations and technical guidelines regarding the feasibility assessment of urban intersection improvements. The government, particularly the Ministry of Transportation and local governments, needs to formulate clearer standards regarding feasibility parameters, including road capacity, level of service, queue length, traffic conflicts, safety, land-use impacts, and integration with the surrounding road network. Additionally, local governments must ensure that every decision to improve intersection functionality is based on formal feasibility studies, interagency coordination through the Road Traffic and Transportation Forum, and transparent policy justifications. In the context of the Gunggung, Langsep, Dieng, and Terusan Dieng intersections, the Malang City Government must not only identify traffic problems but also clarify the legal basis, the competent authorities, the assessment procedures, and the technical indicators used in determining policy alternatives. Thus, intersection improvement policies can be implemented in a lawful, rational, accountable, and public-interest-oriented manner.

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