



Regulatory Reconstruction and Law Enforcement Effectiveness Regarding Electric Bicycle Use by Minors

Rekonstruksi Regulasi dan Efektivitas Penegakan Hukum Penggunaan Sepeda Listrik Anak di Bawah Umur

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Abstract

The use of electric bicycles by underage children on public roads poses complex legal challenges in Indonesia. This study analyzes in depth the reconstruction of the juridical classification of electric bicycles and the effectiveness of law enforcement based on Law Number 22 of 2009 and Minister of Transportation Regulation Number 45 of 2020. Using a normative-empirical legal research method, this study compares domestic micro-mobility regulations with international standards in the European Union, Queensland, and Mongolia. The results indicate a legal uncertainty resulting from classification ambiguity between motorized and non-motorized vehicles, currently challenged under Constitutional Court Case Number 187/PUU-XXIV/2026. On-the-ground law enforcement is ineffective due to the absence of criminal penalties in the Ministerial Regulation, while public legal culture remains highly permissive. This article proposes a comprehensive regulatory reconstruction through technical standardization, strengthening administrative sanctions, and adopting the doctrine of vicarious criminal liability for negligent parents to ensure sustainable public safety.

Abstrak

Penggunaan sepeda listrik oleh anak di bawah umur di jalan raya umum menimbulkan persoalan hukum yang sangat kompleks di Indonesia. Penelitian ini menganalisis secara mendalam mengenai rekonstruksi klasifikasi yuridis sepeda listrik dan efektivitas penegakan hukumnya berdasarkan Undang-Undang Nomor 22 Tahun 2009 serta Peraturan Menteri Perhubungan Nomor 45 Tahun 2020. Dengan menggunakan metode penelitian hukum normatif-empiris, kajian ini membandingkan regulasi mikro-mobilitas domestik dengan standar internasional di Uni Eropa, Queensland, dan Mongolia. Hasil penelitian menunjukkan adanya ketidakpastian hukum akibat ambiguitas klasifikasi antara kendaraan bermotor dan non-bermotor yang kini sedang diuji dalam Perkara Mahkamah Konstitusi Nomor 187/PUU-XXIV/2026. Penegakan hukum di lapangan dinilai tidak efektif karena ketiadaan sanksi pidana dalam Permenhub, sementara budaya hukum masyarakat masih sangat permisif. Artikel ini menawarkan rekonstruksi regulasi komprehensif melalui standarisasi teknis kendaraan, penguatan sanksi administratif, dan penerapan doktrin pertanggungjawaban pengganti pidana bagi orang tua yang terbukti lalai mengawasi anak di jalan raya guna mewujudkan keselamatan publik secara berkelanjutan.



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A. INTRODUCTION

1. Background

The massive penetration of micro-mobility transportation modes, most notably electric bicycles (e-bikes), has triggered a severe disruption to the landscape of road safety and the architecture of national transportation law. Initially, this entity was legally constructed as an economical commuting alternative aligned with the global energy transition agenda to suppress urban carbon emissions.¹ In Indonesia, this narrative has been heavily reinforced by state intervention through the Battery-Based Electric Motor Vehicle (KBLBB) program, which has been subsidized by trillions of rupiah in fiscal incentives.² However, the functional shift of e-bikes from a closed-circuit recreational medium to a cross-highway commuting mode has engendered alarming sociological and juridical anomalies. This entity, possessing acceleration capacities akin to light motorized vehicles, is paradoxically dominated by pediatric users (minors) who cognitively, motorically, and legally lack the requisite capacity (*bekwaamheid*) to navigate high-speed traffic flows.³

The escalation of utilization by this vulnerable demographic has transformed public spaces into arenas with exponential fatality rates. Epidemiological data from the US Consumer Product Safety Commission (CPSC) records a 49-fold increase in head trauma incidents attributed to e-bike collisions over the past five years, accompanied by specific injury patterns, such as pelvic fractures, which are typically exclusive to motorcycle accidents.^{4,5} In China, e-bikes have been confirmed to contribute to 56,200 accidents claiming over 8,400 lives within a brief period due to operational migration into

¹ Stefania Boglietti, Benedetto Barabino, and Giulio Maternini, "Survey on E-Powered Micro Personal Mobility Vehicles: Exploring Current Issues towards Future Developments," *Sustainability* 13, no. 7 (March 26, 2021): 3692, <https://doi.org/10.3390/su13073692>.

² Kurniawati Hasjanah and Rahmi Puspita Sari, "IESR Desak Pemerintah Segera Terapkan Insentif Dan Tetapkan Target Adopsi Kendaraan Listrik," IESR, 2026, <https://iesr.or.id/iesr-desak-pemerintah-segera-terapkan-insentif-dan-tetapkan-target-adopsi-kendaraan-listrik/>.

³ Anat Meir and Ben Dagan, "Can Young Novice E-Bike Riders Identify Hazardous Traffic Situations? An Exploratory Study," *Travel Behaviour and Society* 21 (October 2020): 90–100, <https://doi.org/10.1016/j.tbs.2020.06.001>.

⁴ American College of Surgeons, "Electric Bikes Are Emerging as Public Health Hazard," American College of Surgeons, 2024, <https://www.facs.org/for-medical-professionals/news-publications/news-and-articles/bulletin/2024/julyaugust-2024-volume-109-issue-7/electric-bikes-are-emerging-as-public-health-hazard/>.

⁵ Adrian M. Fernandez et al., "Electric Bicycle Injuries and Hospitalizations," *JAMA Surgery* 159, no. 5 (May 1, 2024): 586, <https://doi.org/10.1001/jamasurg.2023.7860>.

motorized vehicle lanes.⁶ This global condition reflects a tangible threat in Indonesia while simultaneously exposing the paralysis of the national traffic legal system in responding to technological hybridization.

The fundamental root of this safety crisis stems from a clash of norms and the ambiguity of juridical classification within the structure of positive law. Law Number 22 of 2009 concerning Traffic and Road Transportation (UU LLAJ) remains imprisoned within an obsolete dichotomous paradigm, rigidly classifying land transportation modes into "Motorized Vehicles" (engine-powered) and "Non-Motorized Vehicles" (human/animal-powered) under Article 47 paragraph (1).^{7,8} This binary statutory construction generates a legal vacuum (*recht vacuüm*) for e-bikes that are pedaled yet propelled by hybrid motor traction. The government's patchwork regulatory efforts through the Minister of Transportation Regulation Number PM 45 of 2020 have conversely obfuscated the normative hierarchy. This technical regulation, which positions e-bikes as non-motorized entities subject to a minimum age limit of 12 years and a maximum speed of 25 km/h, has entirely lost its imperative force on the ground.^{9,10} *De facto*, this Ministerial Regulation directly collides with the repressive policies enacted by the National Police Traffic Corps (Korlantas Polri) in 2026, which unilaterally classified high-speed e-bikes as KBLBBs subject to the Driver's License (SIM) regime.¹¹

The tension between the administrative legality of the Ministerial Regulation and the repressive justification of the police has culminated in a heated constitutional debate, evidenced by the filing of a judicial review petition to the Constitutional Court under Case Number 187/PUU-XXIV/2026. The petitioners posited that the nebulous status of e-bikes violates the constitutional right to fair legal certainty (Article 28D paragraph (1) of the 1945 Constitution of the Republic of Indonesia), considering that the absence of a uniform

⁶ Wenxin Ma, Zhiyong Liu, and Ruimin Li, "Effect of Helmet-Wearing Regulation on Electric-Bike Riders: A Case Study of Two Cities in China," *Transportation Safety and Environment* 6, no. 3 (May 30, 2024), <https://doi.org/10.1093/tse/tdad038>.

⁷ Teguh Rama Prasja and Esy Kurniasih, "Perlindungan Konsumen Terhadap Penggunaan Sepeda Listrik," *JKIH: Jurnal Kajian Ilmu Hukum* 4, no. 2 (November 5, 2025): 231–46, <https://doi.org/10.55583/jkih.v4i2.1553>.

⁸ "Undang-Undang Nomor 22 Tahun 2009 Tentang Lalu Lintas Dan Angkutan Jalan. Lembaran Negara Republik Indonesia Tahun 2009 Nomor 96" (2009).

⁹ Febrina Gladys Elvira et al., "Analysis Of Electric Bicycles As A Vehicle In Indonesia: A Normative Legal Review," *Syariah: Jurnal Hukum Dan Pemikiran* 20, no. 1 (July 14, 2020): 90, <https://doi.org/10.18592/sjhp.v20i1.3571>.

¹⁰ "Peraturan Menteri Perhubungan Nomor PM 45 Tahun 2020 Tentang Kendaraan Tertentu Dengan Menggunakan Penggerak Motor Listrik, BN No. 654 Tahun 2020" (2020).

¹¹ Perdy Pratama and Rosa Tedjabuwana, "Pengaturan SIM Terhadap Pengguna Sepeda Listrik," *Wajah Hukum* 9, no. 2 (October 14, 2025): 532, <https://doi.org/10.33087/wjh.v9i2.1865>.

foundational framework triggers "amicable" out-of-court settlements in child-related accidents that inherently sacrifice the sense of justice. Although the proceedings ultimately resulted in an inadmissible ruling (*Niet Ontvankelijke Verklaard* or N.O.) due to formal evidentiary prerequisites, the trial authentically validated that the e-bike classification crisis constitutes an urgent constitutional emergency demanding immediate statutory reconstruction.¹²

To untangle this complexity, a comprehensive examination of the preceding primary literature (state of the art) is absolutely imperative to map the evolving academic discourse. Throughout the 2021–2026 period, the debate surrounding micro-mobility has polarized into three principal schools of thought. First, the Administrative Compliance School, represented by Muttiah et al., Syafitri et al., and Putri & Malau.^{13,14,15} This paradigm posits that regulatory failure stems purely from an infrastructure deficit regarding dedicated bike lanes and inadequate public socialization, thereby recommending an urban planning improvement approach. Second, the Global Safety and Technical Standardization School, pioneered by Haustein & Møller, Cicchino et al., and Yang et al.^{16,17,18} This cohort quantitatively substantiates that the absence of technical certification (braking systems) and traction control incompetence are the primary causes of the highest fatalities, thereby advocating for absolute mechanical restrictions. Third, the Law Enforcement and Criminal Justice System School, spearheaded by domestic scholars such

¹² MKRI, "Pengujian Materiil Undang-Undang Nomor 22 Tahun 2009 Tentang Lalu Lintas Dan Angkutan Jalan," MKRI, 2026, <https://tracking.mkri.id/index.php?page=web.TrackPerkara&id=187/PUU-XXIV/2026#>.

¹³ Muttiah Muttiah, Ahmad Baihaqi, and Siti Paulina, "Implementasi Peraturan Menteri Perhubungan Nomor 45 Tahun 2020 Tentang Kebijakan Penggunaan Sepeda Listrik Di Bawah Umur Kecamatan Daha Utara Kabupaten Hulu Sungai Selatan," *Jurnal Kebijakan Publik* 3, no. 1 (May 12, 2026): 218–28, <https://ejurnal.stiaamuntai.ac.id/index.php/PPJ/article/view/1784>.

¹⁴ Lisa Syafitri, Desy Putri Kamila, and Helmy Boemiya, "Analisis Yuridis Penggunaan Sepeda Motor Listrik Oleh Anak Di Bawah Umur Berdasarkan Permenhub Republik Indonesia Nomor PM 45 Tahun 2020," *Jurnal Penelitian Inovatif* 4, no. 4 (November 30, 2024): 2423–32, <https://doi.org/10.54082/jupin.980>.

¹⁵ Lusi Adinda Miranti Putri and Hasbullah Malau, "Efektivitas Penggunaan Sepeda Listrik Berdasarkan Peraturan Menteri Perhubungan Republik Indonesia Nomor PM 45 Tahun 2020 Di Kota Padang," *Jurnal ISO: Jurnal Ilmu Sosial, Politik Dan Humaniora* 4, no. 2 (August 19, 2024): 15, <https://doi.org/10.53697/iso.v4i2.1828>.

¹⁶ Sonja Haustein and Mette Møller, "Age and Attitude: Changes in Cycling Patterns of Different e-Bike User Segments," *International Journal of Sustainable Transportation* 10, no. 9 (October 20, 2016): 836–46, <https://doi.org/10.1080/15568318.2016.1162881>.

¹⁷ Jessica B. Cicchino, Paige E. Kulie, and Melissa L. McCarthy, "Injuries Related to Electric Scooter and Bicycle Use in a Washington, DC, Emergency Department," *Traffic Injury Prevention* 22, no. 5 (July 4, 2021): 401–6, <https://doi.org/10.1080/15389588.2021.1913280>.

¹⁸ Zhichao Yang et al., "E-Bike Agents: Large Language Model-Driven E-Bike Accident Analysis and Severity Prediction," October 24, 2025, <http://arxiv.org/abs/2506.04654>.

as Nugraha et al. and Sapitri et al.^{19,20} This pole highlights the dilemma of law enforcement officials trapped between restorative justice approaches for minors and the discretionary exercise of confiscation, while also igniting preliminary discourse regarding penal sanctions for parents.

Based on the aforementioned thematic synthesis, a gap analysis reveals a fundamental "blind spot" in Indonesian legal literature. The majority of preceding studies remain ensnared in descriptive analyses concerning partial compliance with Ministerial Regulation 45/2020, without dissecting the normative validity of the regulation when juxtaposed against absolute international technical standards, such as those of the European Union (EN 15194), or when confronted with contemporary constitutional discourse. Furthermore, studies on juvenile criminal law continue to experience stagnation, focusing predominantly on diversion procedures for underage offenders without offering a theoretical construct on how the positive legal regime might hold parents criminally liable for negligence based on omission.

Rooted in this research gap, and distinct from prior studies that predominantly focused on the administrative policy aspects of the Ministerial Regulation or the mere provision of urban infrastructure, this study offers novelty by radically dissecting the juridical classification ambiguity of hybrid vehicles utilizing the European Union's EN 15194 standard as a comparative analytical tool. Simultaneously, it reconstructs parental criminal liability through the doctrine of vicarious liability. The elevation of this issue from a mere domestic traffic problem into a discourse on the universal protection of children's human rights is actualized by confronting regressive Indonesian regulations with the progressive tightening of micro-mobility legislation (draconian laws) observed in the jurisdictions of Queensland and Mongolia in 2026.

As the culmination of the aforementioned rationalization, this article establishes a primary thesis statement: the high fatality rate of child e-bike users in Indonesia is not solely caused by a vacuum in technical regulations, but rather originates from a systemic ambiguity within the UU LLAJ that fails to incorporate hybrid engineering, coupled with

¹⁹ Dian Nugraha, Laurensius Arliman, and Bisma Putra Pratama, "Upaya Kepolisian Dalam Penertiban Pengendara Sepeda Listrik Di Jalan Raya Untuk Mencegah Terjadinya Kecelakaan Lalu Lintas," *Unes Journal of Swara Justisia* 9, no. 3 (November 3, 2025): 512–19, <https://doi.org/10.31933/z7ydw961>.

²⁰ Ayu Sapitri, Rio Armanda Agustian, and Toni UBB, "Penjatuhan Sanksi Terhadap Pengguna Sepeda Listrik Sebagai Pelaku Tindak Pidana Lalu Lintas Di Jalan Raya Berdasarkan Undang-Undang Nomor 22 Tahun 2009 Tentang Lalu Lintas Dan Angkutan Jalan," *Jurnal Hukum Jurisdictie* 7, no. 1 (March 22, 2025): 45–58, <https://doi.org/10.34005/jhj.v6i2.169>.

the paralysis of national law in prosecuting the impunity of parental negligence. The academic sphere and legislators must accord crucial attention to these findings, as the failure to delineate absolute legal boundaries for transportation modes is tantamount to legitimizing lethal threats in public spaces. As a remedy, this article formulates a reconstruction of juridical classification predicated on motor wattage standards that mandate throttle prohibition, the fortification of repressive law enforcement discretion, and the expansion of the interpretation of negligence offenses (Articles 359/360 of the Indonesian Criminal Code) applicable to parents, in order to holistically restore legal certainty and justice.

2. Research Questions

Predicated upon the aforementioned background exposition, which dissects the normative clashes, constitutional adjudications, and the escalation of traffic collisions, the legal issues are formulated as follows:

- a. How can the juridical classification be reconstructed, and what is the efficacy of law enforcement regarding the operation of electric bicycles by minors on public roadways under contemporary Indonesian positive law?
- b. How does the regulatory framework governing micro-mobility (e-bike) safety for minors in Indonesia compare to international regulatory trends when examined through the perspective of universal child rights protection?

3. Research Method

This research is constructed utilizing a mixed-method legal research design, which dialectically integrates normative and empirical legal research instruments. The selection of this methodology is justified by the analytical necessity that unraveling the juridical classification ambiguity of electric bicycles cannot rely exclusively upon the examination of normative texts (*law in books*), but rather mandates a comprehensive assessment of the sociological resonance and binding force of said norms at the level of police law enforcement and societal behavior (*law in action*). To dissect this complexity, this study operationalizes a methodological framework encompassing a statute approach, a conceptual approach, a comparative approach, and a qualitative approach.²¹

²¹ Alysia Blackham, "When Law and Data Collide: The Methodological Challenge of Conducting Mixed Methods Research in Law," *Journal of Law and Society* 49, no. S1 (September 18, 2022), <https://doi.org/10.1111/jols.12373>.

The statute approach is operationalized to meticulously examine the vertical and horizontal synchronization among Law Number 22 of 2009 concerning Traffic and Road Transportation, Law Number 11 of 2012 concerning the Juvenile Criminal Justice System, and Minister of Transportation Regulation Number 45 of 2020. The comparative approach is essentially utilized to contrast the legal efficacy of micro-mobility technical classifications in Indonesia with the EN 15194 standard in the European Union, alongside age restriction policies in the jurisdictions of Queensland (Australia) and Mongolia, in order to deduce a coherent trajectory for policy reform. Meanwhile, the qualitative approach is operationalized to dissect the empirical realities of underage riding behavior and the underlying rationality of the confiscation discretion exercised by law enforcement officials.²²

The data sources for this research synthesize two mutually complementary primary clusters, specifically legal materials and field data. The specification of primary legal materials encompasses authoritative regulations (the UU LLAJ, the UU SPPA, Ministerial Regulation 45/2020, and the Indonesian Civil Code) alongside judicial documents comprising the Hearing Transcripts and the Constitutional Court Decision for Case Number 187/PUU-XXIV/2026. Furthermore, secondary legal materials are extracted from globally reputable journal literature (Scopus-indexed) published within the preceding five years, investigative reports from international safety agencies (the Consumer Product Safety Commission), and doctrinal criminal law literature concerning vicarious liability. To fortify the empirical dimension, primary field data were obtained through a series of interviews with the National Police Traffic Corps (Korlantas Polri) regarding hybrid enforcement policies in 2026, coupled with naturalistic observations on arterial roadways to record the factual paradigms of children utilizing these transportation modalities.

The technique for compiling legal materials is executed through meticulous library research and integrated systematic retrieval across digital legal databases, whereas the acquisition of field data relies heavily on semi-structured, in-depth interviews and passive observational methodologies. During the final phase, the legal analysis is executed by operationalizing the instruments of systematic interpretation and deductive syllogism. The systematic interpretation method is critically deployed as an analytical apparatus to

²² Ralf Michaels, "Comparative Law Today – Tones, Themes, Trends," *Comparative Legal History* 14, no. 1 (January 2, 2026): 4–28, <https://doi.org/10.1080/2049677X.2026.2671591>.

reconcile the overlapping norms of vehicle classification, their collision with the KBLBB agenda, and the doctrine of universal child rights protection. Consequently, the derived conclusions are highly prescriptive in nature, offering a juridical reconstruction design (*ius constituendum*) that is capable of guaranteeing an equilibrium between the advancement of electromechanical engineering and the absolute certainty of traffic law enforcement.²³

B. DISCUSSION

1. Juridical Classification Ambiguity and Normative Anomalies of Electric Bicycles in Indonesia

The presence of electric bicycles on Indonesian public roadways has confronted the positive legal system with an acute cognitive dissonance regarding the juridical classification of vehicles. Architecturally, Law Number 22 of 2009 concerning Traffic and Road Transportation (UU LLAJ) is constructed upon a rigid binary foundation. Article 47 paragraph (1) bifurcates all land transportation entities into two mutually exclusive genera: "Motorized Vehicles" (necessitating propulsion via mechanical equipment or engines) and "Non-Motorized Vehicles" (propelled exclusively by human or animal power).²⁴ Before the law, electric bicycles plunge into an ontological anomaly; their external manifestation features pedals akin to conventional bicycles, yet they are substantially equipped with battery-powered traction motors enabling them to accelerate to speeds exceeding 30 km/h without pedaling.²⁵

The inability of the legislature to predict this leap in electromechanical evolution has engendered a *recht vacuüm* (legal vacuum), wherein these vital instruments operate devoid of any obligation for registration (BPKB, STNK) or driver's license (SIM) possession. Executive endeavors to patch this regulatory lacuna through Minister of Transportation Regulation Number PM 45 of 2020 have conversely birthed a problematic compromise. This policy categorizes e-bikes as "non-motorized" entities subject to operational restrictions (a minimum age limit of 12 years, a maximum speed of 25 km/h, and a prohibition on arterial roadways).²⁶ However, critiquing the administrative-

²³ Lei Liu and Ran Tao, "The Systemic Nature of Law from a Judicial Perspective," *Humanities and Social Sciences Communications* 13, no. 1 (April 8, 2026): 765, <https://doi.org/10.1057/s41599-026-07212-0>.

²⁴ Undang-Undang Nomor 22 Tahun 2009 tentang Lalu Lintas dan Angkutan Jalan. Lembaran Negara Republik Indonesia Tahun 2009 Nomor 96.

²⁵ Prasja and Kurniasih, "Perlindungan Konsumen Terhadap Penggunaan Sepeda Listrik."

²⁶ Peraturan Menteri Perhubungan Nomor PM 45 Tahun 2020 tentang Kendaraan Tertentu dengan Menggunakan Penggerak Motor Listrik, BN No. 654 Tahun 2020.

oriented perspectives of Syafitri et al. and Putri & Malau—who tend to reduce the failure of this Ministerial Regulation to the mere inadequacy of dedicated bike lanes—this analysis discerns that the genuine root of the problem lies in the disharmony of the regulatory hierarchy and the absence of coercive power. A Ministerial Regulation lacks the attributive legitimacy to impose binding threats of penal sanctions or administrative fines.^{27,28}

The destructive impact of this ambiguity was constitutionally confirmed through Constitutional Court Case Number 187/PUU-XXIV/2026. The petitioners substantiated a tangible legal injury: law enforcement officials encountered an impasse in determining legal proceedings when fatal accidents involved electric bicycles, as the nebulous status of the vehicle complicated the imposition of negligence offenses.²⁹ Although it culminated in a *Niet Ontvankelijke Verklaard* (inadmissible) ruling due to formal procedural defects, these proceedings authentically proved that the classification of e-bikes constitutes a constitutional crisis implicating the guarantee of legal certainty (Article 28D paragraph (1) of the 1945 Constitution of the Republic of Indonesia), rather than a mere administrative traffic problem.

The obsolescence of the domestic legal system becomes glaringly apparent when elevated and confronted with global standardization frameworks. The European Union rejects categorization predicated upon "physical appearance," dissecting it instead through thermodynamic parameters and electronic controls via the EN 15194 standard (Electrically Power Assisted Cycles). The absolute prerequisites for an e-bike to be legally recognized as a bicycle (pedelec) are: a maximum continuous rated motor power of 250 Watts, an automatic motor cut-off feature at 25 km/h, and an absolute throttle prohibition wherein the motor engages strictly upon pedaling.³⁰ Should the entity possess a full throttle—analogue to the majority of imported assemblages in Indonesia—EU authorities *ipso jure* classify it as an L1e-B Moped (light motorized vehicle), which mandates insurance, license plates, and a driver's license, alongside a minimum age

²⁷ Syafitri, Kamila, and Boemiya, "Analisis Yuridis Penggunaan Sepeda Motor Listrik Oleh Anak Di Bawah Umur Berdasarkan Permenhub Republik Indonesia Nomor PM 45 Tahun 2020."

²⁸ Putri and Malau, "Efektivitas Penggunaan Sepeda Listrik Berdasarkan Peraturan Menteri Perhubungan Republik Indonesia Nomor PM 45 Tahun 2020 Di Kota Padang."

²⁹ MKRI, "Pengujian Materiil Undang-Undang Nomor 22 Tahun 2009 Tentang Lalu Lintas Dan Angkutan Jalan."

³⁰ Din Calculator, "E-Bike Legal Checker," Din Calculator, 2026, <https://www.dincalculator.com/bike/ebike-checker>.

restriction of 16 years.^{31,32,33}

In a more structured manner, the comparative lag of Indonesia's legal classification amidst the global current of regulatory tightening can be analyzed in Table 1 below:

Table 1. Comparison of Micro-Mobility (E-Bike) Safety Regulations for Minors

Country / Region	Minimum Age Limit	Maximum Speed Limit	Juridical Classification	Juridical Sanctions for Violators
Indonesia (Permenhub 45/2020)	12 Years	25 km/h (Throttle specifications loosely regulated)	Specific Vehicles (Non-Motorized)	Persuasive reprimand / No penal sanctions in Permenhub
European Union (EN 15194 Standard)	14–16 Years (Varies by country)	25 km/h (Strict Pedal Assist / Throttle Prohibited)	Exceeding 25 km/h or Throttle equipped = Moped (L1e-B)	Vehicle confiscation & Heavy financial fines
Australia (Queensland 2026)	16 Years	25 km/h	Micro-Mobility Vehicle (Learner License Required)	On-the-spot fines (Infringement Notice)
Mongolia (2026 Amendment)	18 Years	20 km/h	Total Prohibition of Minors on Public Roads	Vehicle impoundment & Penal sanctions for parental negligence

Source: Processed by the Author based on global normative instruments (2026)

Referring to the aforementioned disparities, Indonesia urgently requires a reconstruction of the UU LLAJ that adopts rigorous technical precision. Any bicycle equipped with a full throttle or possessing power outputs exceeding reasonable limitations must be legally classified as a KBLBB. The certainty of this technical classification constitutes a *conditio sine qua non* to dismantle the hesitance of law enforcement officers when confiscating these lethal devices from the hands of minors.

2. Extension of Criminal Liability: The Doctrine of Vicarious Liability for Parents

The operation of electric bicycles by minors engenders a novel pathology within the criminal law enforcement system. Considering that the severity of pediatric e-bike collision trauma is equivalent to that of gasoline-powered motorcycle accidents, the law is confronted with a fundamental dilemma: reconciling the deterrent effect necessary for public protection with the mandate of restorative justice designed for child protection.³⁴

From a *das sollen* (normative) perspective, the architecture of juvenile criminal

³¹ A Raimondi et al., "Suitable Solutions and EU Regulatory Framework of Electric Light Mobility Vehicles for Last-Mile Delivery: An Overview," *IOP Conference Series: Materials Science and Engineering* 1306, no. 1 (May 1, 2024): 012031, <https://doi.org/10.1088/1757-899X/1306/1/012031>.

³² Michelangelo-Santo Gulino et al., "Enhancing Road Safety of PLEVs by Novel Vehicle Concepts: A Comprehensive Investigation on Regulations, Accident Statistics, and Perception of Riders in Europe," *Heliyon* 11, no. 1 (January 2025): e41129, <https://doi.org/10.1016/j.heliyon.2024.e41129>.

³³ American College of Surgeons, "Electric Bikes Are Emerging as Public Health Hazard."

³⁴ Zoe E. Flyer et al., "Electric-Bicycles and Speed-Related Trauma in Pediatrics: Risk of Internal Injury and Hospitalization," *Injury* 57, no. 5 (May 2026): 112931, <https://doi.org/10.1016/j.injury.2025.112931>.

liability is guided by Law Number 11 of 2012 concerning the Juvenile Criminal Justice System (UU SPPA), which revolves around the doctrine of the *best interests of the child*. The law deterministically posits that children under the age of 12 lack the requisite psychological capacity to formulate punishable *mens rea* (criminal intent) or *culpa* (negligence), thereby mandating an absolutely non-punitive approach (Article 21 of the UU SPPA).³⁵ For minors aged 12 to 18 years, the UU SPPA mandates resolution through the mechanism of Diversion (restorative justice), which manifests as amicable mediation and forgiveness. However, observing the fatality scale of high-speed e-bike accidents, the application of Diversion that merely culminates in "forgiveness" generates a structural impunity that severely violates the victims' sense of justice.

To bridge this legislative vacuum, civil instruments—specifically via Article 1367 paragraph (2) of the Indonesian Civil Code (KUHPerdata)—have inherently established the principle of strict liability, wherein parents bear full responsibility for damages resulting from the tortious acts (*onrechtmatige daad*) committed by children under their custody.³⁶ Nevertheless, civil restitution is profoundly insufficient to generate a requisite social deterrent effect. Distinct from the research conducted by Sapitri et al. and Nugraha et al., which remains shackled to the impasse of traffic ticketing instruments and diversion paradigms applied to juvenile subjects,^{37,38} this study elevates the academic discourse by operationalizing the theory of vicarious criminal liability as an analytical framework to legally ensnare parental subjects.

Indonesian criminal law is conventionally rooted in the principle of personality (*no punishment without personal guilt*).³⁹ However, the negligence of parents who consciously facilitate young children in propelling moped-class e-bikes on arterial roads must be rigorously reconstructed as an *actus reus* through the schema of omission. Should this active omission become the *conditio sine qua non* for the death of a pedestrian, the parents

³⁵ "Undang-Undang Nomor 11 Tahun 2012 Tentang Sistem Peradilan Pidana Anak, Lembaran Negara Republik Indonesia Tahun 2012 Nomor 153, Tambahan Lembaran Negara Republik Indonesia Nomor 5332" (2012).

³⁶ Raden Subekti and Raden Tjitrosudibio, *Kitab Undang-Undang Hukum Perdata* (Jakarta: PT. Pradnya Paramita, 2013). Pasal 1367 ayat (2).

³⁷ Sapitri, Agustian, and UBB, "Penjatuhan Sanksi Terhadap Pengguna Sepeda Listrik Sebagai Pelaku Tindak Pidana Lalu Lintas Di Jalan Raya Berdasarkan Undang-Undang Nomor 22 Tahun 2009 Tentang Lalu Lintas Dan Angkutan Jalan."

³⁸ Nugraha, Arliman, and Pratama, "Upaya Kepolisian Dalam Penertiban Pengendara Sepeda Listrik Di Jalan Raya Untuk Mencegah Terjadinya Kecelakaan Lalu Lintas."

³⁹ Sahran Hadziq and Gatot Sugiharto, "Vicarious Liability Dalam KUHP Nasional Dikaji Dari Perspektif Living Law Di Yogyakarta," *Lex Renaissance* 9, no. 1 (September 25, 2024): 134–56, <https://doi.org/10.20885/JLR.vol9.iss1.art7>.

can be legally qualified as violating the material offenses stipulated under Article 359 or 360 of the Indonesian Criminal Code (causing death or severe injury due to negligence). This juridical construction substantially aligns with the universal constitutional principles of Common Law through the doctrine of *Negligent Entrustment*, wherein the party relinquishing a dangerous instrumentality to an incompetent entity is recognized as the proximate cause.⁴⁰ The integration of this interpretation is absolutely imperative; reconstructing vicarious liability does not aim to criminalize parenting, but rather to design a robust legal ecosystem that compels parents to engage in rational calculation prior to surrendering the control of hybrid motorized vehicles to minors.

3. The Sociology of Law Enforcement and Compliance Engineering Through a Draconian Approach

Formulating norms constitutes merely one phase, yet actualizing them into tangible compliance (*law in action*) remains the paramount challenge. Operationalizing the framework of the Sociology of Law posited by Lawrence M. Friedman, which postulates that law enforcement relies inherently upon the synergy of Legal Substance, Legal Structure, and Legal Culture, provides a sharp analytical tool to comprehend why the anarchy of micro-mobility transpires in Indonesia.⁴¹

Examined through the dimension of Legal Structure, the National Police Traffic Corps (Korlantas Polri) in 2026 initiated a discernible operational shift from a persuasive approach toward a repressive-educative paradigm.⁴² Initiatives ranging from the *Operasi Keselamatan Candi* (Candi Safety Operation) to the decisive measures undertaken by the Bone Resort Police Traffic Unit in executing the discretionary confiscation of e-bike units constitute a progressive interpretation of police discretionary authority (Article 260 paragraph (1) letter a of the UU LLAJ).^{43,44} The audacity of this structural enforcement

⁴⁰ Charnelle Van der Bijl, "Parental Criminal Responsibility for the Misconduct of Their Children: A Consideration," *Potchefstroom Electronic Law Journal* 21 (April 6, 2018): 1–21, <https://doi.org/10.17159/1727-3781/2018/v21i0a1685>.

⁴¹ Lawrence M. Friedman, *The Legal System: A Social Science Perspective* (New York: Russell Sage Foundation, 1975). Hal, 80–100.

⁴² Muhammad Sulthan, "Pengguna Sepeda Listrik Wajib Tahu! Ini Aturan Yang Harus Dipatuhi," KORLANTAS POLRI, 2026, <https://korlantas.polri.go.id/2026-05-20-pengguna-sepeda-listrik-wajib-tahu-ini-aturan-yang-harus-dipatuhi/>.

⁴³ Polres Sukoharjo, "Polres Sukoharjo Perketat Larangan Sepeda Listrik Di Jalan Raya Selama Operasi Keselamatan Candi 2026," Polres Sukoharjo, 2026, <https://polressukoharjo.com/polres-sukoharjo-perketat-larangan-sepeda-listrik-di-jalan-raya-selama-operasi-keselamatan-candi-2026/>.

⁴⁴ Ajeng Putri Prasetyo, "Banyak Dipakai Anak-Anak, Satlantas Bone Tegaskan Sepeda Listrik Bukan Untuk Jalan Raya," KORLANTAS POLRI, 2026, <https://korlantas.polri.go.id/2026-06-16-banyak-dipakai-anak-anak-satlantas-bone-tegaskan-sepeda-listrik-bukan-untuk-jalan-raya/>.

generated a shock therapy effect; nevertheless, this maneuver was inherently sabotaged by the fragility of the Legal Substance. Because Ministerial Regulation 45/2020 lacks coercive power, the impoundment of units by law enforcement officers is profoundly susceptible to being challenged through pre-trial motions (*pra-peradilan*) by commercial rental agencies under the pretext of the absence of a specific criminal offense.

More crucially, the most profound failure originates from the dimension of Legal Culture. The sociological construction of Indonesian society remains entrapped in a logical fallacy that perceives e-bikes merely as "toys" rather than proxies of motorized vehicles. The pragmatism of parents who sacrifice the fatal safety of their children for the sake of daily transportation efficiency constitutes a cultural pathology that blunts the efficacy of any law.⁴⁵ The absence of rational education regarding blind spots and high-speed braking mechanics is collectively sanctioned by the family unit. In responding to this systemic impasse, comparative analysis demonstrates that effective cultural engineering frequently necessitates an approach that is rigorously rigid and draconian.

Mongolia (2026) enacted an absolute prohibition on the use of electric bicycles in public spaces for individuals under the age of 18, accompanied by custodial sentences for violating parents.⁴⁶ The jurisdiction of Queensland instantaneously imposes financial penalties (infringement notices) on unlicensed minors who violate speed thresholds.⁴⁷ Meanwhile, Paris has implemented a total ban on rented electric scooters following a surge in mortality rates.⁴⁸

Refuting the thesis posited by the Administrative Compliance School (Muttiah et al.), which firmly believes that dedicated bike lane infrastructure serves as the sole proactive solution,⁴⁹ this study rigorously argues that compliance engineering in Indonesia demands repressive instruments that are acutely financially and asset-oriented. Law enforcement will perpetually remain ineffective if the Structure (the Police) is left to battle alone against the Culture (permissive familial behavior) without being armed with a

⁴⁵ Prasja and Kurniasih, "Perlindungan Konsumen Terhadap Penggunaan Sepeda Listrik."

⁴⁶ Xinhua, "Mongolia Bans Under-18s from Riding Scooters, Mopeds, Electric Bikes," News English, 2026, <https://english.news.cn/asiapacific/20260701/c3df6ee8505e4fbb6cf07360d69d006/c.html>.

⁴⁷ Ciprian N Radavoi and Wellett Potter, "Pedestrians' Rights in the Time of the e-Scooter: What Happened to the 'Foot' in Footpath?," *Alternative Law Journal* 47, no. 3 (September 17, 2022): 217–21, <https://doi.org/10.1177/1037969X221108806>.

⁴⁸ Matúš Šucha et al., "E-Scooter Riders and Pedestrians: Attitudes and Interactions in Five Countries," *Heliyon* 9, no. 4 (April 2023): e15449, <https://doi.org/10.1016/j.heliyon.2023.e15449>.

⁴⁹ Muttiah, Baihaqi, and Paulina, "Implementasi Peraturan Menteri Perhubungan Nomor 45 Tahun 2020 Tentang Kebijakan Penggunaan Sepeda Listrik Di Bawah Umur Kecamatan Daha Utara Kabupaten Hulu Sungai Selatan."

robust Substance (the Revision of the UU LLAJ). The permanent confiscation of vehicular units, the direct imposition of commercial fines upon parents, and the suspension of operational licenses for e-bike rental agencies serving pediatric subjects represent the ultimate *ius constituendum* pathway to generate a systemic shock effect, thereby propelling the nation toward a dignified civilization of transportation safety.

C. CONCLUSION

The juridical reconstruction of the classification of electric bicycles in Indonesia is profoundly crucial, given that the sluggish legislative adaptation and the convoluted dichotomy between motorized and non-motorized vehicles enshrined within Law Number 22 of 2009 concerning Traffic and Road Transportation have engendered a vacuum within the repressive legal regime—an anomaly authentically substantiated through the judicial review dispute at the Constitutional Court in 2026. Drawing upon the dynamics of global safety, Indonesian domestic law must imperatively be reconstructed by adopting precise international technical standardizations, such as the European Union's EN 15194 regulation, to delegitimize high-powered, full-throttle electric bicycles, ensuring they are classified *ipso jure* as Battery-Based Electric Motor Vehicles (KBLBB) that are absolutely prohibited for underage use. Conversely, the paralysis of law enforcement efficacy on public roadways—stemming from the absence of material penal sanctions within Minister of Transportation Regulation Number PM 45 of 2020, coupled with an acutely permissive societal culture—demands that police authorities aggressively fortify their discretionary operations of vehicular unit confiscation. As the ultimate resolution, the state must enact an expansion of vicarious criminal liability to encompass the active supervisory negligence of parents, thereby actualizing a profound harmonization between the deterrent effect of the rule of law and the absolute protection of the best interests regarding the preservation of children's lives in public spaces.

REFERENCES

- American College of Surgeons. "Electric Bikes Are Emerging as Public Health Hazard." American College of Surgeons, 2024. <https://www.facs.org/for-medical-professionals/news-publications/news-and-articles/bulletin/2024/julyaugust-2024-volume-109-issue-7/electric-bikes-are-emerging-as-public-health-hazard/>.
- Bijl, Charnelle Van der. "Parental Criminal Responsibility for the Misconduct of Their Children: A Consideration." *Potchefstroom Electronic Law Journal* 21 (April 6, 2018): 1–21. <https://doi.org/10.17159/1727-3781/2018/v21i0a1685>.

- Blackham, Alysia. "When Law and Data Collide: The Methodological Challenge of Conducting Mixed Methods Research in Law." *Journal of Law and Society* 49, no. S1 (September 18, 2022). <https://doi.org/10.1111/jols.12373>.
- Boglietti, Stefania, Benedetto Barabino, and Giulio Maternini. "Survey on E-Powered Micro Personal Mobility Vehicles: Exploring Current Issues towards Future Developments." *Sustainability* 13, no. 7 (March 26, 2021): 3692. <https://doi.org/10.3390/su13073692>.
- Cicchino, Jessica B., Paige E. Kulie, and Melissa L. McCarthy. "Injuries Related to Electric Scooter and Bicycle Use in a Washington, DC, Emergency Department." *Traffic Injury Prevention* 22, no. 5 (July 4, 2021): 401–6. <https://doi.org/10.1080/15389588.2021.1913280>.
- Din Calculator. "E-Bike Legal Checker." Din Calculator, 2026. <https://www.dincalculator.com/bike/ebike-checker>.
- Elvira, Febrina Gladys, Sri Sukmana Damayanti, Gavrilla Theodora, and Olga Nadina. "Analysis Of Electric Bicycles As A Vehicle In Indonesia: A Normative Legal Review." *Syariah: Jurnal Hukum Dan Pemikiran* 20, no. 1 (July 14, 2020): 90. <https://doi.org/10.18592/sjhp.v20i1.3571>.
- Fernandez, Adrian M., Kevin D. Li, Hiren V. Patel, Isabel Elaine Allen, Umar Ghaffar, Nizar Hakam, and Benjamin N. Breyer. "Electric Bicycle Injuries and Hospitalizations." *JAMA Surgery* 159, no. 5 (May 1, 2024): 586. <https://doi.org/10.1001/jamasurg.2023.7860>.
- Flyer, Zoe E., Andreina Giron, John Schomberg, Mary Maginas, Jeffrey Nahmias, Yigit S. Guner, Romeo Ignacio, Troy Reyna, David Gibbs, and Laura F. Goodman. "Electric-Bicycles and Speed-Related Trauma in Pediatrics: Risk of Internal Injury and Hospitalization." *Injury* 57, no. 5 (May 2026): 112931. <https://doi.org/10.1016/j.injury.2025.112931>.
- Friedman, Lawrence M. *The Legal System: A Social Science Perspective*. New York: Russell Sage Foundation, 1975.
- Gulino, Michelangelo-Santo, Susanna Papini, Giovanni Zonfrillo, Peter Miklis, Thomas Unger, and Dario Vangi. "Enhancing Road Safety of PLEVs by Novel Vehicle Concepts: A Comprehensive Investigation on Regulations, Accident Statistics, and Perception of Riders in Europe." *Heliyon* 11, no. 1 (January 2025): e41129. <https://doi.org/10.1016/j.heliyon.2024.e41129>.
- Hadziq, Sahran, and Gatot Sugiharto. "Vicarious Liability Dalam KUHP Nasional Dikaji Dari Perspektif Living Law Di Yogyakarta." *Lex Renaissance* 9, no. 1 (September 25, 2024): 134–56. <https://doi.org/10.20885/JLR.vol9.iss1.art7>.
- Hasjanah, Kurniawati, and Rahmi Puspita Sari. "IESR Desak Pemerintah Segera Terapkan Insentif Dan Tetapkan Target Adopsi Kendaraan Listrik." IESR, 2026. <https://iesr.or.id/iesr-desak-pemerintah-segera-terapkan-insentif-dan-tetapkan-target-adopsi-kendaraan-listrik/>.
- Haustein, Sonja, and Mette Møller. "Age and Attitude: Changes in Cycling Patterns of Different e-Bike User Segments." *International Journal of Sustainable Transportation* 10, no. 9 (October 20, 2016): 836–46.

<https://doi.org/10.1080/15568318.2016.1162881>.

Liu, Lei, and Ran Tao. "The Systemic Nature of Law from a Judicial Perspective." *Humanities and Social Sciences Communications* 13, no. 1 (April 8, 2026): 765. <https://doi.org/10.1057/s41599-026-07212-0>.

Ma, Wenxin, Zhiyong Liu, and Ruimin Li. "Effect of Helmet-Wearing Regulation on Electric-Bike Riders: A Case Study of Two Cities in China." *Transportation Safety and Environment* 6, no. 3 (May 30, 2024). <https://doi.org/10.1093/tse/tdad038>.

Meir, Anat, and Ben Dagan. "Can Young Novice E-Bike Riders Identify Hazardous Traffic Situations? An Exploratory Study." *Travel Behaviour and Society* 21 (October 2020): 90–100. <https://doi.org/10.1016/j.tbs.2020.06.001>.

Michaels, Ralf. "Comparative Law Today – Tones, Themes, Trends." *Comparative Legal History* 14, no. 1 (January 2, 2026): 4–28. <https://doi.org/10.1080/2049677X.2026.2671591>.

MKRI. "Pengujian Materiil Undang-Undang Nomor 22 Tahun 2009 Tentang Lalu Lintas Dan Angkutan Jalan." MKRI, 2026. <https://tracking.mkri.id/index.php?page=web.TrackPerkara&id=187/PUU-XXIV/2026#>.

Muttiah, Muttiah, Ahmad Baihaqi, and Siti Paulina. "Implementasi Peraturan Menteri Perhubungan Nomor 45 Tahun 2020 Tentang Kebijakan Penggunaan Sepeda Listrik Di Bawah Umur Kecamatan Daha Utara Kabupaten Hulu Sungai Selatan." *Jurnal Kebijakan Publik* 3, no. 1 (May 12, 2026): 218–28. <https://ejurnal.stiaamuntai.ac.id/index.php/PPJ/article/view/1784>.

Nugraha, Dian, Laurensius Arliman, and Bisma Putra Pratama. "Upaya Kepolisian Dalam Penertiban Pengendara Sepeda Listrik Di Jalan Raya Untuk Mencegah Terjadinya Kecelakaan Lalu Lintas." *Unes Journal of Swara Justisia* 9, no. 3 (November 3, 2025): 512–19. <https://doi.org/10.31933/z7ydw961>.

Peraturan Menteri Perhubungan Nomor PM 45 Tahun 2020 tentang Kendaraan Tertentu dengan Menggunakan Penggerak Motor Listrik, BN No. 654 Tahun 2020 (2020).

Polres Sukoharjo. "Polres Sukoharjo Perketat Larangan Sepeda Listrik Di Jalan Raya Selama Operasi Keselamatan Candi 2026." Polres Sukoharjo, 2026. <https://polressukoharjo.com/polres-sukoharjo-perketat-larangan-sepeda-listrik-di-jalan-raya-selama-operasi-keselamatan-candi-2026/>.

Prasetyo, Ajeng Putri. "Banyak Dipakai Anak-Anak, Satlantas Bone Tegaskan Sepeda Listrik Bukan Untuk Jalan Raya." KORLANTAS POLRI, 2026. <https://korlantas.polri.go.id/2026-06-16-banyak-dipakai-anak-anak-satlantas-bone-tegaskan-sepeda-listrik-bukan-untuk-jalan-raya/>.

Prasja, Teguh Rama, and Esy Kurniasih. "Perlindungan Konsumen Terhadap Penggunaan Sepeda Listrik." *JKIH : Jurnal Kajian Ilmu Hukum* 4, no. 2 (November 5, 2025): 231–46. <https://doi.org/10.55583/jkih.v4i2.1553>.

Pratama, Perdy, and Rosa Tedjabuwana. "Pengaturan SIM Terhadap Pengguna Sepeda Listrik." *Wajah Hukum* 9, no. 2 (October 14, 2025): 532. <https://doi.org/10.33087/wjh.v9i2.1865>.

- Putri, Lusi Adinda Miranti, and Hasbullah Malau. "Efektivitas Penggunaan Sepeda Listrik Berdasarkan Peraturan Menteri Perhubungan Republik Indonesia Nomor PM 45 Tahun 2020 Di Kota Padang." *Jurnal ISO: Jurnal Ilmu Sosial, Politik Dan Humaniora* 4, no. 2 (August 19, 2024): 15. <https://doi.org/10.53697/iso.v4i2.1828>.
- Radavoi, Ciprian N, and Wellett Potter. "Pedestrians' Rights in the Time of the e-Scooter: What Happened to the 'Foot' in Footpath?" *Alternative Law Journal* 47, no. 3 (September 17, 2022): 217–21. <https://doi.org/10.1177/1037969X221108806>.
- Raimondi, A, G Savino, J Lagrimino, G Biagioni, and N Baldanzini. "Suitable Solutions and EU Regulatory Framework of Electric Light Mobility Vehicles for Last-Mile Delivery: An Overview." *IOP Conference Series: Materials Science and Engineering* 1306, no. 1 (May 1, 2024): 012031. <https://doi.org/10.1088/1757-899X/1306/1/012031>.
- Sapitri, Ayu, Rio Armanda Agustian, and Toni UBB. "Penjatuhan Sanksi Terhadap Pengguna Sepeda Listrik Sebagai Pelaku Tindak Pidana Lalu Lintas Di Jalan Raya Berdasarkan Undang-Undang Nomor 22 Tahun 2009 Tentang Lalu Lintas Dan Angkutan Jalan." *Jurnal Hukum Jurisdictie* 7, no. 1 (March 22, 2025): 45–58. <https://doi.org/10.34005/jhj.v6i2.169>.
- Subekti, Raden, and Raden Tjitrosudibio. *Kitab Undang-Undang Hukum Perdata*. Jakarta: PT. Pradnya Paramita, 2013.
- Šucha, Matúš, Elisabeta Drimlová, Karel Rečka, Narelle Haworth, Katrine Karlsen, Aslak Fyhri, Pontus Wallgren, Peter Silverans, and Freya Sloomans. "E-Scooter Riders and Pedestrians: Attitudes and Interactions in Five Countries." *Heliyon* 9, no. 4 (April 2023): e15449. <https://doi.org/10.1016/j.heliyon.2023.e15449>.
- Sulthan, Muhammad. "Pengguna Sepeda Listrik Wajib Tahu! Ini Aturan Yang Harus Dipatuhi." *KORLANTAS POLRI*, 2026. <https://korlantas.polri.go.id/2026-05-20-pengguna-sepeda-listrik-wajib-tahu-ini-aturan-yang-harus-dipatuhi/>.
- Syafitri, Lisa, Desy Putri Kamila, and Helmy Boemiya. "Analisis Yuridis Penggunaan Sepeda Motor Listrik Oleh Anak Di Bawah Umur Berdasarkan Permenhub Republik Indonesia Nomor PM 45 Tahun 2020." *Jurnal Penelitian Inovatif* 4, no. 4 (November 30, 2024): 2423–32. <https://doi.org/10.54082/jupin.980>.
- Undang-Undang Nomor 11 Tahun 2012 tentang Sistem Peradilan Pidana Anak, Lembaran Negara Republik Indonesia Tahun 2012 Nomor 153, Tambahan Lembaran Negara Republik Indonesia Nomor 5332 (2012).
- Undang-Undang Nomor 22 Tahun 2009 tentang Lalu Lintas dan Angkutan Jalan. Lembaran Negara Republik Indonesia Tahun 2009 Nomor 96 (2009).
- Xinhua. "Mongolia Bans Under-18s from Riding Scooters, Mopeds, Electric Bikes." *News English*, 2026. <https://english.news.cn/asiapacific/20260701/c3df6ee8505e4fbba6cf07360d69d006/c.html>.
- Yang, Zhichao, Jiashu He, Mohammad B. Al-Khasawneh, Darshan Pandit, and Cirillo Cinzia. "E-Bike Agents: Large Language Model-Driven E-Bike Accident Analysis and Severity Prediction," October 24, 2025. <http://arxiv.org/abs/2506.04654>.