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Implementation of Electronic Traffic Law Enforcement to Improve Traffic Safety in the Special Region of Yogyakarta

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ABSTRACT

The implementation of Electronic Traffic Law Enforcement (ETLE) in the Special Region of Yogyakarta (Daerah Istimewa Yogyakarta (DIY)) is an effort to digitize traffic law enforcement to reduce violations and accidents. However, despite the program's implementation in 2021, the number of accidents and traffic violations continues to increase year after year. This study aims to evaluate the effectiveness of ETLE, identify barriers to its implementation, and provide strategic recommendations to improve traffic safety in the Special Region of Yogyakarta (Daerah Istimewa Yogyakarta (DIY)). This research uses a qualitative descriptive approach to describe the implementation of ETLE in the Special Region of Yogyakarta in depth by utilizing primary data from interviews, observations, and documentation, as well as secondary data in the form of supporting documents and statistics. Data analysis was conducted using an Interactive Analysis Model that includes data collection, reduction, presentation, and drawing conclusions, supported by Duncan's Effectiveness Measurement Theory and fishbone diagram analysis. Credibility testing was carried out through extended observations, triangulation, negative case analysis, and the use of references to ensure the research results were accurate, valid, and accountable. The research results show that the implementation of ETLE in the Special Region of Yogyakarta remains ineffective in reducing traffic accidents, despite its effective mechanisms. ETLE plays a significant role in identifying violations, but its widespread implementation is still hampered by factors such as workforce, technology, methods, and measurement. Therefore, 12 strategic recommendations are needed to optimize ETLE and improve traffic safety in the Special Region of Yogyakarta.

KEYWORDS *DIY, ETLE, Traffic Safety, Violations*

INTRODUCTION

Traffic accidents are a persistent problem alongside societal development and advancement (Echaluce & Macabeo, 2024). Traffic violations often lead to disorder and accidents on the roads (Elfahim, El Midaoui, Youssfi, & Bouattane, 2023). The imbalance between vehicle numbers and road construction results in traffic congestion, which increases the potential for accidents (Berhanu, Alemayehu, & Schröder, 2023). Road users must comply with applicable rules, procedures, and laws to improve traffic safety and minimize accident risks (Organization, 2023).

The implementation of *Electronic Traffic Law Enforcement (ETLE)* is a priority program of the Traffic Corps of the Republic of Indonesia National Police (Kapolri) General Listyo Sigit Prabowo, as the Head of the Traffic Corps (Korlantas Polri) (Narendroputro & Rusfian, 2023). It aims to reduce member deviations in law enforcement processes, such as ticketing, and to raise public awareness of traffic order (Setiawan et al., 2023). ETLE is a police initiative in Traffic Safety Management supported by the five pillars of traffic safety in Presidential Regulation No. 1 of 2022 concerning the National General Plan for Traffic and Road Transportation Safety (RUNK LLAJ). The legal foundation for ETLE in supporting traffic safety emphasizes the 4th Pillar, Safe Drivers, managed by the Republic of Indonesia National Police to ensure safe traffic and legal certainty (Kristanto, Suryandari, & Sejati, 2024). ETLE

eliminates direct interaction between officers and violators, making it the most suitable method in the *Technology 4.0/5.0* era (Exposure to ETLE SPEEDCAM, Head of the Traffic Police Unit, Directorate of Law Enforcement, Korlantas Polri, 2022). This innovation is viewed as an appropriate step to enhance transparency between the police and the public and to reduce extortion risks (Wulandari, 2020). One of the main tasks of the Yogyakarta Special Region Police Traffic Directorate (Ditlantas Polda DIY) involves implementing the ETLE program, including public education and law enforcement supported by Information and Communication Technology.

Based on traffic accident and violation data from the Dataku Application of the Yogyakarta Regional Development Planning Agency (Bappeda), 2022 saw 7,830 accidents and 46,848 violations. Although 2023 recorded fewer accidents (6,868), 2024 saw an increase in violations to 64,431. These trends fuel debate about the role of ETLE in improving traffic safety (Ruci, Soehodho, & Sumabrata, 2024). Given this data, further study is needed to assess the effectiveness of ETLE implementation in Yogyakarta and explore factors causing obstacles to its implementation (Mayastinasari & Lufpi, 2021).

The police's ETLE program is a digitalization effort in the 4.0 era aimed at reducing direct interaction between officers and violators (Irfan, 2023). ETLE was implemented in the Special Region of Yogyakarta (DIY) in 2021 to reduce traffic accidents and violations (Kurnia Wahyu, 2022; Rakhmadani, 2017; Subadina, 2020). However, data indicate that accidents and violations have continued to rise annually, making ETLE in DIY an intriguing case requiring deeper analysis of its effectiveness and influencing factors (Putri & Yahman, 2025).

Previous studies highlight various ETLE aspects. Kurnia Wahyu (2022) found ETLE effective in handling violations in Surabaya, while Mayastinasari & Lufpi (2021) emphasized its enforcement efficiency. Conversely, Rakhmadani (2017) and Subadina (2020) noted challenges such as technological limitations and public awareness issues. Despite this, there is a lack of in-depth evaluation on ETLE's effectiveness in reducing accidents—not just violations—especially in the Yogyakarta context. Most research focuses on general implementation, without addressing local constraints or offering tailored strategic recommendations (Abdullah, F. A., & Windiyastuti, F. 2022).

Data from Bappeda show that in 2022, there were 7,830 accidents and 46,848 violations. While accidents dropped to 6,868 in 2023, violations rose significantly to 64,431. This trend questions ETLE's effectiveness since its 2021 introduction in DIY (Wirna, Paraniti, & Pidada, 2023). The rise in violations and fluctuating accidents suggests ETLE's impact on traffic safety is not optimal (Aprianto, Nurrohman, Octavioliena, & Ependi, 2025).

This study introduces novelty by integrating Duncan's Theory of Effectiveness Measurement with fishbone diagram analysis to systematically evaluate ETLE's effectiveness and identify root causes of implementation obstacles in Yogyakarta. Unlike previous studies, it provides localized, actionable recommendations based on a multi-dimensional analysis (Bhargava, Phan, Zhou, & Lee, 2015).

Addressing these issues, this study aims to evaluate ETLE's effectiveness in reducing traffic accidents in the Special Region of Yogyakarta (DIY), identify implementation obstacles, and propose strategic recommendations to enhance traffic safety. The analysis is expected to offer a comprehensive view of the ETLE program's success and optimization strategies (Silvas, Hofman, Murgovski, Etman, & Steinbuch, 2016). The results should benefit the Yogyakarta

Regional Police Directorate and stakeholders in evaluating and improving ETLE implementation for better traffic safety. Theoretically, this research contributes to public policy and traffic law enforcement literature by integrating effectiveness theory and root cause analysis. Its findings may also guide other regions planning similar electronic traffic law enforcement systems.

METHOD

The research method used was descriptive qualitative, aiming to provide an in-depth description of the implementation of ETLE in the Special Region of Yogyakarta. The study utilized three types of instruments: software, survey hardware, and interview documentation tools. Data were collected from primary sources through in-depth interviews, observations, and documentation, as well as secondary sources including ETLE-related documents and supporting statistics. Nonprobability sampling with purposive sampling was employed, selecting samples based on characteristics relevant to the research objectives, addressing the research problem and aligning with the research framework (Sugiyono, 2023).

Data analysis followed an Interactive Analysis Model with stages of data collection, data reduction, data display, and conclusion drawing. Initial analysis produced tentative conclusions, which were categorized using Duncan's Theory of Effectiveness Measurement (Steers, 1985) and supported by fishbone analysis to identify factors influencing ETLE implementation.

Data credibility was ensured through extended observation, increased research accuracy, triangulation, negative case analysis, and reference use. Triangulation validated data accuracy and reliability.

RESULT AND DISCUSSION

A. Traffic Accident and Violation Data in Yogyakarta

Traffic accident data (laka lantas) in Yogyakarta reflects the level of traffic safety through indicators such as the number of incidents, type of accident, material losses, number of violations, fines, and number of vehicles. A complete summary of traffic accidents and traffic violations for the 2020–2023 period is presented in Table 1.

Table 1. Traffic Accident and Traffic Violation Data

Element	Years				
	2020	2021	2022	2023	
Traffic Accident Data					
Number of Traffic Accidents	4.559,00	5.350	7.830	6.868	Events
Fatalities	346,00	452,00	570	94	Soul
Minor Injuries	5.715,00	6.390	10.17	3.893	Soul
Serious Injuries	1	6	0	58	Soul
Material Losses	2.111.235.500	2.393.687.000	3.901.777.000	3.786.080.300	Rp
Data Breach					

Element	Years				
	2020	2021	2022	2023	
Number of Violations	74.819,00	29.615	46.848	64.431	Incident
Fines	3.966.307.000	2.578.583.000	3.012.234.000	1.033.511.000	Rp

Source: Bappeda DIY, 2024

Based on the traffic accident data above, in 2020–2021 the number of traffic accidents in Yogyakarta increased from 4,559 to 5,350 incidents, although traffic violations decreased from 74,189 to 29,615. This decreases coincided with the installation of ETLE in Yogyakarta in 2021. In 2022, traffic accidents rose again to 7,830 incidents before decreasing to 6,868 in 2023. Conversely, traffic violations increased from 46,848 in 2022 to 64,431 in 2023. Detailed data on the total traffic accidents at ETLE locations for the 2019–2023 period are presented in Table 2.

Table 2. Total accidents and ETLE locations 2019-2023

Year	Total Events
2019	395
2020	291
2021	326
2022	481
2023	526

Source: Ditlantas Polda DIY, 2024

Traffic accident data at ETLE installation locations for the 2019–2023 period shows fluctuations in the number of incidents both before and after ETLE installation. In the period before ETLE installation (2019–2020), the number of traffic accidents decreased from 395 to 291 incidents, with the highest location being at the Maguwo Three-Way Intersection and the lowest location being at the Ngabean or Maguwo Four-Way Intersection. Entering the period after ETLE installation (2021–2023), the number of traffic accidents tended to increase, from 326 incidents in 2021 to 526 incidents in 2023. The location with the highest number of incidents remained at the Maguwo Three-Way Intersection, while the lowest location since 2022 moved to the Tambak Wates Four-Way Intersection. This means that there was no significant decrease in the number of traffic accidents after ETLE installation. The most common type of accident was minor traffic accidents.

B. Implementation of ETLE in DIY

ETLE is a police measure in traffic safety management supported by five pillars of traffic safety. The implementation of ETLE's legal basis in supporting traffic safety focuses on Pillar 4, namely Safe Drivers, which is managed by the Indonesian National Police to ensure legal certainty and safe traffic. Based on the focus of Pillar 4, as follows:

1. Improvement of regulations related to the KLLAJ,
2. Development of educational programs on traffic regulations,

3. Implementation of campaigns and outreach on the KLLAJ,
4. Integration of Driver's Licenses (SIM) with data and violation records.
5. Improvement of SIM issuance requirements and procedures.
6. Development of Human Resources (HR) and infrastructure for SIM testing.
7. Technical training and coaching for drivers.
8. Utilization of information technology and law enforcement in the implementation of the KLLAJ.
9. Control, supervision, and law enforcement of the seven risk factors.
10. Examination of the physical and mental condition of drivers.
11. Investigation of traffic accidents and reconstruction of traffic incidents.

An interview with the Yogyakarta Regional Police Traffic Directorate (Ditlantas Polda Yogyakarta) explained that the installation of ETLE is based on the identification of "black spots" or locations with a high frequency of traffic accidents, based on data from the IRSMS. This data is uploaded and processed by operators daily to design safety measures, such as installing signs or ETLE at accident-prone areas. As stated, "Every day, over a period of time, the data is generated and then pulled into data to create safety measures... we want to install signs or ETLE in areas with frequent traffic accidents, or so-called "black spots." /Ja, Yogyakarta Regional Police Traffic Directorate, interview, January 30, 2024.

According to the Head of the Dakgar Section of the Traffic Corps (Korlantas Polri), ETLE has benefits such as fostering a culture of orderly traffic, supporting government programs, providing excellent service in the areas of security and safety, minimizing violations, reducing accident fatalities, and preventing conflicts and officer misconduct. ETLE can detect various violations, such as running red lights, violating traffic markings, not wearing seat belts, using cell phones while driving, going against traffic, and speeding (Efendi, 2022). However, in Yogyakarta, ETLE's capabilities are still limited and focused more on four-wheeled vehicles. This was confirmed by the police: "ETLE can improve the order of vehicle name changes... if a car owner commits a violation, it will be directed to the original owner's address." /Dw, Yogyakarta Regional Police Traffic Directorate, interview, January 29, 2024.

Figure 2. Exposure of Violations that can be detected by ETLE
Source: Exposure of ETLE SPEEDCAM, Head of Dakgar Section, Ditgakkum Korlantas Polri, 2022

The current ETLE cameras in Yogyakarta can only detect a few types of violations and are still focused on four-wheeled vehicles. Violations that can be captured include road marking and sign violations, seat belt violations, and running a traffic light (apill). This was confirmed by the police: "Identification of road marking and sign violations, seat belt violations, and running a red light violations can currently only be captured by the ETLE camera system. For two-wheeled vehicles, the existing ETLE cameras have not yet recorded any violations for two-wheeled vehicles." /Dw, Yogyakarta Regional Police Traffic Directorate, interview, January 29, 2024.

Furthermore, ETLE in Yogyakarta also serves another law enforcement support function: helping to solve crimes. If a crime occurs at the ETLE installation location, camera footage can be used to monitor the incident in real time and even detect the perpetrator's face through the reflection in the car window. As the police stated: "...not only that, solving crimes is also possible... the ETLE system can detect faces through car windows." /Dw, Traffic Directorate of the Yogyakarta Regional Police, interviewed on January 29, 2024.

C. ETLE Mechanism

Drivers are expected to understand the process, and it's crucial for violators to understand how ETLE works. The ETLE mechanism involves downloading the application and signing in with your username and password. The complete ETLE mechanism can be seen in Figure 3 below.

Figure 3. Exposure to the mechanisms that can be detected by ETLE

Source: Exposure to ETLE SPEEDCAM, Head of the Traffic Police Unit, Directorate of Law Enforcement, Traffic Corps, Indonesian National Police, 2022

The ETLE system in Yogyakarta has operated 24/7 without any disruption since its implementation. The back office team is tasked with monitoring and validating the thousands of violations recorded daily. Police monitor the situation more intensively during the day when traffic is heavy. As stated: "So it works 24/7... after that, we'll have another team, the back-office team... to validate because there are thousands of violations there," and "The ETLE system has never experienced any downtime or anything... all ETLE locations are functioning properly." /Dw, Yogyakarta Regional Police Traffic Directorate, interview, January 29, 2024/.

The ETLE mechanism begins with the capture of violations by cameras, then sending data to the Head of Traffic Accidents of the Yogyakarta Regional Police ETLE as evidence. Back office officers verify vehicles through ERI, rejecting data if the vehicle identity does not match: "The back office team validates/matches... which is not validated if the police number is different from the vehicle type..." /Dw, January 29, 2024/. Automatic violation confirmation letters are printed nationally and sent via PT Pos at DIPA costs: "This letter is automatic... we collaborate on an MOU with PT. Pos... we bear the costs" /Dw, January 29, 2024/.

Violators are required to confirm within 8 days through the ETLE website or the Gakkum office; the fine payment deadline is 15 days. The STNK will be temporarily blocked if confirmation is ignored: "…if the public ignores… the Samsat officer blocks the STNK…" /Dw, January 29, 2024/. Fine payments are made via BRIVA and transferred to the prosecutor's account: "…all the money is in the prosecutor's office. So the police take action, the judge decides…" /Dw, January 29, 2024/. ETLE fines have been determined and are included in Law Number 22 of 2009 concerning the price of fines for detectable violations, which can be seen in Table 3 below.

Table 3. ETLE fines based on (Law Number 22, 2009)

Types of Violations	Maximum Imprisonment	Maximum Fine (Rp.)	Information
Vehicles without license plates	2 months	500.000,00	Article 280
Motorcyclists failing to comply with traffic regulations	1 month	250.000,00	Article 285 paragraph 1
Car drivers failing to comply with driving requirements	2 months	500.000,00	Article 285 paragraph 2
Cars not equipped with necessary equipment, such as license plates	1 month	250.000,00	Article 278dd
Driving at high speeds	2 months	500.000,00	Article 287 paragraph 5
Motor Vehicle Test Certificate	2 months	500.000,00	Article 288 paragraph 1
Driver not wearing a seat belt	1 month	250.000,00	Article 289
Not wearing a helmet meeting Indonesian National Standard (SNI)	1 month	250.000,00	Article 291 paragraph 1
The vehicle's main lights were not on at night	1 month	250.000,00	Article 293 paragraph 1
The vehicle's main lights were not on during the day	1 month	100.000,00	Article 293 paragraph 2
The turn signals were not used	15 days	250.000,00	Article 294

D. Obstacles to ETLE Implementation

The main obstacle to ETLE implementation in the Special Region of Yogyakarta (DIY) is a lack of human resources. The personnel structure at the Yogyakarta Regional Police Traffic Directorate (Ditlantas Polda DIY) is not fully staffed, resulting in burdensome distribution of tasks, both in public service in the field and in processing traffic ticket documents, which overwhelms officers. As stated: "...our problem is a lack of personnel... we even take work home..." /Dw, Ditlantas Polda DIY, January 29, 2024/. Furthermore, supporting facilities, such as the printer specifically for printing ticket envelopes, often break down, hindering the smooth administration process.

E. Road User Perceptions of ETLE

Based on the results of interviews regarding ETLE implementation in the Special Region of Yogyakarta, informants provided varying answers, resulting in the following advantages and disadvantages of ETLE.

Table 4. Advantages and Disadvantages of ETLE

No	Advantages	Disadvantages
1	Increasing road user awareness with ETLE	Unable to regulate the behavior of indifferent road users
2	Minimizing the potential for fraudulent levies during law enforcement	The public is not yet fully aware of the mechanisms and how ETLE works

No	Advantages	Disadvantages
3	Smoothing traffic flow with digital ticketing	Not yet able to regulate vehicle ownership that has not been transferred
4	Understanding driver conditions	Smoothing traffic flow with digital ticketing
5	Understanding vehicle violations	Detecting potential disruptions, for example, during heavy rain or certain conditions
6	Understanding data on violations occurring in the community	Placement of ETLE points is still not widely available

Source: Researcher Analysis, 2024

F. Analysis of ETLE Implementation Barriers

Fishbone analysis is a method that describes cause-and-effect relationships to identify the root causes of a major problem, which are then divided into main and sub-causes. The results of this analysis provide recommendations for corrective actions. This diagram is useful for analyzing the causal factors and characteristics of the highest failure rates. The fishbone diagram can be seen in Figure 4.

Table 4. Brainstorming Findings

Source: Researcher Analysis, 2024

Key Issues	Main Cause Category	Sub-Causes of the Problem
Obstacles to ETLE Implementation	***Manpower (workforce)***	Lack of ETLE personnel
		Inappropriate division of labor
	Machine (machines and technology)	Limited ETLE camera specifications
		Inadequate printer specifications
	Method (method or process)	Promotions are only conducted at the beginning of marketing
		Lack of regular outreach
		Separate outreach targets are implemented
		Road users are not yet aware of the ETLE locations
		Road users have not yet felt the impact of ETLE
	Measurement (measurement or inspection)	There has been no decrease in the potential for traffic accidents before and after the installation of ETLE.
		There has been no decrease in the number of violations before and after the installation of ETLE.

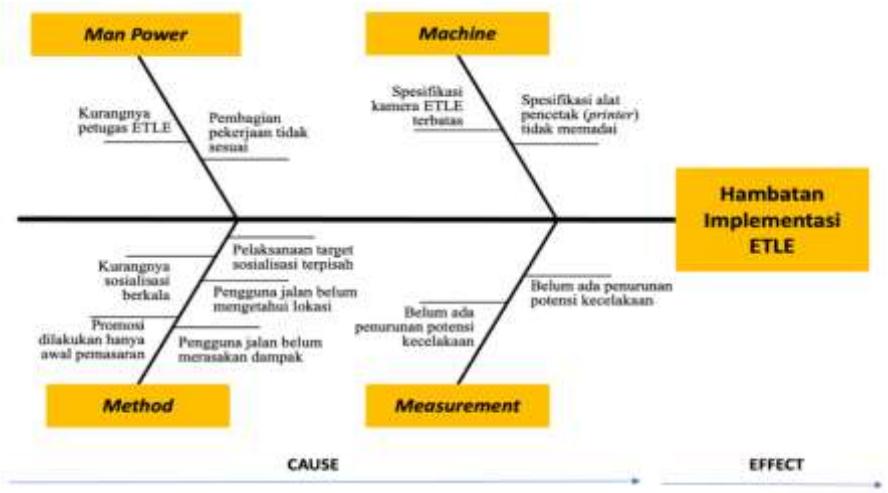

Figure 4. Fishbone Diagram Results
Source: Researcher Analysis, 2024

Based on the Fishbone Diagram in Figure 4, the root causes that contribute to the Main Causal Factors can be identified. The next step is to determine corrective actions as recommendations to be taken based on these key factors.

G. Recommendations for ETLE Implementation

The proposed implementation of ETLE in the Special Region of Yogyakarta (DIY) is aimed at improving traffic safety. Based on interviews, researchers compiled various constructive and useful recommendations for improving and optimizing the ETLE system. These recommendations aim to increase the effectiveness of ETLE in reducing traffic violations and accidents. Next, corrective actions were implemented in the form of 12 recommendations, summarized and grouped according to the main causes of the problems. These are presented in Table 5 as a guide for future improvements.

Table 5. Corrective Actions Based on Main Cause Category

Main Cause Category	Corrective Actions
Manpower (workforce)	Preparing Human Resources
	Establishing a traffic safety consortium. This consortium is designed to ensure that ETLE implementation is not solely carried out by a single institution, but also to enable stakeholders to mutually support ETLE implementation, making it more effective in improving traffic safety.
	Improving Inter-Regulatory Coordination: Coordination between agencies with CCTV surveillance systems on the road can be facilitated by collaborating on the use of CCTV cameras. This can help agencies minimize budget expenditures for camera installation.
Machine (machines and technology)	Completing the specifications for ETLE implementation facilities: adding ETLE cameras that can detect two-wheeled vehicles, as motorcycles are becoming more common, and facilities at ETLE service offices are being expanded.

	Installing ETLE cameras throughout the city; the ETLE system is installed at intersections and roads to improve traffic safety.
	Installing dummy cameras; these cameras are deployed in locations with high traffic volumes.
Method (method or process)	Regularly promote ETLE, which is essential based on the behavior of Indonesian citizens.
	Install promotional media for ETLE, both on social media and in person. Promotional media can be distributed at strategic locations frequently viewed by the public.
	Consistently implementing the ETLE program and consistent law enforcement are expected to improve traffic safety.
Measurement (measurement or inspection)	Modifying Technology, by reviewing best practices with technology implemented abroad.
	Using Public Transportation, encouraging people to use public transportation to reduce the number of private vehicles on the road.
	Regulating Permits: Establishing a separate institution for issuing driving licenses (SIMs) like those found abroad. This separates driver's licenses from ETLE service providers, allowing police to focus on the field and allowing SIM permits to be issued by authorized institutions. This is expected to further streamline the administrative process for traffic permits.

Source: Researcher Analysis, 2024

CONCLUSION

The research found that while the implementation of *Electronic Traffic Law Enforcement (ETLE)* in the Special Region of Yogyakarta ran smoothly with effective mechanisms for identifying traffic violations, its impact on reducing traffic accidents remained limited. Key obstacles included manpower shortages, limited technology and equipment, inadequate methods, and measurement challenges. Despite ETLE's potential to assist law enforcement, constraints such as insufficient device numbers, limited monitoring coverage, and human resource capacity hindered its effectiveness in improving traffic safety. To enhance ETLE's impact, strategies are needed like intensifying outreach through various media, increasing the number of cameras at strategic locations, improving personnel numbers and competencies, ensuring strict law enforcement free from illegal levies, and developing more comprehensive evaluation metrics such as accident rates per vehicle and per resident. Future research should investigate the long-term effects of these improvement strategies and explore the integration of emerging technologies and community engagement to further optimize ETLE's effectiveness in reducing traffic accidents.

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