

Assessing Non-Compliance with Motorcycle Plate Standards in Senawang from Behavioral and Enforcement Perspectives

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Abstract: This research investigates non-compliance with statutory motorcycle registration plate standards in Senawang, Negeri Sembilan, Malaysia. Drawing on enforcement records (2020 to 2024), field observations, and stakeholder consultations, the study applies descriptive statistics and root cause analysis to evaluate the prevalence, typologies, and determinants of plate irregularities. Results indicate a persistent and structurally embedded problem, with improper sizing (71 percent) and decorative modifications (21 percent) as dominant violations. Non-compliance is further intensified during festive periods, reflecting cyclical enforcement gaps. The findings identify behavioural drivers, retail practices, and legislative weaknesses as principal causal factors. The study contributes to transport governance literature by integrating empirical violation data with community-level perspectives, and it proposes a multidimensional framework that includes public awareness campaigns, consistent enforcement, retailer regulation, legislative revision, and adoption of automated recognition technologies to strengthen compliance and road safety.

Keywords: *Motorcycle registration compliance, Transport governance, Enforcement and legislative frameworks, Behavioural drivers of non-compliance, Root cause analysis*

1. Introduction

Motorcycle registration number is a core element of transport governance in Malaysia because they enable lawful identification, enforcement, and investigations. The Road Transport Department (Jabatan Pengangkutan Jalan Malaysia, JPJ) prescribes the size, font, and layout of registration plates and has recently introduced the secure JPJ ePlate with anti-counterfeit and RFID features for new zero-emission vehicles (JPJ, 2025; Lee, 2024; Lim, 2024). Despite these measures, non-standard or decorative plates remain widespread and compromise vehicle identification during crashes and crimes. Enforcement agencies report large numbers of summonses in recent years (Tan, 2025), while police often rely on alternative technologies to address difficulties in reading illegible plates.

Cases reported in the media highlight the real-world risks of plate irregularities. A Kuala Lumpur roadblock revealed a motorcyclist using a fake registration number and no valid licence (Augustin, 2024), while state-level enforcement reports consistently identify non-standard plates as one of the most common offences (Baslie, 2025). Under the Motor Vehicles (Registration and Licensing) Rules 1959 and the Road Transport Act 1987, riders who use non-standard or fake plates may face penalties that include compounds, fines, or imprisonment (Awaludin, 2025). These laws establish the framework for enforcement, yet persistent violations in Senawang suggest that deterrence remains weak. At the local level, operations

near Plaza Tol Senawang in Negeri Sembilan frequently uncover motorcycle “fancy” plates, underscoring the importance of focusing on this area (Tarmize, 2022).

Malaysian research further shows that affordability and social preferences drive non-compliance, while legibility and standardisation are critical for effective enforcement (Suleiman Lee et al., 2023). The nationwide transition toward automated enforcement systems such as ANPR-supported tolling and multi-lane free flow highlights why standardised, readable plates are vital in a modern enforcement ecosystem (Ruzman, 2025).

Non-standard registration plates are therefore a visible and growing concern in Senawang, Negeri Sembilan. Local practices include improper sizing, non-standard fonts, decorative lettering, and repositioning that reduces legibility. These choices are driven by lifestyle preferences, peer influence, and limited awareness of legal requirements. They increase safety risks while complicating enforcement by JPJ and the Royal Malaysia Police (PDRM). This study focuses on Taman Pinggiran Senawang and employs field surveys with motorcycle owners and direct observation of plates to evaluate compliance, explore reasons for non-compliance, and consider implications for enforcement and road safety. The study sample targets motorcycle owners aged sixteen and above.

This study aims to analyse non-compliance with motorcycle plate standards in Senawang, identify the factors behind the use of non-standard plates, and propose practical strategies to improve compliance and reduce violations in the study area. This research study is significant for policy and practice. It offers local standard evidence on how and why non-standard plates persist, clarifies the implications for enforcement by JPJ and PDRM, and points to targeted interventions such as sustained awareness efforts, consistent roadside checks, and engagement with riders and plate vendors. By linking observed practices to their likely causes, the findings can help authorities design more effective strategies that strengthen compliance, improve legibility and identification, and finally enhance road safety in Senawang and comparable urban situations.

2. Literature review

Vehicle registration numbers are foundational to transport governance because they uniquely identify vehicles for enforcement, investigation, and safety management. In Malaysia, non-standard motorcycle plates are a visible compliance problem that authorities continue to note, and personalization trends have encouraged deviations from prescribed formats. Historically, the need for clearly legible plates is well established. Evans et al. (1973) showed that even small transcription errors in plate recording undermine traffic flow estimation, which implies that poor legibility can compromise data quality and enforcement outcomes. Policy responses are evolving, and the Ministry of Transport has announced the JPJePlate initiative to standardize new plates and curb cloning and falsification. Investigations in other jurisdictions highlight complementary risks and practices. Related work by Yermekov et al. (2018) argued that weak inspection at registration enables falsified identifiers and recommended reintroducing verification procedures at the point of registration.

In Malaysia, state-based prefixes and codes can confuse witnesses, which reduces investigative accuracy. As noted by Lee et al. (2018), the use of alphabetic state codes can produce uncertainty when a witness recalls a plate during an investigation. Statutory size, design, and placement requirements exist under the Road Transport Act and related JPJ rules, covering minimum character height and width, plate dimensions, color, and font characteristics. Yet field observations still document illegal fonts, incorrect sizes, improper backgrounds, and hidden or missing plates on the front or rear of motorcycles, all of which constitute offenses.

Across countries, many authorities prescribe strict standards for font, size, color, spacing, and number of lines, and they report higher compliance where enforcement and public education are strong. Studies by Shah et al. (2018) and Bhargav and Deshpande (2019) describe both the benefits of strict standardization and the challenge of variation within and across countries that complicates universal rules. In Malaysia, allowance for multiple font styles has produced marked variability that recognition systems struggle to handle. Malaysian studies by Azhar et al. (2024) and Setumin et al. (2010) reports that flexible font use makes it difficult for international plate recognition models to detect Malaysian plates reliably. In line with those technical concerns, Li and Zhang (2020), Nizzad et al. (2021), and Sowmyayani et al. (2024) emphasize that standardized high-contrast formats support accurate and rapid identification that underpins enforcement after speeding or wrong way incidents.

Policy and behavioural research highlight the roles of incentives and institutional capacity. Evidence from Liu et al. (2020) shows that holding a nonlocal license plate, traveling longer daily distances, and starting trips far from the city center predict higher violation rates under one day per week and odd even restrictions in Langfang. A broader synthesis by Guerra et al. (2022) reviewed license plate-based driving restrictions, while Ramos et al. (2017) described the limits of *pico y placa* and the case for congestion pricing, and Liu et al. (2024) showed that changing plate allocation policies can shift purchasing toward newer cleaner vehicles for some drivers while others keep older more polluting cars. Work on owner experience and compliance identified both gaps and opportunities. Schoech et al. (2014) combined imaging and database matching and then surveyed owners, reporting non-compliance and process pain points that suggest a role for streamlined procedures. Fedeli (2023) documented how weak coordination among authorities can enable tax related non-compliance in the vehicle market, which underscores the importance of coherent enforcement systems.

Technology oriented studies propose automated detection pipelines and real-time enforcement support. Recent work by Shetty et al. (2024) and Shafi et al. (2022) described real-time detectors for non-compliant plates, and Nayan et al. (2024) linked non-compliance to hindered enforcement and safety risks. This body of evidence implies that better plate readability can improve violation capture and incident response. Complementing enforcement, policy instruments can change fleet composition and travel behaviour. Chi et al. (2021) found that license plate quota policies can promote new energy vehicle adoption in settings with strong transit and charging infrastructure, though they may have short-term industry trade-offs.

Malaysian behavioural evidence points to awareness and culture as proximate drivers of non-compliance. Zulkeflee et al. (2023) mentioned that ignorance, negligence, and over confidence influence plate choices, and Ngadiman et al. (2015) reported moderate awareness of maintenance and compliance with gaps in knowledge about specific registration standards. Consistent with the idea that knowledge gaps impede compliance, Harms et al. (2020) found that many business drivers could not accurately report advanced driver assistance features installed in their own cars, which points to a general need for clearer information at the user level. Digital remedies have been suggested. Sharma et al. (2019) proposed a smart RC card linked to user phones to automate reminders and penalties, which could raise document compliance.

Inconsistent plates create operational consequences for data and technology in transport systems. Evidence from Xing et al. (2016) and Abosreea et al. (2023) shows that non-standard identifiers degrade the integrity of traffic data used in intelligent transportation systems. Gaur et al. (2024) discussed the adaptation costs when computer vision pipelines must handle non-standard inputs and the need for stronger models, and Nizzad et al. (2021) recommended approaches that reduce manual verification by improving robustness. A practical synthesis

points to two complementary tracks. First, enforce standardization to reduce variation and simplify enforcement, which aligns with recommendations from Li et al. (2020) and Sowmyayani et al. (2024). Second, harden recognition models to tolerate residual variability, as proposed by Nizzad et al. (2021) and related work, while deploying analytics that support field operations.

Despite extensive prior work, several gaps remain that motivate the present study. First, empirical estimates of motorcycle specific plate size noncompliance at fine spatial scales in Malaysia are scarce, and links to enforcement and safety proxies are underreported. Prior research repeatedly shows that standardized formats support accurate identification and timely processing, which implies measurable enforcement effects when formats are not met, as shown by Li and Zhang (2020) and by Nizzad et al. (2021) together with Sowmyayani et al. (2024). Second, while behavior, awareness, and enforcement have been discussed, few studies integrate a local audit of plate measurements with a community awareness assessment and retailer practices, even though collaboration with number plate accessory shops is necessary in this context. Third, technology-oriented papers propose detectors for non-compliant plates, yet there is little evaluation of performance on Malaysian motorcycles with the exact typography, placement, and damage patterns observed in neighbourhoods such as Taman Pinggiran Senawang. Fourth, although JPJePlate points toward standardization for new registrations, the legacy fleet and the motorcycle segment have not been comprehensively profiled to prioritize enforcement and education. Addressing these gaps, this study provides localized measurements of non-standard motorcycle plate characteristics against legally prescribed dimensions, synthesizes user awareness and attitudes, and discusses policy and technological levers suitable for staged implementation in Malaysia's ongoing move toward standardized and enforceable plates.

3. Research method

This research investigates the issue of non-standard motorcycle registration numbers in Senawang, Negeri Sembilan. The methodology is designed to assess patterns of non-compliance, identify root causes, and propose practical strategies for improvement. The framework is structured into three phases: data collection, data analysis, and strategy development. Figure 1 shows the research flow illustrating the three main phases of the study. The process begins with data collection from the Road Transport Department, proceeds to statistical and root cause analysis, and ends with strategy development involving stakeholder consultation.

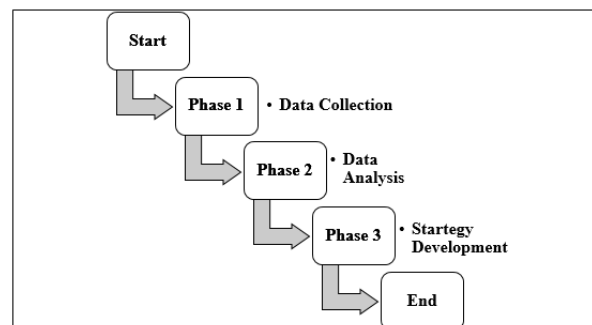


Fig. 1. Research flow

3.1 Data collection

Secondary data were obtained from the Road Transport Department for the period 2020–2024. Records of registration plate violations were categorized by month and type of offense, which included incorrect plate size, decorative plates, absence of plates, and other irregularities. Descriptive statistics were used to summarize the data in terms of frequency and percentage. These summaries highlighted visible trends and formed the basis for deeper analysis.

3.2 Data analysis

The second phase applied root cause analysis (RCA) to explore systemic drivers of non-compliance. The process involved four steps as shown in Figure 2. First, the problem was defined using descriptive data. Second, brainstorming generated potential causes across enforcement, awareness, behavioural, retail, and legislative categories. Third, cause and effect relationships were mapped to highlight how these factors interacted. Finally, solutions were prioritized based on the most influential causes. The RCA was conducted collaboratively with enforcement officers, experts, and community stakeholders. Weekly sessions provided opportunities to refine cause–effect links and validate findings against actual practices. This participatory approach ensured the results reflected both quantitative evidence and practical field knowledge.

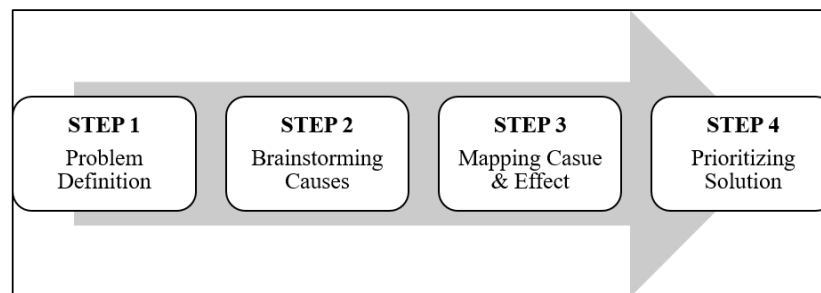


Fig. 2. Root cause analysis process

3.3 Strategy development

The final phase translated analytical results into targeted strategies. Stakeholder consultations were carried out with motorcycle owners, plate accessory retailers, and enforcement officers. These sessions provided practical insights into existing challenges and shaped feasible interventions. Recommendations include public awareness campaigns, stronger enforcement practices, and potential legislative adjustments. The aim is to improve compliance, enhance road safety, and reduce repeat violations.

This methodology integrates statistical evaluation, root cause analysis, and stakeholder engagement. By progressing from descriptive review to systemic analysis and strategy development, the study ensures that its findings are both evidence-based and practical for implementation.

4. Results and discussion

This The findings provide understandings into the scale and persistence of non-compliance with motorcycle registration plate regulations in Senawang, Negeri Sembilan. The analysis highlights yearly and monthly trends, violation categories, and structural factors identified through root cause analysis. These results are then discussed in the context of earlier research to validate the outcomes and emphasize broader significance.

4.1 Temporal patterns of non-compliance

Between 2020 and 2024, summons cases increased from 1,350 to 1,878 as shown in figure 3. This upward trend indicates that non-standard plates are a growing concern. Peaks occurred during festive seasons, such as Chinese New Year, Hari Raya, Merdeka Eve, and the Year End period. These spikes were strongly linked to hometown exodus travel and intensified enforcement campaigns. The seasonal patterns suggest that enforcement operates reactively and that violations recur in cycles driven by cultural practices and traffic demand.

4.2 Violation types

Analysis of 2024 data shows that more than 71 percent of cases involved plates not according to size, making it the most common violation. Decorative or fancy plates contributed about 21 percent and were more common at the start of the year, coinciding with festive preparations. Not showing plates accounted for about 6 percent, while other violations, including tampered or fake plates, represented just over 1 percent and were detected mostly during large-scale operations. Figure 4 shows the breakdown of summons cases by type in 2024.

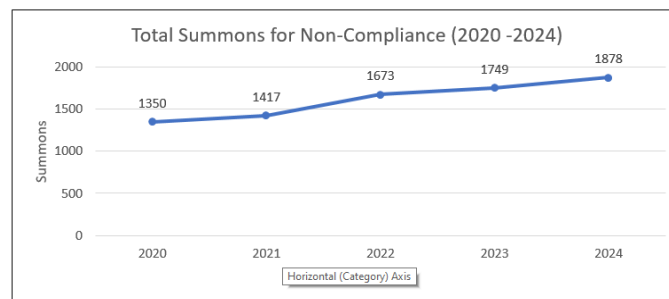


Fig. 3. Total summons for non-compliance (2020–2024)

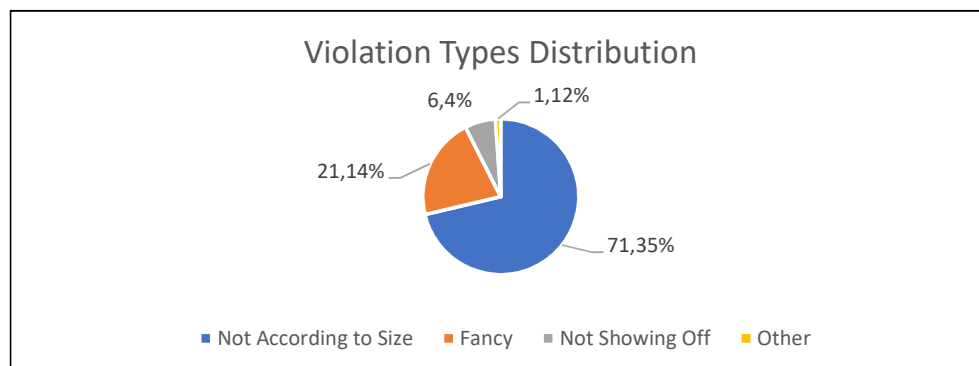


Fig. 4. Violation types distribution (2024)

4.3 Root cause analysis

The analysis shows that non-standard registration plates persist due to a combination of structural and behavioural factors. Weak and inconsistent enforcement reduces deterrence, while the absence of sustained awareness campaigns leaves many riders uninformed about standards and risks. Fashion trends, identity expression, and peer influence drive decorative plate use, and retail practices reinforce this by supplying non-standard plates in response to demand. At the regulatory level, outdated rules and inconsistent penalties further weaken compliance. Figure 5 presents the root cause analysis in a fishbone diagram which summarizes five main categories of contributing factors. These categories are enforcement, awareness, behaviour, retail practices, and legislation. Each category contains specific causes such as limited monitoring, lack of awareness initiatives, preference for decorative plates, unregulated suppliers, and legislative gaps.

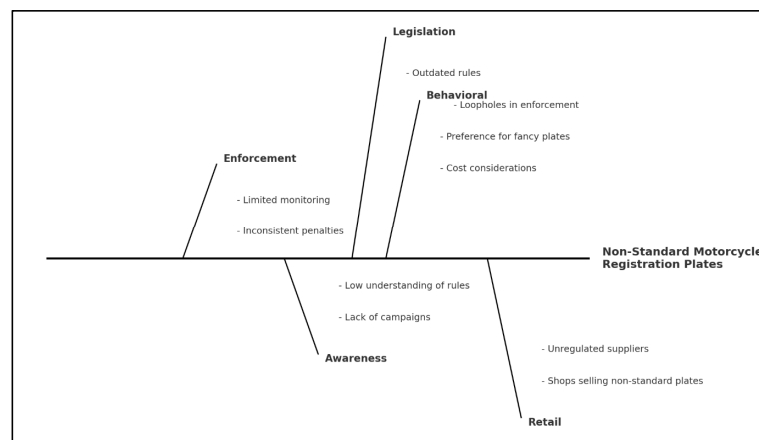


Fig. 5. Root cause analysis of non-standard registration plates

4.4 Research discussion

The findings confirm that non-compliance with motorcycle registration plates in Senawang is not random but driven by predictable cycles of rider behaviour and enforcement campaigns. High percentages of non-compliance every month, often above sixty percent and reaching more than eighty percent in some months, indicate a persistent culture of negligence. Riders continue to prioritize convenience and style over compliance, while the easy availability of non-standard plates reinforces the issue.

Stakeholder interviews further highlight that motorcyclists, retailers, and enforcement officers all recognize their role in the problem. Motorcycle owners follow trends without checking legality, retailers continue supplying non-standard plates due to strong customer demand, and enforcement officers face challenges of limited resources and inconsistent monitoring.

This finding shows that the issue is structural rather than isolated. It is supported by Arshid et al. (2019) who found that non-standard license plates in Pakistan hinder enforcement and accident investigations. Similarly, Ng et al. (2015) reported that irregular plate designs reduce the effectiveness of recognition systems in Malaysia, which aligns with this study observation that improper sizing and decorative modifications dominate violations. Improper sizing emerged as the leading cause of violations also reflects observations in earlier studies by Lee et al. (2023), which showed that non-standard plate sizing is widespread due to low awareness and affordability factors.

Overall, the study shows that non-standard registration plates are a widespread problem requiring comprehensive solutions. Raising awareness, tightening enforcement, and regulating supply are essential steps to reduce violations and improve road safety in Senawang. The findings show that non-standard registration plates are increasing over time, with sizing violations as the dominant type. The issue is intensified by predictable seasonal surges and supported by behavioural, market, and enforcement-related factors. By aligning with previous studies, this research confirms that tackling the problem requires a mix of continuous public awareness, supply chain regulation, and stronger enforcement strategies.

5. Conclusion

This study observed the issue of non-standard motorcycle registration plates in Senawang, Negeri Sembilan. The findings show that non-compliance is a persistent and structural problem, with improper sizing as the most frequent violation, followed by decorative modifications and plate absence. Such practices reduce plate legibility, impede law enforcement, and heighten road safety risks. The analysis revealed that these violations are driven by behavioural and cultural factors such as peer influence and lifestyle preferences, as well as by weak regulatory enforcement, limited public awareness, and the ongoing availability of non-standard plates through retailers.

This problem can be mitigated through several recommended measures. Public awareness initiatives should be prioritized to educate riders about the importance of plate standardization and its role in enforcement and accident prevention. Enforcement activities must be consistent and intensified during festive periods, when violations typically surge. Regulation of plate retailers is equally important, as curbing the supply of non-standard plates can reduce their prevalence. Legislative updates are needed to close regulatory gaps, while technological tools such as automated plate recognition systems adapted to Malaysian conditions can provide long-term enforcement support. By integrating awareness, enforcement, regulation, and technology, authorities can develop a more effective strategy to enhance compliance and road safety in Senawang and similar urban contexts.

6. Implications

The results of this research have important practical and theoretical implications. On the operational side, they provide actionable guidance for enforcement agencies and policymakers, highlighting the need for targeted interventions, vendor regulation, and enforcement strategies that take seasonal patterns into account. On a theoretical side, the study contributes to the literature on transport governance and compliance by providing localized evidence from Senawang, where such work has been limited. The integration of statistical violation data with stakeholder perspectives strengthens understanding of how behavioral drivers, retail practices, and institutional gaps interact to sustain non-compliance. This dual contribution enriches the discourse on road safety and offers understandings that may be relevant beyond the Malaysian context.

7. Research limitations

This study provides important contributions, but several limitations should be considered. The research was geographically confined to Senawang, which may limit the generalizability of the findings to other regions with different socio-economic or enforcement conditions. The reliance on secondary data and stakeholder accounts also means that unrecorded or underreported violations may not have been fully captured. Methodologically, the use of descriptive and root cause analysis provided important findings but did not allow for causal

relationships to be established. In addition, the focus on motorcycles means the results may not reflect compliance behaviours among other vehicle types such as cars or commercial vehicles. These limitations highlight the need for further research that incorporates broader geographic coverage, more diverse datasets, and experimental or longitudinal methods to evaluate the impact of targeted interventions on compliance.

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