
DESIGNING ENFORCEMENT FOR SAFETY, NOT HAZARD: EVIDENCE FROM A TRAFFIC MANAGEMENT SYSTEM FAILURE IN KANO METROPOLIS

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ABSTRACT

Traffic enforcement is a core component of urban traffic management systems, yet its design is rarely subjected to the same safety-engineering scrutiny applied to road geometry, signal timing, or vehicle standards. This paper argues that it should be. Drawing on evidence from Kano metropolis, Nigeria, where traffic management relies heavily on contact-based enforcement by the Kano Road Traffic Authority (KAROTA), the study examines how an enforcement subsystem oriented toward revenue generation rather than safety outcomes may itself become a source of crash risk. A cross-sectional survey of 331 urban drivers found that higher self-reported compliance with traffic regulations was independently associated with greater, not lower, self-reported crash involvement ($OR = 1.72, p = .007$), while perceived importance of regulation was independently protective ($OR = 0.48, p < .001$); the two were statistically unrelated. A descriptive attitude–behaviour typology showed that drivers reporting consistent compliance without valuing the rules recorded the highest crash rate (83%), while those who valued regulation but complied flexibly were safest (42%). Documented cases of enforcement-related harm, and institutional evidence on KAROTA's revenue mandate and personnel profile, are consistent with an enforcement-as-hazard mechanism, though they cannot establish its incidence. The paper argues, interpretively rather than as a tested claim, that safe traffic management system design should treat enforcement legitimacy as a design parameter, and that substituting automated, infrastructure-based compliance mechanisms for discretionary contact-based enforcement offers a plausible safety improvement. Implications for the transition to technology-enabled enforcement in Nigerian cities are discussed.

Keywords: Traffic Management System Design; Enforcement Safety; Attitude–Behaviour Congruence; Safe System Approach; Nigeria

1. INTRODUCTION

The Safe Systems approach to road safety treats the road transport environment as an engineered system whose components — road geometry, vehicle design, speed management, and user behaviour — interact to produce or prevent harm (Khan and Das, 2024; OECD/ITF, 2021). A core principle is that no single component failure should result in death or serious injury; the system should be designed so that errors are anticipated, accommodated, and their consequences minimised. This principle has driven decades of progress in infrastructure engineering, vehicle crashworthiness, and signal design.

One component of the traffic management system, however, has largely escaped safe-systems scrutiny: the enforcement subsystem. Traffic enforcement — the institutional apparatus of officers, checkpoints, patrols, and sanctions — is conventionally evaluated by asking whether it is sufficiently consistent, visible, and well-resourced, and the standard recommendation is to intensify it (Elvik et al., 2009; Uhunwagho et al., 2025). This evaluative frame implicitly treats enforcement as an unambiguous safety input rather than as a designed subsystem that can itself generate hazard if poorly engineered.

This paper examines that assumption using evidence from Kano metropolis, Nigeria, where traffic management depends heavily on contact-based street enforcement by the Kano Road Traffic Authority (KAROTA). It argues that an enforcement subsystem designed around revenue extraction, staffed without adequate training, and operating without procedural safeguards may produce

compliance that is not reliably protective, and enforcement encounters that are themselves hazardous. Two points about the paper's scope should be stated at the outset. First, the study did not administer validated measures of compliance motivation, procedural justice, or enforcement legitimacy; the theoretical frameworks below are therefore applied interpretively, to organise and explain the observed associations, rather than tested directly. Second, the documented cases used later are illustrative of a mechanism and cannot establish its incidence or representativeness. Within these bounds, the paper proposes that enforcement legitimacy be treated as a design parameter in traffic management systems, and that the transition from discretionary, contact-based enforcement to automated, infrastructure-based compliance mechanisms is a safety-engineering question deserving direct study.

2. ENFORCEMENT AS A DESIGNED SUBSYSTEM

2.1 The conventional evaluative frame and its limitation

The dominant Nigerian road safety literature evaluates enforcement agencies — the Federal Road Safety Corps (FRSC) and state traffic authorities — by measuring activity volume: patrol frequency, checkpoint density, fine revenue, and public-awareness campaign reach. A recent representative study of the FRSC Minna Sector Command concludes that road safety would improve with greater consistency and visibility of enforcement and with more funding and personnel (Uhunwagho et al., 2025). This framing rests on a simple deterrence model in which more enforcement yields more compliance, which in turn yields fewer crashes.

The limitation is that deterrence models assume the enforcement agent is legitimate — trusted, competent, and procedurally fair — and that the compliance produced is normatively accepted rather than merely coerced (Tyler, 2006). Where this assumption fails, the model's predictions may reverse, and more enforcement may produce more coerced, evasive, and hazardous behaviour rather than more safety. This is a system-design question rather than a purely behavioural one. The institutional parameters of the enforcement subsystem — its funding model, recruitment standards, accountability mechanisms, and mode of operation — shape whether it functions as a safety mechanism or as a hazard source.

2.2 Contact-based versus infrastructure-based enforcement

A useful distinction for safe-system design is between contact-based enforcement, in which officers physically stop, confront, and sanction drivers in real time, and infrastructure-based enforcement, in which detection is automated through cameras, sensors, and signal systems, with sanctions processed remotely. Contact-based enforcement introduces a direct, in-traffic interaction between an officer and a driver. That interaction can itself generate hazard — through sudden braking, evasion manoeuvres, or physical altercation — particularly where the enforcement is perceived as illegitimate or extractive. Infrastructure-based enforcement removes the hazardous encounter, decouples detection from personal discretion, and can operate continuously rather than selectively. The transition from contact-based to infrastructure-based enforcement is therefore a safety-engineering decision with plausible implications for crash risk, yet it is rarely framed as such in the Nigerian context, where discussion remains centred on enforcement quantity rather than enforcement mode and design.

3. THEORETICAL BASIS

Two complementary frameworks are used interpretively in this paper to link enforcement system design to safety outcomes through compliance motivation. Neither construct was measured directly in the survey; the frameworks are applied to organise and explain the observed associations, and the absence of direct measurement is a limitation noted here and revisited in Section 7.

Self-determination theory (Deci and Ryan, 1985, 2000) distinguishes autonomous motivation, in which behaviour is aligned with personal values and tends to be stable and generalised, from controlled motivation, in which behaviour is driven by external pressure and tends to be narrow and situation-dependent. Applied to traffic, it suggests that the same observable compliance may be protective or hazardous depending on its motivational source. Enforcement system design plausibly influences which type predominates: a legitimate, procedurally fair system supports internalisation,

whereas an extractive system may produce controlled, surveillance-dependent compliance that lapses or becomes evasive when the officer appears.

Procedural-justice and legitimacy theory (Sunshine and Tyler, 2003; Tyler, 2006) specifies the institutional conditions that build or erode legitimacy: consistency, transparency, respectful treatment, and the absence of corruption. An enforcement subsystem designed around revenue targets, staffed at the lowest educational grades, and operating without oversight creates conditions that theory would expect to erode legitimacy and, through the motivational pathway above, to favour controlled over internalised compliance. The combined framework yields the paper's central proposition, offered as an interpretive hypothesis: an enforcement subsystem functions as a safety mechanism when it is designed to produce legitimate, internalised compliance, and risks becoming a hazard source when it is not.

4. THE KANO CASE: EVIDENCE OF A SYSTEM DESIGN FAILURE

4.1 Institutional design parameters

KAROTA was established in 2012 by the Kano State Government with a dual mandate of traffic management and revenue generation, with a reported monthly revenue target of approximately ₦100 million (Zakimayu et al., 2023). More than 95% of its approximately 1,600 agents were recruited at the lowest educational grades, and the agency's own administrators have acknowledged that agents enforce fewer than five of the 90-plus codified traffic offences (Zakimayu et al., 2023). The metropolis, with a population exceeding four million, is served by fewer than 100 operational traffic signals. This combination — a revenue-incentivised workforce, minimal training, and scarce automated infrastructure — represents an enforcement subsystem oriented, whether by intent or not, toward contact-based operation rather than safety outcomes.

4.2 Survey methodology

A cross-sectional survey was conducted across five local government areas of Kano metropolis. Adult drivers were recruited using purposive sampling at high-traffic locations, including fuel stations, motor parks, and checkpoints; the sampling frame limitations this entails are addressed in Section 7. An a priori power analysis for logistic regression ($\alpha = .05$, power = .80, anticipated $R^2 = .10$) indicated a minimum of 271 cases, and the achieved sample of 331 exceeded this threshold. Participation was voluntary and anonymous, and informed consent was obtained.

A structured questionnaire captured demographics, driving profile, perceived importance of traffic regulation, self-reported compliance, and crash involvement. Perceived importance was measured on a four-point item (from 'not at all important' to 'very important'); self-reported compliance was measured on a three-point frequency item ('sometimes', 'most of the time', 'always'); and the outcome was self-reported involvement in any road crash or collision in the preceding six months. The crash item did not specify a severity threshold and is therefore interpreted throughout as self-reported crash or collision involvement of any severity, not as verified or injury crashes. The instrument was piloted with 20 drivers excluded from the final sample; because the key measures are single items rather than multi-item scales, no internal-consistency statistics are reported, and this measurement constraint is noted as a limitation. Analyses were conducted in Python 3.11 (scipy, statsmodels, scikit-learn).

4.3 Survey findings

Bivariate associations were assessed using chi-square tests and Spearman correlations. A binary logistic regression predicting crash involvement was reduced by backward elimination on the Akaike information criterion to a parsimonious specification containing five predictors: compliance, perceived importance, driving frequency, awareness frequency, and gender. This model was re-estimated using Firth's penalised maximum likelihood to address small-sample bias arising from the small female subsample ($n = 18$); all variance inflation factors were below 1.2. In the penalised model, higher compliance was independently associated with greater crash risk (OR = 1.72, 95% CI [1.16, 2.56], $p = .007$), while perceived importance was independently protective (OR = 0.48, 95% CI [0.32, 0.72], $p < .001$). The two were statistically unrelated ($\rho = -.00$, $p = .994$), and a causal mediation analysis with bootstrapped confidence intervals indicated that compliance did not transmit the protective effect of perceived importance.

Cross-classifying drivers on dichotomised perceived importance and compliance produced four descriptive response profiles with significantly different crash rates ($\chi^2(3) = 29.1$, $p < .001$): high importance with inconsistent compliance, safest at 42%; high importance with consistent compliance, 67%; low importance with inconsistent compliance, 70%; and low importance with consistent compliance, highest at 83%, with adjusted odds 2.67 times the high-importance/consistent reference (95% CI [1.18, 6.03], $p = .018$) after adjustment for driving frequency and gender. These are descriptive classifications of survey responses, not measured motivational types; the labels used in earlier work carried motivational connotations and are avoided here. One feature is notable: the high-importance/consistent profile recorded a higher crash rate (67%) than the high-importance/inconsistent profile (42%), which is difficult to reconcile with a clean partition of behavioural types and reinforces the descriptive status of the classification.

4.4 Documentary evidence: enforcement encounters as hazard events

The survey associations are consistent with, though they do not by themselves establish, a mechanism in which the enforcement encounter itself can produce harm. Respondents' open-text comments referred to accidents attributed to 'the fear of KAROTA officials', to officers who 'follow the driver' who fails to stop, and to enforcement that they associated with aggressive driving. These are perceptions, not incident records.

Independently, press and field records document individual incidents in which enforcement contact preceded injury or death: traffic officials physically intervening in moving vehicles ('steering-dragging') with fatal results, reported in Kano and, in a structurally similar case, in Lagos involving the Lagos State Traffic Management Authority (LASTMA); fatal pursuits of drivers evading enforcement; officers struck and killed while attempting to stop vehicles, including a case in which a driver was sentenced to 15 years for killing a Kano traffic officer (Punch, 2024); and clashes between enforcement agents and road users (Gazette, 2023). A feature of this record worth noting analytically is that the harm is bidirectional — both drivers and officers are killed — which is more consistent with a hazardous interaction dynamic than with misconduct by either party alone. These cases are illustrative and are drawn from journalism; they document that such events occur, not how frequently, and no inference about incidence or representativeness is drawn from them.

Institutional documentation further indicates that extraction-oriented conduct is present within Nigerian traffic enforcement more broadly, including anti-corruption operations concerning FRSC officials (ICPC, 2021), reporting on the taxation of tricycle operators in Kano (ICIR, 2024), and reporting on highway extortion (Premium Times, 2025). These sources describe the institutional environment in which the Kano subsystem operates; they are contextual rather than causal evidence.

5. DISCUSSION: ENFORCEMENT LEGITIMACY AS AN ENGINEERING PARAMETER

The survey, documentary, and institutional strands are mutually consistent and, taken together, are suggestive of an enforcement subsystem that is not functioning purely as a safety mechanism. They fall short, individually and jointly, of establishing that contact-based enforcement causes crashes: the survey is cross-sectional and self-reported, and the documented cases are illustrative. What the strands support is a coherent, testable hypothesis rather than a demonstrated causal claim — namely, that a contact-based, revenue-oriented, low-legitimacy enforcement configuration may favour coerced rather than internalised compliance and may generate hazardous enforcement encounters.

From a safe-systems engineering perspective, the value of this framing is that it locates a potential safety problem in design parameters that are within an agency's control — funding model, recruitment and training standards, accountability mechanisms, and mode of operation — rather than in the conduct of individual officers. Treating enforcement legitimacy as a design parameter means subjecting these choices to the same evidence-based scrutiny applied to road cross-sections, signal phasing, or crashworthiness standards.

The Kano and Lagos 'steering-drag' cases, occurring in different cities and involving different agencies, are suggestive that the hazard may not be specific to a single agency but may instead be associated with the contact-based enforcement configuration itself. This remains a hypothesis: two documented cases cannot establish that the pattern is general, and a systematic compilation of

enforcement-related crash events across multiple Nigerian cities would be required to test it. The claim is therefore offered as a direction for investigation, not as an established generalisation.

6. TOWARD SAFER ENFORCEMENT SYSTEM DESIGN

Four design principles follow from the analysis, offered as engineering directions for traffic management systems in Nigerian cities. Because they follow from the institutional and documentary evidence and from safe-system principles, rather than from the survey associations alone, they do not depend on resolving the causal questions above.

First, decouple enforcement from revenue generation. A revenue mandate creates an incentive structure that rewards extraction over safety and is corrosive of the legitimacy on which internalised compliance depends. Enforcement funded from general appropriation, rather than from what it collects, better aligns the agent's incentive with safety outcomes.

Second, shift the balance from contact-based toward infrastructure-based enforcement. Automated systems — speed and red-light cameras, and automatic number-plate recognition — decouple detection from personal discretion, remove the hazardous in-traffic encounter, operate continuously, and generate an auditable, corruption-resistant record.

Third, invest in the enabling infrastructure. Automated enforcement depends on functional signals, signage, and markings. Fewer than 100 operational signals for a metropolis of over four million forces reliance on contact-based enforcement by default; signal and signage provision is therefore both a traffic-flow measure and a precondition for shifting enforcement mode.

Fourth, professionalise personnel for the contact-based functions that remain necessary, such as crash response and impaired-driving detection. Recruitment, training, and evaluation should emphasise procedural fairness and safety outcomes rather than revenue collected, with training in de-escalation and in the hazards of in-traffic physical intervention.

7. LIMITATIONS AND FUTURE WORK

The study has several limitations that bound its conclusions. The design is cross-sectional and relies on self-report, so no causal ordering can be established; in particular, post-crash behavioural adaptation, in which involvement in a crash leads a driver to report stricter subsequent compliance, is a plausible alternative explanation for the positive compliance–crash association that the data cannot exclude. The crash outcome is broad and severity-unrestricted, with a six-month recall window and no validation against police or hospital records, and the reported rate should not be compared with injury-crash statistics. The key measures of perceived importance and compliance are single items rather than validated multi-item scales. The theoretical constructs of central interest — compliance motivation, procedural justice, and enforcement legitimacy — were not measured directly; the frameworks are applied interpretively, and the response-profile typology is descriptive rather than a validated motivational classification.

The sample is predominantly male (approximately 95%) and was recruited purposively without a sampling frame. These features limit the generalisability of all findings, and of the typology in particular: the profiles describe response patterns within this specific, non-representative sample, and their crash rates should not be read as population estimates or extended to women drivers, who are severely under-represented. The documentary cases are illustrative and journalistic, and the institutional analysis relies on secondary sources. Collectively, these constraints mean the paper advances an evidence-consistent, testable hypothesis rather than a confirmed causal claim.

Future work should pursue three priorities. First, a comparative study of cities relying predominantly on contact-based versus infrastructure-based enforcement, measuring both compliance quality and crash outcomes, would test the central design proposition directly. Second, primary studies should administer validated procedural-justice and self-determination measures, alongside a severity-anchored or record-linked crash outcome and a proper exposure measure, ideally in a longitudinal design capable of separating post-crash adaptation from prospective risk. Third, a systematic compilation of enforcement-related crash events across multiple Nigerian cities would test whether the enforcement-as-hazard pattern generalises beyond the illustrative cases presented here.

8. CONCLUSION

Traffic enforcement is a subsystem of the traffic management system, and like any subsystem it can be designed for safety or, inadvertently, for hazard. In Kano, the enforcement subsystem's institutional parameters — a revenue mandate, minimally trained contact-based agents, and scarce automated infrastructure — characterise a configuration that this study's converging but limited evidence suggests may generate coerced, evasive compliance and dangerous enforcement encounters. The evidence supports this as a hypothesis to be tested, not as an established finding.

The corrective this points toward is not more enforcement but better-designed enforcement: revenue-decoupled, progressively automated, supported by functional infrastructure, and, where human contact remains necessary, staffed by trained and accountable personnel. Framed this way, enforcement legitimacy is not a matter external to engineering; it is a design parameter that plausibly shapes whether the enforcement subsystem contributes to, or detracts from, the safety of the traffic management system as a whole — a proposition this paper commends to direct empirical test.

REFERENCES

- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-Determination in Human Behavior*. Plenum Press. <https://doi.org/10.1007/978-1-4899-2271-7>
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01
- Elvik, R., Høye, A., Vaa, T., & Sørensen, M. (2009). *The Handbook of Road Safety Measures* (2nd ed.). Emerald. <https://doi.org/10.1108/9781848552517>
- Gazette. (2023). Scores injured as traffic agency officials, tricycle riders clash in Kano. *Peoples Gazette Nigeria*. <https://gazettengr.com/scores-injured-as-traffic-agency-officials-tricycle-riders-clash-in-kano/>
- ICIR. (2024). Forgery, illegal taxes, extortion, corruption: Realities of taxing Keke riders in Kano (Part 2). The International Centre for Investigative Reporting. <https://www.icirnigeria.org/forgery-illegal-taxes-extortion-corruption-realities-of-taxing-keke-riders-in-kano-2/>
- ICPC. (2021). Operation Tranquility: Uprooting corrupt FRSC officials from Nigerian highways. Independent Corrupt Practices and Other Related Offences Commission. <https://icpc.gov.ng/operation-tranquility-uprooting-corrupt-frsc-officials-from-nigerian-highways/>
- Khan, M. N., & Das, S. (2024). Advancing traffic safety through the safe system approach: A systematic review. *Accident Analysis & Prevention*, 199, 107518. <https://doi.org/10.1016/j.aap.2024.107518>
- Mooren, L., & Shuey, R. (2024). Systems thinking in road safety management. *Journal of Road Safety*, 35(2), 63–73. <https://doi.org/10.33492/JRS-D-24-2-2109985>
- OECD/ITF. (2021). *The Safe System Approach in Action*. International Transport Forum. <https://www.itf-oecd.org/sites/default/files/docs/safe-system-in-action.pdf>
- Premium Times. (2025). Unending toll: How highway extortion fuels soaring food prices in Nigeria. <https://www.premiumtimesng.com/news/headlines/826938-unending-toll-how-highway-extortion-fuels-soaring-food-prices-in-nigeria.html>
- Punch. (2024). Driver jailed 15 years for killing Kano traffic officer. <https://punchng.com/driver-jailed-15-years-for-killing-kano-traffic-officer/>
- Sunshine, J., & Tyler, T. R. (2003). The role of procedural justice and legitimacy in shaping public support for policing. *Law & Society Review*, 37(3), 513–547. <https://doi.org/10.1111/1540-5893.3703002>
- Tyler, T. R. (2006). *Why People Obey the Law*. Princeton University Press. <https://doi.org/10.2307/j.ctv1j66769>

- Uhunwagho, C., Aidelokhai, D. I., Nmadu, T., Musa, U., & Abu, I. (2025). Assessing the impact of activities of the Federal Road Safety Corps in alleviating automobile accidents in Minna, Niger State. *Kashere Journal of Politics and International Relations*, 3(1), 219–231.
- Zakimayu, T., Abdussalam, B., & Abedo, U. (2023). Revamping the roles of non-state policing actors: An appraisal of KAROTA in Kano metropolis. *Nigerian Journal of Peace, Development & Humanitarian Affairs*, 3, 29–44.