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# An Analysis of Trends and Contributing Factors to Road Crashes in Zamboanga City: Basis for Road Safety Policy

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Keywords:

*Governance, Community-Based Risk Reduction, Road Safety, Road Crashes, Policy Framework, Traffic Enforcement, Infrastructure Deficiencies, Behavioral Factors, Zamboanga City, Sustainable Development Goals*

A B S T R A C T

*Road crashes are a global concern, resulting in over 1.2 million deaths annually and 50 million injuries (WHO, 2009). In Zamboanga City, crashes from 2018 to 2022 show significant behavioral, infrastructural, and environmental challenges. While overall incidents declined from 2,252 in 2018 to 838 in 2022 due to stricter regulations and reduced vehicular mobility during the COVID-19 pandemic, crashes remain frequent during peak hours and in high-risk zones like Veterans Avenue and the Maria Clara Lobregat National Highway. Young male drivers aged 18–25 were disproportionately involved, with over-speeding, distracted driving, and driving under the influence identified as primary causes. Infrastructure deficiencies, including poorly maintained roads, faded markings, and inadequate lighting, and environmental factors like heavy rainfall, exacerbate these risks. Enforcement gaps, such as insufficient use of speed cameras and breathalyzers, further hinder compliance. This study proposes a Road Safety Response Framework with five components: enhanced traffic enforcement through modern tools and stricter penalties; infrastructure improvements, including better lighting and pedestrian-friendly features; targeted public awareness campaigns; technology-driven solutions like AI-powered analytics; and multi-sector collaboration involving government, NGOs, and private organizations. This evidence-based framework aims to mitigate risks and improve road safety outcomes. Aligned with the United Nations Sustainable Development Goals (SDGs), particularly Goals 3 and 11, this study provides actionable strategies for policymakers and urban planners to reduce crashes and foster safer transportation systems. By addressing behavioral, infrastructural, and systemic factors, this research offers a model for sustainable urban road safety governance in Zamboanga City and similar contexts.*

## 1 INTRODUCTION

### a Background of the Study

Road crashes are significant global public health and safety issues, resulting in substantial losses of life and severe injuries each year. According to the World Health Organization (WHO), road crashes constitute approximately 1.2 million lives annually, with up to 50 million more people suffering nonfatal injuries (WHO, 2009). These road crashes encompass various types of incidents, including collisions between vehicles, single-vehicle crashes, and pedestrian accidents. In the Philippines, road crashes are a particularly pressing concern, with increasing fatalities and injuries reported yearly. In 2014 alone, the Philippine National Police (PNP) recorded over 1,200 fatalities and more than 9,000 injuries due to road crashes, highlighting the growing threat these incidents pose to public safety (Philippine News Agency, 2015).

The term "road crashes" is increasingly preferred over "road accidents" in the literature, as it reflects the preventable nature of these incidents. Road crashes are often the result of a combination of factors such as human error, poor road conditions, vehicle defects, and environmental challenges. In global studies, road design and maintenance have been identified as critical factors contributing to the frequency and severity of road crashes. Research in Sweden, for example, has shown that a significant number of single-vehicle crashes involving pedestrians and cyclists are linked to deficiencies in road maintenance and poor infrastructure design (Amin et al., 2022). These findings indicate that road crashes are not merely random events but are often

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the result of systemic failures in road safety management.

In the context of the Philippines, particularly in Zamboanga city, localized studies on road crashes are limited. Existing research has focused primarily on identifying black spots or accident-prone areas without adequately addressing the broader trends and contributing factors of road crashes.

Given the lack of comprehensive, long-term studies on road crashes in Zamboanga city, this research aims to fill this gap by analyzing road crash data from 2018--2022. This study focuses on identifying trends in road crashes and examining the primary factors that contribute to these incidents. By doing so, this research seeks to provide valuable insights that can inform policymaking, improve road infrastructure, and ultimately reduce the frequency and severity of road crashes in Zamboanga City on the basis of the United Nation's Sustainable Development Goals (SDGs) 16.3 Strong Institutions, and 17 Partnership for the Goals.

## b Statement of the Problem

The increasing number of road crashes in Zamboanga city has become a significant public safety concern, contributing to both fatalities and serious injuries. While various factors such as human error, road infrastructure, vehicle conditions, and environmental influences have been identified globally as contributors to road crashes, there is a lack of localized research that comprehensively analyzes these factors within the specific context of Zamboanga city.

This study sought to address this gap by analyzing road crash data from 2018--2022 in Zamboanga city to determine the following:

1. What are the trends in road crashes in Zamboanga city from 2018 to 2022?
2. What are the primary factors contributing to road crashes in Zamboanga city from 2018--2022?
3. What is the appropriate road safety response framework to address road crashes in Zamboanga city?

**Objectives of the study**

This study sought to comprehensively analyze the trends and contributing factors associated with road crashes in Zamboanga city from 2018–2022. Specifically, the study is designed to achieve the following objectives:

1. To identify and analyze the trends in road crashes in Zamboanga city from 2018--2022 in terms of the following:
    - Frequency of road crashes;
    - Date and time of incidents;
    - Demographic characteristics (such as sex and age) of those involved;
    - Causes of accidents; and
    - Geographic zones where accidents occur.
2. To assess the primary factors contributing to road crashes in Zamboanga city from 2018 to 2022.
3. To develop an appropriate road safety response framework on the basis of the analysis of trends and factors, the researcher provides recommendations to mitigate future road crashes and improve road safety measures in Zamboanga city.

## c Significance of the Study

This study is crucial for addressing the growing issue of road crashes in Zamboanga city, which have resulted in significant losses of life and injuries over the past decade. By analyzing road crash trends from 2018 to 2022 and identifying the primary factors contributing to these incidents, this study provides valuable insights for policymakers, urban planners, law enforcement agencies, and other stakeholders.

In the context of public administration, this study is especially relevant, as it provides a framework for integrating road safety into urban governance and public policy. Public administrators play a critical role in ensuring that policies are not only designed effectively but also implemented and monitored over time. The study's focus on long-term trends and contributing factors will equip public administrators with the knowledge necessary to create and enforce comprehensive road safety programs, which are vital for fostering sustainable urban development. Furthermore, the findings contribute to a deeper understanding of how local governments can balance economic growth and urban expansion with the safety and well-being of citizens, which is a core concern of public administration.

## d Scope and Delimitation

This study focuses on analyzing road crashes in Zamboanga city over a five-year period from 2018--2022. The research specifically investigates trends in road crashes, including the frequency, severity, and types of incidents, as well as identifying the primary factors that contribute to these crashes. This study focuses on road crashes occurring within the boundaries of Zamboanga city.

The data for this study will be sourced from official reports and statistics provided by local authorities, including the Philippine National Police (PNP) and other relevant local agencies responsible for road safety and traffic monitoring.

## 2 REVIEW OF THE RELATED LITERATURE

### a Literature Review

**Global Road Crash Trends**

Studies indicate that certain demographic characteristics, particularly young male drivers, are more prone to road crashes globally. The WHO (2018) reported that men, particularly those aged between 15 and 29, are at a greater risk of being involved in road traffic crashes. Elvik and Bjørnskau (2019) reported similar trends in Norway, where males were disproportionately represented in road crash statistics, particularly among those engaging in risky driving behaviors.

**National and Local Trends in the Philippines**

In the Philippines, road crashes have emerged as a significant public health and safety issue, reflecting both global patterns and the unique challenges faced by developing countries. Over the past decade, the number of road traffic fatalities has steadily increased. According to data from the Philippine Statistics Authority (PSA), the number of deaths due to road crashes increased by 39% between 2011 and 2021, increasing from 7,938 fatalities in 2011 to 11,096 in 2021 (Adel et al., 2023).

***Zamboanga City's Experience: A Localized Perspective***

Zamboanga city, one of the major urban centers in Mindanao, mirrors the national trend of increasing road crashes. As a city continues to grow in terms of both population and economic activity, the strain on its road infrastructure has become increasingly evident. Many of Zamboanga city's roads are unable to accommodate the increasing number of vehicles, leading to frequent traffic congestion and a higher incidence of road crashes, particularly along major thoroughfares such as the Maria Clara Lorenzo Lobregat (MCLL) National Highway and the Labuan to Limpapa National Road (Baya, 2022).

***Geographic Zones of High Risk***

Accident-prone zones in Zamboanga city are concentrated along major highways and densely populated urban areas. The MCLL National Highway, in particular, has been identified as a high-risk area due to its heavy traffic and the presence of both private and commercial vehicles. Similarly, the Labuan to Limpapa National Road sees a high volume of traffic, contributing to frequent collisions (Baya, 2022).

***Date and Time of Incidents in Zamboanga City***

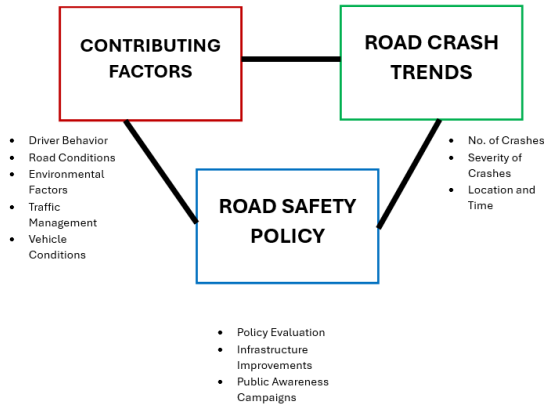
Zamboanga city's road crash patterns closely follow national and international trends. The city's major highways, such as the Maria Clara Lorenzo Lobregat (MCLL) National Highway, experience high volumes of traffic during the early morning (6:00 AM to 9:00 AM) and late afternoon (5:00 PM to 8:00 PM). These times coincide with the commuting hours of workers and students, leading to increased road congestion and a higher frequency of crashes (Baya, 2022).

### b Theoretical Framework

The theoretical framework for this study draws upon key concepts from accident causation theories, systems theory, and risk and crisis management, forming a multidimensional approach to understanding and addressing road safety issues.

### c Conceptual Framework

**Figure 1**
**Conceptual Framework for the Study of Road Crashes in Zamboanga City**




## 3 RESEARCH METHODOLOGY

### a Research Design

This study employed a mixed-methods research design, combining quantitative and qualitative approaches to provide a comprehensive analysis of road crash trends and contributing factors in Zamboanga city from 2018--2022. The quantitative phase sought to identify and analyze patterns in road crashes through the use of descriptive and inferential statistical techniques. This phase draws on data from police reports, hospital records, and traffic management databases to establish trends and correlations between key variables such as road conditions, vehicle types, and crash severity.

### b Research Locale

The research focused on Zamboanga city, an urban area in the Philippines with significant road traffic activity and a history of frequent road crashes. The city's Central Business District (CBD) and major thoroughfares, including the Maria Clara Lorenzo Lobregat (MCLL) National Highway, Mayor Vitaliano

Agan Avenue, and Governor Camins Avenue, were key areas of interest. These locations were chosen because of their high traffic volume, which is correlated with a greater incidence of road crashes. School zones, public transportation hubs, and residential areas adjacent to high-traffic roads were also included to ensure a comprehensive assessment of road safety across different urban contexts.

## 4 PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

### Presentation of the Results

#### Trends in Road Crashes in Zamboanga City (Objective 1)

A road crash is any accident involving at least one road vehicle in motion on a public road or private road to which the public has access, resulting in at least one injured or killed person (United Nations, European Union and the International Transport Forum at the OECD, 2019).

This section presents the quantitative findings from surveys and secondary data, with a focus on trends in road crashes.

**Table 1**
**Frequency of Road Crashes**
**Data on Road Crash Incidents in Zamboanga City (2018–2022)**

| Vehicular accident | 2018 | 2019 | 2020 | 2021 | 2022 | Grand Total |
|---|---|---|---|---|---|---|
| RIR DP | 1461 | 1530 | 1109 | 755 | 499 | 5354 |
| RIR HOMICIDE | 48 | 54 | 37 | 34 | 38 | 211 |
| RIR PI | 747 | 959 | 475 | 340 | 299 | 2516 |
| **Grand Total** | **2252** | **2543** | **1621** | **1129** | **838** | **8381** |

*Source: Zamboanga City Police Office*

*Legend:*
*RIR DP – Reckless Imprudence Resulting in Damage to Property*
*RIR PI– Reckless Imprudence Resulting in Physical Injury*

### 1.1 Timing of Road Crashes

**Table 2**
**Road Crashes according to time of day and night from 2018—2022**

| Time Period | 2018 | 2019 | 2020 | 2021 | 2022 | Grand Total |
|---|---|---|---|---|---|---|
| **12:00 MN – 6:00 AM (Night)** | 126 | 136 | 78 | 64 | 143 | **547** |
| **6:01 AM - 12 PM (Morning)** | 1 | 12 | 5 | 8 | 3 | |
| **12:01 PM - 6 PM (Afternoon)** | 889 | 993 | 720 | 483 | 316 | **3401** |
| **6:01 PM – 11:59 MN (Evening)** | 336 | 402 | 298 | 64 | 134 | **1234** |
| **Total** | | | | | | **8381** |

*Source: Zamboanga City Police Office*

**Figure 2**
**Bar graph. Road Crashes according to time of day and night (2018--2022)**

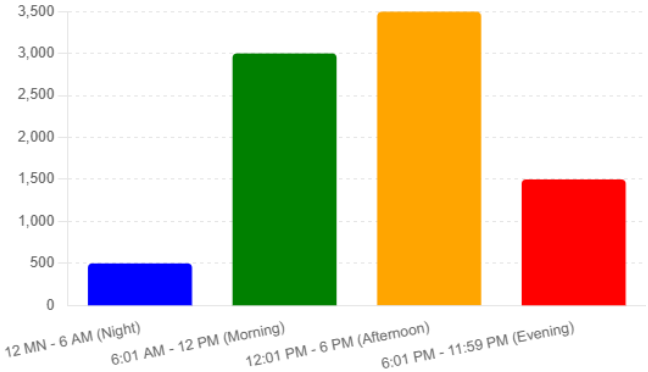



**Figure 3**
**Bar graph. Factors affecting road crashes (2018--2022)**

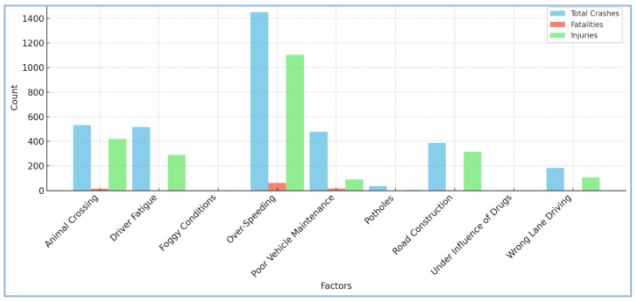



**Figure 4**
**Heatmap of Road Accidents**
**Image. Heatmap of road accidents across Zamboanga city (2018–2022)**

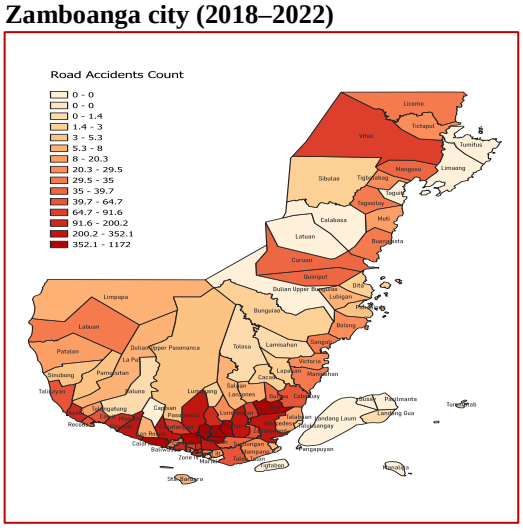


**Figure 5**
**Author's proposed road safety framework**


## 5 SUMMARY, CONCLUSIONS AND RECOMMENDATIO

### a Summary

This study provides a comprehensive analysis of road crashes in Zamboanga city from 2018--2022, focusing on identifying trends and contributing factors and proposing evidence-based solutions through the development of a Road Safety Response Framework. Road crashes are a significant public health concern globally, resulting in 1.2 million deaths and 50 million injuries annually (World Health Organization [WHO], 2009]. In the Philippines, road crashes are a persistent issue, with over 1,200 fatalities reported by the Philippine National Police in 2014 (Adel et al., 2023). These alarming statistics underscore the urgent need for targeted interventions to improve road safety and reduce fatalities.

The quantitative findings revealed a steady decline in road crash incidents over the five-year period, dropping from 2,252 cases in 2018 to 838 in 2022. This reduction can be attributed to several factors, including stricter enforcement of traffic regulations, increased public awareness campaigns, and reduced vehicular mobility during the COVID-19 pandemic. However, while overall crash rates declined, the data showed that crashes during peak hours (6:01 AM–12:00 PM and 12:01 PM–6:00 PM) remained consistently high, primarily due to increased traffic density. Nighttime crashes, although less frequent, often result in more severe outcomes due to reduced visibility, driver fatigue, and higher vehicle speeds during lighter traffic conditions.

Demographic analysis revealed that young male drivers aged 18–25 years were the most affected by road crashes, which aligns with global trends that highlight the increased risk-taking behavior among younger drivers (Elvik & Bjørnskau, 2019). Students and government employees were disproportionately represented in the crash data, likely due to their frequent use of high-traffic routes during commutes. Behavioral factors such as overspeeding, distracted driving, and driving under the influence of alcohol were identified as the primary causes of road crashes. These behaviors are exacerbated by insufficient enforcement of traffic laws and inconsistent penalties, which fail to serve as effective deterrents.

The study also revealed that significant infrastructure deficiencies contribute to crash risk. Poorly maintained roads, inadequate lighting, and faded road markings were prevalent in high-risk zones such as Veterans Avenue and Maria Clara Lobregat National Highway. These areas also experience frequent crashes because of their high traffic volume and complex road layouts. Environmental factors, such as heavy rainfall during monsoon seasons, further increase risks by reducing visibility and creating hazardous road conditions.

Qualitative insights highlighted the lack of modern enforcement tools, such as speed cameras and breathalyzers, and the limited availability of traffic enforcers as significant challenges in ensuring compliance with traffic regulations. The respondents emphasized the need for public education campaigns to address risky behaviors and promote a culture of road safety. These qualitative findings, combined with quantitative data, informed the development of a comprehensive Road Safety Response Framework.

The proposed framework integrates five key components: enhanced traffic enforcement, infrastructure improvements, public awareness campaigns, technology-driven solutions, and multisector collaboration. These components address both immediate and systemic issues in road safety, offering multiple approaches to mitigating crash risk and improving safety outcomes. The findings of this study demonstrate that while progress has been made in reducing crash rates, persistent gaps in enforcement, infrastructure, and public awareness require sustained and coordinated interventions. The insights gained from this research contribute to the broader discourse on sustainable urban development and the critical role of transportation systems in enhancing public health and safety.

This study provides a foundation for policy reforms and actionable strategies to reduce road crashes and promote safer transportation systems in Zamboanga city. The findings also serve as a model for other urban centers facing similar challenges, highlighting the importance of evidence-based solutions and collaborative efforts in addressing road safety concerns.

### b Conclusion

The findings of this study illuminate the nature of road crashes in Zamboanga city from 2018 to 2022, emphasizing the interplay of behavioral, infrastructural,

and environmental factors in shaping road safety outcomes. While the observed decline in crash incidents over the five-year period indicates notable progress, persistent challenges reveal the complexity of addressing road safety in a dynamic urban setting. These challenges necessitate sustained, coordinated, and comprehensive interventions to ensure meaningful and lasting improvements.

Behavioral factors emerged as the most significant contributors to road crashes, with overspeeding and distracted driving identified as the leading causes. These behaviors are consistent with global trends, where human error accounts for approximately 90% of road traffic incidents (World Health Organization [WHO], 2018). The demographic analysis underscored the vulnerability of young male drivers aged 18–25, whose greater propensity for risk-taking and limited driving experience place them at greater risk. Additionally, students and government employees were disproportionately represented in the crash data, reflecting their exposure to high-traffic zones and the need for targeted interventions to safeguard these road users.

Infrastructural deficiencies, such as poorly lit roads, faded pedestrian crossings, and potholes, were found to exacerbate crash risk, particularly in high-traffic areas such as Veterans Avenue and Maria Clara Lobregat National Highway. These deficiencies hinder safe mobility, particularly for motorcyclists and pedestrians, who are among the most vulnerable road users. These findings align with global evidence that well-maintained and properly designed infrastructure, including clear signage and designated lanes, can significantly reduce crash risk by up to 40% (WHO, 2018). Despite efforts to address these issues, infrastructure remains a critical area requiring sustained investment and modernization to meet the growing demands of Zamboanga city's urban landscape.

Environmental factors, including heavy rainfall and reduced visibility during monsoon seasons, compound the risks of road crashes. These conditions are particularly hazardous for night-time drivers, whose crashes are often more severe because of higher speeds during lighter traffic. This underscores the importance of climate-responsive road safety measures, including better drainage systems, weather-appropriate signage, and increased awareness among drivers about the hazards of driving in adverse conditions.

Enforcement gaps, such as inadequate manpower, a lack of modern tools such as speed cameras and breathalyzers, and inconsistencies in the application of penalties, are significant barriers to effective traffic law compliance. Without consistent and equitable enforcement, risky behaviors such as overspeeding, distracted driving, and driving under influence persist, further endangering road users. The qualitative findings revealed widespread public support for automated enforcement systems and stricter penalties, which could enhance compliance and foster a culture of accountability.

The study concludes that addressing these persistent challenges requires a holistic and evidence-based approach, as outlined in the proposed Road Safety Response Framework. This framework integrates five interconnected components: enhanced traffic enforcement, infrastructure improvements, public awareness campaigns, technology-driven solutions, and multisector collaboration. Together, these components address both immediate and systemic issues, creating a comprehensive strategy that aligns with global best practices in road safety. By adopting this framework, Zamboanga city can reduce road crash incidents, improve safety outcomes, and ensure the sustainability of its road safety initiatives.

Moreover, this study highlights the critical role of transportation systems in promoting public health and safety. In addition to reducing crashes, the proposed interventions can contribute to broader urban development goals, such as enhancing mobility, reducing congestion, and fostering economic growth. By prioritizing road safety, Zamboanga city can not only protect its residents but also set a benchmark for other urban centers in the Philippines and beyond, demonstrating the transformative potential of coordinated and evidence-based strategies.

In conclusion, while progress has been made in improving road safety, the persistence of behavioral, infrastructural, and enforcement-related challenges underscores the need for sustained and collaborative efforts. The findings of this study provide a robust foundation for designing and implementing targeted interventions that address the root causes of road crashes. With the adoption of the proposed framework, Zamboanga city has the opportunity to significantly enhance road safety, protect its citizens, and contribute to global efforts to reduce road traffic injuries and fatalities.

## c Recommendations

**Enhanced Traffic Enforcement**
**Adopt Advanced Engineering Technologies**

To improve traffic management and reduce violations, authorities must adopt state-of-the-art enforcement tools. Technologies such as electronic citation (e-citation) ticketing systems, speed cameras, CCTV systems, and breathalyzers provide consistent and accurate monitoring of high-risk driving behaviors such as speeding and driving under influence. These tools eliminate reliance on subjective human judgment, reducing errors and opportunities for corruption. The integration of noncontact apprehension systems, which automatically detect and penalize traffic violations without requiring direct interaction, ensures fair and efficient enforcement. These advancements not only enhance the capacity of traffic authorities but also have a deterrent effect, encouraging compliance among motorists.

**Increasing Interconnectivity and Transparency**

The implementation of an e-citation ticketing system that links directly to the database of the Land Transportation Office (LTO) is critical in advancing a transparent and efficient enforcement process. This interconnectivity allows for real-time recording and transmission of traffic violations, reducing opportunities for on-the-spot negotiations or disputes between violators and enforcers. Additionally, compliance with the demerit point system, as mandated by Republic Act 10930, will be streamlined through such a system, reinforcing accountability among drivers. To further enhance transparency, violators should receive immediate notifications of their penalties through multimedia platforms such as email, SMS, or social media. This measure simplifies the fine payment process, eliminates ambiguity, and addresses the recurring issue of unauthorized confiscation of licenses, particularly with the introduction of the 10-year license validity period.

**Optimization of Manpower Deployment**

To address traffic-related risks effectively, enforcement agencies must optimize manpower deployment in high-risk areas and during peak traffic hours. The strategic placement of additional traffic enforcers in zones prone to accidents, such as school vicinities, hospital surroundings, and major intersections, can significantly deter reckless driving and ensure smoother traffic flow. The high visibility of enforcers serves as a psychological deterrent to potential violators and reassures the public of active traffic management. To maximize efficiency, traffic personnel should undergo regular training in modern enforcement techniques and be equipped with the necessary tools to perform their duties effectively.

**Imposing Stricter Penalties**

Stronger penalties for traffic violations are necessary to reinforce accountability and prevent repeat offenses. Authorities should impose higher fines for habitual violators to emphasize the seriousness of traffic laws. In addition to punitive measures, mandatory road safety seminars should be introduced as a rehabilitative approach for violators. These seminars can focus on raising awareness about the consequences of reckless driving, the importance of adhering to road safety norms, and fostering a sense of responsibility among motorists. Educational interventions are critical for addressing behavioral issues that often contribute to traffic violations, ultimately reducing recidivism.

**Promote Public–Private Collaboration**

Collaboration with private organizations, especially transportation firms and logistics companies, is vital for promoting adherence to road safety standards among professional drivers. These companies should be encouraged to implement regular safety training programs for their personnel, ensuring that drivers are well informed about traffic regulations and best practices. Partnerships with private entities can also support data sharing, which can help identify high-risk areas and inform enforcement strategies. By involving the private sector in enforcement initiatives, authorities can expand the reach and impact of their road safety programs, creating a more comprehensive approach to traffic management.

**Address Policy and Operational Gaps**

To ensure consistent and fair enforcement, authorities must address gaps in existing policies and operational procedures. The unauthorized confiscation of drivers' licenses by local government units, for instance, should be rectified by aligning local enforcement policies with national guidelines. This alignment is particularly critical given the longer validity of licenses introduced under Republic Act 10930. Clear communication and coordination between national and local traffic enforcement agencies are essential to streamline enforcement processes and reduce procedural inconsistencies. Focusing on these gaps will strengthen the overall traffic management framework and build public trust in the system.

**Infrastructure improvements**

Addressing infrastructure deficiencies is critical for mitigating road crash risk. Immediate actions should focus on repairing potholes, repaining faded road markings, and installing adequate street lighting in accident-prone areas such as Veterans Avenue and Maria Clara Lobregat National Highway. These measures enhance visibility and ensure safer navigation for drivers, especially during nighttime or adverse weather conditions.

Long-term infrastructure improvements should prioritize redesigning dangerous intersections to minimize traffic conflicts and improve flow. Exclusive lanes for motorcycles, bicycles, and public transport vehicles can reduce congestion and protect vulnerable road users. Pedestrian-friendly infrastructure, such as well-marked crosswalks, pedestrian bridges, and protective barriers, should also be implemented to increase safety. Furthermore, construction zones should be equipped with proper signage, barriers, and diversion routes to prevent accidents. Integrating road safety features into city planning and urban development projects can ensure that infrastructure meets the evolving needs of Zamboanga city.

**Public awareness campaigns**

Educational campaigns are crucial for changing risky driving behaviors and fostering a culture of road safety. These campaigns should target high-risk groups, including young male drivers aged 18–25, who are most prone to overspeeding and distracted driving. Messages highlighting the dangers of risky behaviors, backed by real-life stories and statistics, can resonate more effectively with this demographic.

Road safety education should be integrated into school curricula to build lifelong safe driving habits. Community workshops, public service announcements, and social media campaigns can amplify these messages, allowing them to reach diverse audiences. Collaboration with NGOs, media outlets, and local influencers can increase the credibility and reach of these campaigns. Regular evaluation of campaign effectiveness, using metrics such as changes in driver behavior or crash rates, can help refine strategies for greater impact.

**Technology-Driven Solutions**

Leveraging technology is essential for modernizing traffic management and enhancing road safety outcomes. Real-time traffic monitoring systems should be implemented to identify high-risk zones, optimize traffic flow, and enable proactive interventions. Smart traffic signals that adjust to real-time conditions can minimize congestion and reduce the likelihood of collisions at intersections.

Mobile applications offering road safety education, reporting mechanisms for violations, and navigation tools for safer routes can empower road users to make informed decisions. Predictive analytics, powered by AI, can help authorities anticipate crash hotspots and allocate resources effectively. Investment in automated enforcement systems, such as speed cameras and red-light cameras, ensures the consistent application of traffic laws. Partnerships with technology providers can facilitate the adoption of innovative solutions, such as dashboard cameras for public transport vehicles, which can increase accountability and compliance.

**Multisector Collaboration**

Improving road safety requires collaboration among government agencies, NGOs, academic institutions, and the private sector. Establishing a dedicated task force or council for road safety can ensure better coordination of efforts, allocation of resources, and monitoring of initiatives. This task force should oversee the implementation of the Road Safety Response Framework and ensure accountability among stakeholders. The local government unit (LGU) of Zamboanga, as the lead agency, can spearhead these efforts in coordination with key departments such as the Zamboanga City Disaster Risk Reduction and Management Office (ZCDRRMO), City Health Office (CHO), General Services Office (GSO), City Administration Office, and the Zamboanga Traffic Enforcement Unit (ZTEU). National agencies, including the Land Transportation Office (LTO), Land Transportation Franchising and Regulatory Board (LTFRB), Philippine National Police (PNP), Department of Information and Communications Technology (DICT), Department of Public Works and Highways (DPWH), and Department of Health (DOH), also play crucial roles in enforcing traffic laws, regulating public utilities, maintaining infrastructure, and responding to emergencies. Together, this multisector approach ensures the sustainability, scalability, and accountability of road safety measures. Partnerships with international organizations can further enhance these efforts by providing access to technical expertise, funding, and best practices. Aligning with global frameworks such as the United Nations Decade of Action for Road Safety can position Zamboanga city as a model for urban safety and innovation.

**Policy and Legislative Actions**

Policy reforms are crucial to creating a safer road environment. Strengthening existing traffic laws, such as those mandating helmet use and seatbelt compliance, is essential for fostering a culture of accountability. Policymakers should increase penalties for violations such as distracted driving and driving to deter risky behaviors.

Introducing mandatory speed limiters for public transport vehicles and requiring periodic safety inspections for vehicles can further increase road safety. Legislative support for investments in road infrastructure, public awareness campaigns, and technology adoption should also be prioritized. Aligning local policies with national and international road safety frameworks ensures consistency and scalability.

**Future Research Directions**

Future studies should aim to provide deeper insights into the dynamics of road crashes in Zamboanga city. Expanding data collection to cover diverse demographics, geographic zones, and vehicle types can ensure a more comprehensive understanding of crash risk. Advanced tools such as GIS and machine learning algorithms can map high-risk areas, predict crash hotspots, and evaluate the impact of interventions.

Qualitative approaches, such as in-depth interviews and focus group discussions with road users, can uncover behavioral and cultural factors influencing road safety. Research should also assess the effectiveness of existing interventions, such as public awareness campaigns and enforcement measures, to identify areas for improvement. Comparative studies between Zamboanga city and other urban centers can highlight best practices and innovative strategies for local adaptation.

Finally, exploring the role of community engagement in promoting road safety can provide valuable insights into grassroots-level initiatives. Public perceptions of road safety measures should be assessed to align strategies with the needs and expectations of road users. By addressing these research gaps, future studies can contribute to more effective and sustainable road safety solutions.

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