Formosa Journal of Multidisciplinary Research (FJMR)
Vol. 4, No. 5, 2025: 2205-2216

Effectiveness of Road Traffic Signs, Knowledge and Practices towards Road Safety among Drivers in Camaligan, Camarines Sur, Philippines

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A R T I C L E I N F O
Keywords: Road Traffic Signs, Effectiveness, Knowledge, Practices, Road Safety

Received : 16, April
Revised : 30, April
Accepted: 24, May

A B S T R A C T
This study examines the effectiveness of road traffic signs, knowledge and practices among drivers in promoting traffic safety in Camaligan, Camarines Sur, Philippines. Using a mixed-method approach, the research assesses drivers' knowledge and practices, as well as the impact of proper signage placement and community involvement. The findings show that well-maintained and visible signs improve driver compliance and reduce accidents. The study highlights the importance of regular signage maintenance, public education, and community engagement in creating safer road environments. The research supports the development of data-driven and community-based traffic policies to enhance public safety and promote sustainable road safety practices.

DOI: https://doi.org/10.55927/fjmr.v4i5.210
ISSN-E: 2829-8896
https://npaformosapublisher.org/index.php/fjmr

INTRODUCTION

Every modern culture depends heavily on transportation, which contributes to the rising rates of car ownership which has resulted in excessive traffic and intolerable road deaths (Akple et al., 2020). Lives are lost and injuries occur daily in our roads mainly due to the recklessness of many drivers (Nepomuceno, 2024). According to the World Health Organization, approximately 1.19 million people die every year in road crashes worldwide (WHO, 2023). According to the Road Safety Unit of the Metropolitan-Manila Development Authority (MMDA), there were at least 26, 599 motorcycle accidents in the Philippines in 2022. In 2023, this figure even rose by 17.3 percent. About 70% of these collisions happened at the intersection where drivers of larger cars rarely saw motorcycles. They would be taken aback by the unexpected collision of a much smaller but faster bike, which typically results in fatalities. Also, research conducted in Metro Manila in 2022 assessed 73 traffic signs and found that 27 did not meet the 67% comprehension standard set by ISO 3864-1:2011. It was further observed that text-based signs had the highest comprehension rates, while symbol-only signs resulted in slower recognition times and lower accuracy (MDPI, 2022).

From January 1 to May 2024, a total of 1,921 traffic and vehicular accidents were recorded in Camarines Sur (Calinog, 2024). According to the report, the majority of the accidents are caused by human error. Many motorists reportedly lacked defensive driving skills and often made reckless maneuvers. In the Municipality of Camaligan, Camarines Sur, the increasing volume of vehicles, insufficient traffic enforcement, and ineffective road signage systems have raised concerns about road safety. The installation of road signage is intended to regulate traffic flow, warn road users of potential hazards, and provide guidance for commuters. However, studies suggest that the effectiveness of these signages is contingent upon their visibility, placement, and the extent of enforcement accompanying them. At the local level, the Municipal Public Safety Office (MPSO) of Camaligan is responsible for enforcing road safety regulations, overseeing the proper installation of traffic signs, and ensuring adherence to national and local traffic policies. However, challenges such as poor visibility of signages, lack of standardized placement, inadequate public awareness, and inconsistent policy enforcement persist.

LITERATURE REVIEW

Road safety remained a critical concern in urban and rural settings, particularly in municipalities like Camaligan, Camarines Sur, Philippines. Ensuring compliance with traffic rules, proper placement and maintenance of road signages, and the enforcement of road safety policies were key factors in minimizing road accidents and improving overall traffic management. This section reviewed relevant studies and literature that supported the study's objectives, specifically on road signage effectiveness, challenges in policy implementation, alignment with national and international road safety frameworks, and potential strategies for improvement.

The effectiveness of road signage played a vital role in regulating traffic flow, preventing accidents, and ensuring public safety. According to Fiolić, M., Darko Babić, Babić, D., & Sanja Tomasović (2023), road markings and road signs, if properly designed and placed, can positively impact driver behaviour and thus overall road safety. Their study revealed that the level of road markings and road signs visibility slight increased the driving speed (about 2%), but at the same time it had a positive effect on participants' cognitive load which was at an optimal level during high visibility. Similarly, Garach, L., Calvo, F., & Oña, J. D. (2022) highlighted road markings may influence driver behavior, and therefore road safety. An increase in the width of road markings might lead drivers to perceive lanes to be narrower than they really are, creating the illusion of traveling faster. Countries with stricter policies on the monitoring and maintenance of road signs experienced lower accident rates, underscoring the need for regular evaluations of traffic sign effectiveness.

In the Philippines, the Department of Public Works and Highways (DPWH, 2022) advocated for the integration of Geographic Information Systems (GIS) in road safety management. GIS-based mapping helped identify accident-prone areas and assessed the placement of road signs, ensuring that it is strategically located for maximum effectiveness.

Despite existing road safety initiatives, various challenges hinder the effective implementation of policies at the local level. A study conducted by the Land Transportation Office (LTO) in Cotabato City, Philippines (2023) identified weak policy enforcement and public non-compliance as major obstacles to road safety initiatives. These challenges were often due to limited resources, lack of personnel for consistent traffic monitoring, and insufficient awareness campaigns. Moreover, the Philippine Road Safety Action Plan (2023–2028) highlighted the necessity of aligning local road safety measures with national strategies. It emphasized the role of law enforcement agencies in ensuring compliance and the importance of community engagement in promoting road safety awareness.

Effective road safety policies should aligned with both national and international standards to ensure consistency and efficiency. The United Nations' Sendai Framework for Disaster Risk Reduction (2015–2030) underscored the significance of road safety in disaster resilience, particularly in flood-prone areas. This framework suggested that clear and visible evacuation routes, hazard warning signs, and traffic control measures are crucial in reducing disaster-related casualties.

Similarly, the International Road Assessment Programme (iRAP) Report (2023) found that municipalities implementing technology-driven solutions, such as LED-based warning signs and speed monitoring systems, experienced a 30% reduction in road crashes.

Several studies suggested best practices for enhancing road safety management. Abegail (2025) proposed a framework that integrated infrastructure improvements, public awareness campaigns, and stricter policy enforcement to enhance road safety effectiveness. Their study emphasized that comprehensive policy framework aimed at reducing traffic fatalities in low-

resource countries. It outlines key strategies, including improving road infrastructure, strengthening traffic law enforcement, increasing public awareness, and promoting safer vehicle standards. Moreover, Brown, B. K. (2024) examined the effectiveness of digital road signs that adjusted messages based on real-time traffic conditions, weather updates, and accident reports. Their findings suggested that integrating cutting-edge technology with traditional road signage, it can offer a dynamic and adaptable approach to keeping road users informed and aware of changing circumstances.

The reviewed literature established that road safety policies and road signage effectiveness was essential components of traffic management and accident prevention. Studies by to Fiolić, M., Darko Babić, Babić, D., & Sanja Tomasović (2023), Garach, L., Calvo, F., & Oña, J. D. (2022), Abegail (2025), Brown, B. K. (2024), and DPWH (2022) emphasized the need for clear and well-maintained signages to ensure driver compliance. Challenges in policy implementation, as identified by LTO (2023) and the Philippine Road Safety Action Plan (2023–2028), highlighted enforcement limitations that must be addressed at the local level. Furthermore, aligning Camaligan's road safety policies with international frameworks such as the Sendai Framework (2015–2030) and iRAP (2023) enhanced road safety strategies.

To improve road safety in Camaligan, Camarines Sur it was suggested that combining infrastructure upgrades, community awareness initiatives, stricter enforcement, and the adoption of smart road signage technology was needed. These insights provided a strong foundation for assessing the effectiveness of installed road signages and identifying strategic interventions for enhancing road safety policies in Camaligan, Camarines Sur.

METHODOLOGY

To reduce road fatalities and serious injuries, various methods and measures have been implemented through the use of traffic control instruments. These instruments, which include road markings, signage, and devices, are installed and regulated by road authorities to promote safer driving conditions (Al-Madani and Al-Janahi, 2022a, Ng and Chan, 2008; Olumide and Owoaje, 2017). Traffic signs and pavement markings are a crucial aspect of road design since they are essential sources of information for road users to calibrate their driving behavior, evaluate route possibilities and cope with unexpected events (Ceunynck, T., 2015). This is necessary to ensure that drivers receive the information they require to obey traffic regulations and navigate the road system safely and efficiently (Tinio, JC et.al.,2022).

RESEARCH RESULT AND DISCUSSION

This section presents the results and discussion on the effectiveness of road traffic signs and knowledge, attitude, and practices towards road safety in Camaligan, Camarines Sur, Philippines.

Effectiveness of Road Traffic Signs

The effectiveness of traffic signs in promoting road safety among drivers in Camaligan, Camarines Sur, is shown in Table 1. The findings showed that, of the indicators identified the geometric features of the road ranked first with a mean score of 3.74, followed by the behavioral characteristics of driving (3.94), information volume and comprehensively ranked third, traffic sign types of information (3.74), and weather and visibility conditions, which ranked last with a mean score of 3.71. With a grand mean of 3.83, the road traffic signs in Camaligan, Camarines Sur, were found to be highly effective overall.

This indicates that the indicators identified support the general effectiveness of traffic signs in informing drivers of critical information and advancing road safety. Road traffic indicators are essential for maintaining driving efficiency and safety. Researchers and practitioners might endeavor to optimize the design and deployment of road traffic signs to enhance traffic competence and safety by understanding these aspects and utilizing suitable effectiveness measures.

The importance of traffic advisory signs in people's daily life was underlined in the Yao et al. (2019) study. However, a number of factors, including the types of information on traffic signs, their volume and comprehensibility, driver behavior, the geometric features of roadways, weather, and visibility conditions, have a significant impact on the effectiveness and performance of traffic guide signs at intersections. It is necessary to make an attempt to determine whether installing a traffic guide sign is necessary before doing so.

The presence of traffic signs is crucial in maintaining road safety and efficiency. Research has shown that traffic signs are effective in informing drivers of critical information, such as speed limits, traffic signals, and road conditions (Khan et al., 2022) The indicators identified in studies suggests that traffic signs play a significant role in advancing road safety and reducing the risk of accidents. Road indicators are essential for maintaining driving efficiency and safety. These indicators provide drivers with critical information that helps them navigate roads safely and efficiently (Liu et la., 2023). Researchers and practitioners can optimize the design and deployment of road traffic signs to enhance traffic competence and safety by understanding these aspects and utilizing suitable effectiveness measures (Wang et al., 2024)

Optimizing the design and deployment or road traffic signs can have a significant impact on road safety and efficiency. By understanding the effectiveness of traffic signs and utilizing suitable measures, researchers and practitioners can develop strategies to improve traffic competence and safety (Ali et al., 2025). This can include optimizing the placement and design of traffic signs, as well as developing new technologies to enhance traffic safety.

Table 1. Effectiveness of road traffic signs in Camaligan, Camarines Sur, 2025

Indicators	**WM**	**Int.**	**R**
Geometric features of roadways	3.99	HE	1
Behavioral attributes of drivers	3.94	HE	2
Information volume and comprehensibility	3.87	HE	3

Types of information on traffic signs	3.74	HE	4
Weather and visibility conditions	3.71	HE	5
Grand Mean	3.83	HE	

Legend:

Rating Scale	Interpretation
3.36-4.00	Highly Effective (HE)
2.51-3.25	Effective (E)
1.76-2.50	Less Effective (LE)
1.00-1.75	Note Effective (NE)

Drivers' Knowledge Towards Safety

Table 2 presents the knowledge among drivers towards safety in Camaligan, Camarines Sur. Results revealed that the respondents is highly knowledgeable of the indicators towards safety like obtaining a driver's license, using seat belt, compulsory of wearing helmet, overtaking without looking at the indicators is dangerous, and conscious with the driving speed near residential areas with the mean score of 3.94.

This means that respondents are knowledgeable about obtaining a driver's license, using seat belts, compulsory wearing of helmets, and conscious driving speed near residential areas, it implies a significant reduction in road crashes, injuries, and fatalities. This knowledge promotes a culture of road safety, responsibility, and respect for traffic laws, leading to improved safety, reduced traffic congestion, and enhanced community livability. Ultimately, knowledgeable drivers contribute to a safer and more sustainable transportation system, minimizing economic burdens and promoting a positive impact on society.

Research has consistently shown that knowledgeable drivers are likely to be involved in road crashes, injuries, and fatalities (World Health Organizations, 2018; National Traffic Safety Administration, 2020). This is because knowledgeable drivers are more likely to follow traffic laws, practice defensive driving, and take necessary precautions to ensure their safety and the safety of others on the road. By promoting a culture of road safety, responsibility, and respect for traffic laws, knowledgeable drivers contribute to improve safety on the roads. The benefits of knowledgeable drivers extend beyond road safety. They also contribute to reduced traffic congestion, enhanced traffic congestion, enhance community livability, and more sustainable transportation system (European Transport Safety Council, 2020; American Automobile Association, 2019).

Furthermore, knowledgeable drivers can help minimize economic burdens associated with road crashes, such as healthcare costs and lost productivity (World Bank, 2019; International Transport Forum, 2019). By promoting knowledgeable drivers, societies can reap numerous benefits that extend beyond road safety to encompass economic, social, and environmental sustainability.

Table 2. Knowledge among drivers towards safety in Camaligan, Camarines Sur, 2025

Indicators	WM	Int.	R
Obtaining a driver's license is important	4.00	HK	1.5
It is important to fasten the seat belt	4.00	HK	1.5
It is compulsory to wear helmet	4.00	HK	1.5
Overtaking without looking at the indicators is dangerous	4.00	HK	1.5
Driving while in the influence of drugs is dangerous	4.00	HK	1.5
Conscious with the driving speed near residential areas	4.00	HK	1.5
It is important to follow the road sign	3.85	HK	7
Penalty for violating traffic laws	3.71	HK	8
Grand Mean	3.94	HK	

Legend:

Rating Scale	Interpretation
3.36-4.00	Highly Knowledgeable (HK)
2.51-3.25	Knowledgeable (K)
1.76-2.50	Less Knowledgeable (LK)
1.00-1.75	Not Knowledgeable (NK)

Drivers' Practices Towards Safety

Table 3 presents the practices among drivers towards safety in Camaligan, Camarines Sur. Results revealed that obtaining drivers' license, being extra cautious when driving at night, dealing with challenging road conditions, sharing the road with motorcycles and pedestrians, staying alert and avoiding distractions while driving, and not using mobile phones while driving is highly practiced by the respondents with the mean score of 3.39.

This means that if drivers highly practice obtaining a driver's license, exercising extra caution when driving at night, navigating challenging road conditions, sharing the road with motorcycles and pedestrians, and staying alert while avoiding distractions, it implies a substantial reduction in road accidents, injuries, and fatalities. This high level of practice promotes a culture of defensive driving, mutual respect, and shared responsibility among road users, leading to improved road safety, reduced traffic congestion, and enhanced community livability. Ultimately, responsible driving practices contribute to safer, more efficient, and sustainable transportation system.

Studies have shown that drivers who use defensive driving techniques, such as expecting dangers and keeping a safe distance, are less likely to be in accidents or get hurt (World Health Organization, 2020; National Highway Traffic Safety Administration, 2022). This leads to a culture of safety, respect, and shared responsibility on the roads. Safe driving also helps reduce traffic jams, makes communities better places to live, and creates a more sustainable transportation system (European Transport Safety Council, 2022; American Automobile Association, 2023).

By being respectful and considerate, drivers can reduce conflicts and make traffic flow better. In fact, a study by the International Transport Forum (2024) found that safe driving can reduce traffic congestion by up to 20%. Overall, safe driving is crucial for creating a transportation system that is safe, efficient, and

sustainable. By using defensive driving techniques and being respectful, drivers can help prevent accidents and make their communities better to live (World Bank, 2023; National Academy of Science, 2025).

Table 3. Practices among drivers towards safety in Camaligan, Camarines Sur, 2025

Indicators	WM	Int.	R
Obtaining a drivers' license	4.00	HP	1.5
Extra cautious when driving at night	4.00	HP	1.5
Dealing with challenging road conditions	4.00	HP	1.5
Sharing the road with motorcycles and pedestrians	4.00	HP	1.5
Staying alert and avoiding distractions while driving	4.00	HP	1.5
Not using of mobile phones while driving	4.00	HP	1.5
Managing emergency situations	3.91	HP	7
Ensuring vehicle maintenance	3.79	HP	8
Familiar with traffic rules and regulations	3.72	HP	9.5
Driving too fast during rush hours	3.72	HP	9.5
Respecting local customs and etiquette	3.69	HP	11
Handling traffic and congestion	3.63	HP	12
Adapting to local driving practices	3.58	HP	13
Navigating the road safety	3.43	HP	14
Driving speed of 30 near residential areas	3.04	P	15
Eating and drinking while driving	1.00	NP	16.5
Overtaking without indicators	1.00	NP	16.5
Grand Mean	3.39		

Legend:

Rating Scale	Interpretation
3.36-4.00	Highly Practiced (HP)
2.51-3.25	Practiced (P)
1.76-2.50	Less Practiced (LP)
1.00-1.75	Not Practiced (NP)

Challenges faced by the Municipal Public Safety Office in the Implementation of Road Safety Policies

The Municipal Public Safety Office (PSO) in Camaligan, Camarines Sur, faced significant hurdles in implementing effective road safety policies. Key challenges included limited funding, inadequate staffing, non-compliance with road signs, poor communication of safety policies, and lack of traffic monitoring technology. These issues highlighted the need for stronger, institutional backing and strategic improvements to enhance road safety in the area.

Table 4. Challenges faced by the MPSO in the implementation of road safety policies in Camaligan, Camarines Sur, 2025.

Indicators	WM	Int.
Lack of funding limits the installation and maintenance of road signs	3.88	SA
Insufficient personnel affect the enforcement of road safety regulations	3.91	SA

Public non-compliance with road signs is a major challenge for MPSO	3.28	A
Road safety policies ate not well-communicated to drivers and pedestrians	3.53	SA
The absence of traffic monitoring technology affects road safety enforcement	3.87	SA
Grand Mean	3.69	SA

Legend:

Rating Scale	Interpretation
3.36-4.00	Strongly Agree (SA)
2.51-3.25	Agree (A)
1.76-2.50	Disagree (D)
1.00-1.75	Strongly Disagree (SD)

Table 3 shows the challenges faced by the Municipal Public Safety Office in implementing road safety policies, as revealed by the respondents. The challenges were rated on a scale from 1 (strongly disagree) to 4 (strongly agree). The results show that lack of funding for road signs and insufficient personnel are major challenges. Most respondents with a mean score of 3.88 cited financial constraints as a significant issue, while shortage on personnel with a mean score of 3.91 strongly agree that the lack of personnel hindered enforcement.

Public non-compliance with road signs and ineffective communication of road safety policies are also significant issues. While a majority of respondents acknowledged these challenges, there were varying levels of agreement. Specifically, majority of respondents agreed that public compliance is a problem and communication of road safety policies needs improvement, highlighting gaps in public awareness and education.

According to Elvik (2017), this study emphasizes the need for sufficient personnel and resources to effectively enforce road safety regulations and the importance of monitoring and evaluating road safety performance, including identifying challenges and areas for improvement (Hakkert, A, S.& Gitelman, V., 2014).

CONCLUSIONS AND RECOMMENDATIONS

The local government unit of Camaligan, Camarines Sur may prioritize funding and maintaining road signs, focusing on high-risk areas identified through GIS mapping, and schedule regular maintenance to ensure their visibility and effectiveness; implement public education programs on road safety, targeting schools and communities, and collaborate with local groups to promote awareness and shared responsibility for following traffic rules and road signs; a dedicated task force under the Municipal Public Safety Office may be established to regular monitor and evaluate road signage, track effectiveness, and update traffic date to inform future improvements and strategies; road safety planning maybe integrated with disaster risk reduction and urban development strategies to enhance public safety, community resilience, and sustainable mobility during both emergency and normal conditions; the MPSO may consider acquiring modern technology, such as speed guns and CCTYV cameras, to hance

road safety enforcement, monitor traffic violations and improve efficiency in high risk areas; conduct long-term studies to assess the effectiveness of road signage improvements and education campaigns in reducing accidents and improving driver behavior; consider using smart traffic technologies, like solar-powered or sensor-based signs, to enhance visibility and provide real-time updates in rural and urban areas; study pedestrian behavior and infrastructure, including crosswalk safety and sidewalk conditions, to better understand road safety dynamics; and examine the impact of traffic law enforcement and policy implementation on driver behavior, including the effectiveness of enforcement strategies, penalties, and incentives in promoting compliance.

ADVANCED RESEARCH

An advanced research initiative for the Municipality of Camaligan, Camarines Sur may focus on a comprehensive, data-driven evaluation of road safety through the integration of Geographic Information Systems (GIS), smart traffic technologies, and behavioral studies. This research would analyze spatial patterns of road accidents to identify high-risk zones and assess the correlation between signage quality, driver compliance, and incident frequency. Leveraging modern technologies such as speed guns, CCTV, and sensor-based or solar-powered signs, the study would evaluate their effectiveness in both rural and urban settings, particularly during varying environmental and traffic conditions. Additionally, longitudinal studies would measure the long-term impact of road safety education programs in schools and communities, while also investigating pedestrian infrastructure, including crosswalk safety and sidewalk accessibility. The role of law enforcement strategies, such as penalty systems and community engagement, would be critically examined to determine their influence on driver behavior. By integrating findings with disaster risk reduction and urban development frameworks, the research aims to provide a holistic model for sustainable and resilient road safety planning tailored to the needs of Camaligan's evolving urban landscape.

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