

Navigating the Road to Safer Travel in Pakistan: A Multi-Perspective Analysis of Road Safety Challenges and Solutions

Amjad Pervez¹, and Ammar Oad²

¹School of Traffic and Transportation Engineering, Central South University, Changsha, China

²Faculty of Information Engineering, Shaoyang University, Shaoyang, China

Correspondence Author: Amjad Pervez (amjadpervez04@yahoo.com)

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Abstract

With the growing global population, the demand for mobility and well-managed modes of transportation is increasing day by day. However, the rapid growth in motorization is a double-edged sword. On one side, it brings social and economic development; on the other, it results in severe consequences, such as road traffic crashes. Pakistan, a developing country, is also dealing with the same issue. Therefore, this paper aims to explore the road safety issues in Pakistan. The analysis is carried out from five perspectives: infrastructural, institutional, socio-economic, socio-cultural/behavioral, and educational. The study highlights that inadequate road infrastructure, lack of road safety institutions and policies, absence of a credible crash reporting system, poor and ineffective enforcement, road users' aberrant behaviors, and lack of road safety awareness all contribute to road safety problems in Pakistan. To address these issues, the study proposes a set of key measures, such as expanding road infrastructure, establishing dedicated road safety institutions, centralizing data collection efforts, implementing comprehensive safety tests for vehicles, and organizing road safety seminars to educate the youth. These recommendations aim to enhance road safety, ultimately reducing fatalities and economic losses caused by road crashes in Pakistan.

Index Terms: Driver Behavior, Pakistan, Road Infrastructure, Road Safety, Road Crashes.

I. INTRODUCTION

Over the past decades, road safety has received increased attention from transportation researchers and agencies [1-4]. However, despite significant advances in road safety measures in recent years, road crashes continue to be a critical public health concern worldwide, resulting in approximately 1.35 million fatalities and 50 million injuries [5]. Developing countries bear a substantial burden of these statistics, with road traffic fatalities in these regions being three to four times higher than in developed countries [5]. The primary reason for such an alarming rate of traffic fatalities in developing countries is the inadequate management and enforcement of road safety measures in these regions [6-8]. Moreover, almost all developing countries have placed considerable emphasis on constructing infrastructure and implementing policies favoring motorized transportation, leading to a rapid growth in vehicle ownership and amplifying road safety challenges [9], and [10].

Like other developing countries, Pakistan has witnessed a substantial increase in registered motorized vehicles, catapulting from 6.2 million in 2008 to 21.5 million in 2017, resulting in a 268% rise [11]. However, this rapid motorization has not been accompanied by an equivalent growth in road infrastructure. For instance, over the same period, the development in road infrastructure, both low

and high types, remained alarmingly low, registering a mere 3.07% increase [11]. This disparity highlights the inadequate investments in road infrastructure, failure to accommodate rapid motorization, and consequently increasing the risk of road crashes. In addition, the roads in Pakistan are shared by a diverse range of users, including pedestrians, bicyclists, motorcyclists, and motor vehicles, without proper separation, which increases the likelihood of crashes [12], and [13]. Moreover, a considerable proportion of road users in Pakistan lack awareness and understanding of road safety regulations, leading to a higher risk of road crashes [14], and [15].

All the above factors collectively contribute to the pressing road safety issues in Pakistan, evident in terms of both fatalities and economic losses. According to estimates by the World Health Organization, Pakistan records approximately 27,582 traffic fatalities annually. Likewise, the estimated mortality rate per 100 thousand population in Pakistan is 14.3 [5]. The economic cost of road crashes and injuries is estimated to be over 100 billion rupees for Pakistan [16]. Therefore, there is an urgent need to thoroughly assess and address the road safety issues in Pakistan to enhance road safety standards, which in turn, will mitigate the loss of lives and economic costs caused by these crashes.

To fill the above research gap, the present study conducted a comprehensive analysis of the road safety challenges in

Pakistan. The analysis is carried out from five perspectives: infrastructural, institutional, socioeconomic, psychosocial/behavioral, and educational. Each perspective is thoroughly examined to provide a comprehensive understanding of the multi-faceted challenges that contribute to road safety issues in the country. Moreover, to improve the road safety situation in the country, a set of potential countermeasures that can serve as a foundation for improving the current state of road safety are recommended.

II. METHODOLOGY

In order to provide a detailed overview of road safety in Pakistan, this paper follows a structured approach. First, a concise summary of the road safety statistics in Pakistan is presented based on the analysis of quantitative data extracted from official government authorities sourced online. The analysis of five aspects of road safety issues is then examined based on a thorough review of research articles published in reputable, peer-reviewed journals and reports from esteemed international organizations such as the World Bank, the Asian Development Bank, and the World Health Organization.

In addition to relying on the existing road safety literature in Pakistan, the credibility of the reviewed studies is further informed by the authors' direct exposure and personal experience with road safety issues in the country. This practical understanding adds depth to the evaluation. Lastly, building upon the insights gained from the discussion in the road safety challenge section, recommendations are suggested to address the identified issues.

III. STATUS OF ROAD SAFETY IN PAKISTAN

Pakistan's national road network is about 263,775 km long, including 12,131 km of national highways, motorways, and expressways [17], and [18]. Despite the seemingly vast transportation infrastructure, the concerning statistics related to fatalities and injuries indicate a pressing need for enhanced safety measures for safer transportation of both individuals and goods across the country.

According to the Pakistan Bureau of Statistics [11], a total of 104,105 crashes were recorded between 2009 and 2020. Among these, 44,959 were fatal, and 59,146 were non-fatal incidents, as illustrated in figure I. These crashes resulted in 55,141 fatalities and 126,114 injuries, as shown in figure II. It is worth noting that the trend line of fatalities has a slight incline compared to that for injuries. The highest number of crashes and injuries were observed in the year 2017-18 (refer to figure I and figure II), and the highest number of fatalities occurred in 2018-19, showing a marginal increase from the figures of 2017-18.

Moreover, in recent years, the total number of crashes and the corresponding fatalities and injuries in Pakistan have witnessed a concerning rise. This could be attributed to the increased number of vehicle owners in the country. As shown in figure III, vehicle ownership increased substantially from 123,957 to 207,630 between 2009 and 2019. The rapid increase in vehicle ownership is due to the increased urbanization and economic growth in the country [19]. Moreover, the availability of car loans with easy

installment plans offered by banks has made vehicle ownership more accessible, prompting more people in Pakistan to purchase vehicles.

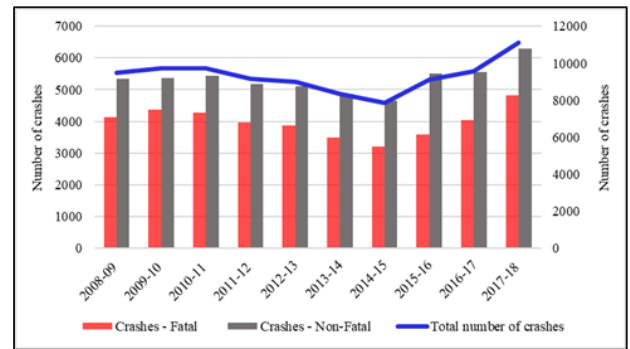


Figure I: Relative Trend of Fatal, Non-Fatal, and Total Crashes

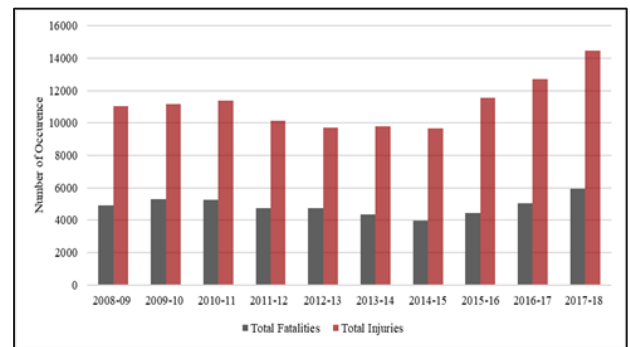


Figure II: Comparison of Road Crash Fatalities and Injuries

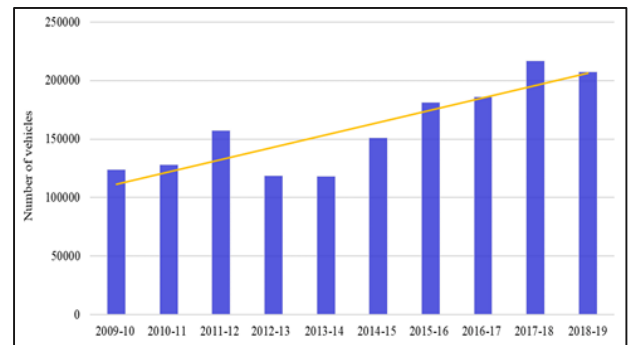


Figure III: Vehicle Ownership in Pakistan

IV. ROAD SAFETY CHALLENGES IN PAKISTAN

A. Infrastructural Aspects

In Pakistan, several infrastructural elements have a direct effect on road safety. The first is the country's insufficient road infrastructure. Despite considerable growth in road construction, the existing roads are not sufficient to meet the nation's growing transportation demands. For instance, a significant portion (75%) of the national highways, which serve the majority of the country's daily transportation, comprises only two lanes. Similarly, the national highways, motorways, and expressways collectively make up a mere 4.6% of the entire national road network. Astonishingly, this fraction handles nearly 80% of the commercial traffic in the country, underscoring the immense pressure on these limited roadways [17], and [18].

Second, besides the insufficient infrastructure, the existing road network has many engineering and construction flaws

that directly or indirectly contribute to road crashes. These include issues like potholes, the usage of improper pavement materials, and inadequate compaction during construction, as illustrated in figure IV. In addition, issues such as inadequate road signage, absence of acceleration or deceleration lanes, sharp curves, insufficient horizontal alignments, and short weaving sections add to the list of road infrastructure deficiencies. These shortcomings collectively contribute to the increasing risk of road crashes in the country.



Figure IV: Inadequate Road Structure (Source: Google)

Third, Pakistan's current road networks are inadequate to meet the needs of the local traffic, including pedestrians and non-motorized vehicles. Bicyclists and motorcyclists can often be seen traveling the wrong way (opposite the traffic direction) on high-speed and urban roads due to the lack of specific lanes and insufficient service roads [20]. Consequently, the risk of road crashes is always high. Pedestrians can also be seen walking and crossing the main roads in unsafe manners [15], [21], and [22]. Thus, the existing road design practices fail to meet the needs of various transport modes. In addition, most of the main road networks in the country dissect through densely populated areas, which in turn increases the likelihood of road safety conflicts.

Fourth, highways in Pakistan are constructed in accordance with international best practices. Therefore, in most cases, highways have standard-width lanes. A common issue lies in the unpaved and varied-width shoulders. On some sections of highways, smaller, slower-moving motorized/non-motorized vehicles use these unpaved shoulders and occasionally venture onto the carriageways, resulting in a higher probability of fatal crashes.

Lastly, a significant concern that has often been overlooked is the illegal extensions of the roadside shops in the vicinity of road carriageways (particularly in the urban areas). These encroachments lead to traffic congestion and crashes, particularly during peak hours. Similarly, various street vendors dealing in items like food, jewelry, clothing, toys, and shoes encroach on the city's pavement and footpath sections, increasing the risk of road safety conflicts. Moreover, parking problems, including unauthorized parking on roads and footpaths, pose a significant road safety concern in Pakistan [23], and [24]. Illegally parked vehicles obstruct the smooth flow of traffic, forcing vehicles to maneuver erratically, leading to potential road crashes [25]. In addition, this practice reduces road space, making it dangerous for pedestrians who are compelled to share the roads due to blocked

footpaths, increasing their vulnerability to crashes [21], and [26].

B. Institutional Aspects

Road safety has a complex and dynamic nature that requires collaboration among diverse sectors within society. As a result, all relevant institutions, including government and private sectors, must work together. More importantly, the government should, in theory, be the primary body responsible for such efforts. However, in Pakistan, there is a lack of dedicated government institutions solely responsible for road safety [26]. In addition, the existing lower-level departments are often understaffed and lack the necessary professional expertise to effectively address the complexities of road safety in the country.

An evident sign of inadequate institutional framework and management in Pakistan is the frequent presence of disabled vehicles (disabled due to crashes or technical faults) on roads, often lacking proper warning signs. For instance, overturned trucks can generally be seen on the highways after a crash, obstructing the road sections for several days (refer to figure V). These sites are typically marked with rocks and boulders, which themselves can lead to secondary crashes. In certain instances, disabled vehicles are parked on two-lane highways without any warning signs, creating hazards for oncoming vehicles traveling at high speeds. Similar situations can be seen in the work zones, where improper barriers and signs are provided on the construction sites, contributing to many fatal crashes.



Figure V: Overturned Trucks Blocking the Carriageway (Source: Google)

The negligence of government departments in Pakistan regarding road safety is a serious concern. Even with departments, officials often lack the awareness and experience to enforce road safety measures [27]. This lack of awareness has resulted in a deficit of effective policies and proper enforcement of rules and regulations, leading to disastrous events. For instance, an incident was reported on 25 June 2017, where an oil tanker was overturned due to a sharp turn on the highway. Despite being a manageable situation initially, the oil tanker caught fire after several hours due to the delayed and negligent response from the safety institution, resulting in the tragic loss of over 219 lives and hundreds of injuries [28].

Many Western countries have road safety programs and effective planning and enforcement. Similarly, in Asia, countries like Malaysia are also deeply engaged in introducing numerous road safety policies by well-coordinated institutional frameworks [29]. These

initiatives include conducting comprehensive research and reviewing existing road safety practices in order to collect data that can be used to develop evidence-based action programs aimed at enhancing road safety. However, Pakistan currently lacks such robust initiatives. Currently, only the Ministry of Communications and Traffic Police is solely responsible for road safety at the federal and provincial levels in the country, but their efforts have not led to the development of a stable road transportation scheme. This indicates a critical need for Pakistan to learn from successful models and establish effective road safety policies and frameworks.

C. Socio-Economical Aspects

Pakistan's gross domestic product has increased substantially, with an estimated annual growth rate of over 5% between 2017 and 2018 [30]. This economic growth has improved financial stability for many, prompting an increased desire for vehicle ownership. However, it is important to note that a substantial proportion of the country's population still lives in poverty [31]. These income disparities in the country significantly impact peoples' transportation preferences. Typically, those with lower incomes in Pakistan tend to rely on unsafe modes of transportation, including poorly maintained vehicles, crowded buses, and rickshaws. These modes, in turn, increase the risks of safety issues on the roads.

Moreover, a significant portion of the lower-income population in Pakistan works in a variety of labor-intensive jobs that involve transporting goods in rickshaws, human-powered carts, or other non-motorized vehicles. Thus, it is common to see people pushing carts through congested junctions/intersections with many approaches and hundreds of motorized vehicles. This contributes to traffic congestion and an increased likelihood of road crashes. The situation becomes even worse during the night as the non-motorized means (e.g., carts) lack adequate reflectors and headlights, making it challenging for motorized vehicles to identify them and avoid potential collisions.

In addition to the above, in Pakistan, a substantial proportion of the country's population uses poorly maintained private vehicles. Due to financial constraints, the owners often delay necessary auto maintenance and repairs. On the same note, when it comes to taxis, private taxis are typically operated by individuals with limited financial means who rely on these vehicles for their livelihood. Consequently, they often neglect vehicle maintenance to save on costs. Therefore, a significant number of these taxis lack essential safety features like seatbelts and airbags, posing significant safety risks for both drivers and passengers.

Moreover, in pursuit of higher profits, heavy vehicle owners/drivers often overload their vehicles. This overloading not only obstructs the driver's visibility but also poses a significant hazard to other drivers on the road, resulting in a variety of dangerous and unsafe situations [32]. Also, the goods are generally unsecured, increasing the likelihood of commodities falling and endangering people, especially at higher speeds and sharp turns. Moreover, in certain scenarios, people sit on top of or at the sides of public and goods vehicles (refer to figure VII),

further amplifying the risk of unsafe circumstances [33], and [34].



Figure VI: Overload and Overpopulated Vehicles (Source: Google)

D. Socio-Cultural/Behavioral Aspects

The socio-cultural (behavioral) factor plays a significant role in road safety issues in Pakistan. Most drivers in the country disregard the traffic rules, resulting in various safety issues such as congestion, road rages, and crashes [35], and [36]. In the following sections, this study attempted to summarize the array of improper behaviors exhibited by drivers in the country.

In Pakistan, lane discipline is uncommon among drivers [37]. In general, drivers honk their way through any available gap between vehicles. The problem is worsened by the diverse mix of traffic on the roads. It is common to witness various non-motorized vehicles sharing and competing on the road alongside private cars, passenger vehicles, trucks, and motorcycles. This phenomenon is more evident on urban roads, leading to chaotic traffic and safety conflicts.

Aggressive driving, such as tailgating, honking, excessive speeding, and red-light running, is another prevalent issue among drivers in Pakistan [38], and [39]. Typically, aggressive driving on the road can take on two different forms: Instrumental and Offensive [40]. Instrumental aggressive driving behavior includes actions like speeding and frequent lane changes, while offensive, aggressive driving involves behaviors like horn-honking and cutting off other drivers. Unfortunately, both types of aggressive driving behaviors are common on roads in Pakistan. Moreover, Krahe et al. [41] concluded that aggressive driving behavior is influenced by personality and age. In Pakistan, both these factors (i.e., macho behavior and underage driving) are more common, often leading to more aggressive driving tendencies, resulting in a higher likelihood of road crashes.

In addition to the above, a common issue contributing to road safety concerns is unauthorized roadside parking (refer to figure VII) [23]. Drivers often park their vehicles on the road, even in areas where parking is not allowed or where designated spaces are unavailable, leading to road safety issues, especially during peak hours. Recent research focusing on road safety issues in Lahore, Pakistan, has also identified this parking issue as a major cause of traffic congestion and associated safety risks [42]. Another safety concern in Pakistan is the prevalent use of high-beam lights on vehicles, especially during nighttime [43]. The excessive use of these high-beam lights by drivers at night can seriously affect the visibility of oncoming drivers, creating hazardous situations. Batool et al. [44] have also reported that in Pakistan, a significant

proportion of drivers use high-beam lights, which increases the likelihood of severe safety outcomes. Lastly, speeding and rash driving is other improper behavior among road users in Pakistan [38], and [39]. These behaviors are common among drivers of all ages, genders, and experience levels; however, they are particularly evident among young drivers and those operating commercial vehicles. Meanwhile, it is worth noting that young motorcyclists in Pakistan are often involved in risky driving and lack awareness of traffic rules and safety regulations [45], and [21].



Figure VII: Unauthorized and Illegal Parking (Source: Google)

E. Educational Aspects

In developed countries, like the United States, road safety education is a mandatory part of the curriculum for school and college students [46]. The Federal Highway Authority in the United States has established comprehensive safety programs specifically designed for students. These programs have five key components: engineering, education, enforcement, environment, and emergency. They also organize seminars to educate students about road safety regulations and responsible behaviors. Moreover, school road safety education is regularly assessed to make it more effective.

Unfortunately, Pakistan currently lacks such initiatives designed to educate the youth about road safety. The absence of a structured road safety education system within schools, colleges, and universities has contributed to common improper behaviors among road users, particularly prevalent among young drivers and motorcyclists. For instance, pedestrians often choose to cross roads directly on the carriageway, even when overhead bridges are available, resulting in a significant number of road crashes [22].

In addition to the above, driving unregistered vehicles and underage driving is a common practice in Pakistan [47]. Prior research indicated that these issues could be effectively addressed through well-designed education policies targeting existing and new road users [27]. The introduction of basic education on road user responsibilities could lead to many positive changes [48], and [49]. However, Pakistan currently lacks the necessary targeted education policies and councils to educate both current and prospective road users effectively.

Another important factor is that a significant proportion of road users in Pakistan, particularly commercial vehicle drivers, have not received formal education. This lack of formal education makes it difficult for them to acquire essential knowledge about road safety. Many of these drivers have learned to drive from other individuals and lack formal driving training [50], and [51]. Consequently,

their driving behaviors can pose an increased risk of safety issues and conflicts on the road.

Moreover, in Pakistan, driving schools that offer formal driving training to prospective drivers are not easily accessible and often come with a high cost, limiting access to a large portion of the population. Consequently, a majority of the drivers in Pakistan imitate others to learn the basics of safe and appropriate road practices [50]. This reliance, especially among young and impressionable minds, contributes to unsafe road safety behaviors, creating a vicious circle. Moreover, many driving schools in the country do not provide high-quality education to promote awareness among new road users.

V. RECOMMENDATIONS

Based on the review provided in the above sections, the present study suggests the following countermeasures:

1. The existing road infrastructure in Pakistan does not meet the road users' demands, presenting several challenges that directly impact the road safety situation in the country. To address these issues and enhance road safety, initiatives, such as expanding the road network to accommodate increasing traffic, maintaining high road quality, and implementing safer road designs with dedicated lanes for non-motorized vehicles and pedestrians, can be taken to enhance road safety in the country.
2. A critical aspect of improving road safety in Pakistan revolves around strengthening the institutions responsible for managing and enforcing safety measures. This involves the establishment of dedicated bodies with the expertise required to address the complexities of road safety. Furthermore, raising awareness and providing training for government officials is essential to ensure the effective enforcement of road safety regulations and practices.
3. In the past, various empirical approaches were employed to collect crash data, and subsequent analyses were conducted to estimate vulnerabilities. Nonetheless, a more practical and realistic approach is required, which involves establishing a well-organized and centralized data collection system. To achieve this, it is imperative that all relevant agencies, including the Department of Transportation, National and Provincial Highway Authorities, and Traffic Police, collaborate to maximize the system's potential while adhering to standardized practices.
4. Most of the cars introduced in Pakistan lack the recommended safety features. Therefore, it is imperative for the government to mandate comprehensive safety tests for all new cars before they are officially approved for use on the roads. This measure is crucial to prevent potential safety issues and conflicts.
5. The unauthorized extensions of shops and carts along the roads significantly contribute to traffic congestion and crashes. It is crucial for local municipal and road safety authorities to take

decisive actions to eliminate these roadside shops and carts. Meanwhile, alternative solutions should be provided for the cart owners, such as offering business loans with easy installment plans to enable them to establish proper shops and conduct their businesses safely and legally rather than on the roadside.

6. Car parking on the roadside and in prohibited areas is a serious problem in Pakistan, causing traffic congestion and road crashes. To address this problem effectively, a two-fold approach should be considered. Firstly, strict fines and penalties should be imposed for illegal parking to discourage this behavior. Secondly, the government should undertake initiatives to build and designate specific parking spaces, especially in major cities, to provide drivers with suitable alternatives for parking their vehicles safely and legally.
7. Youth play a crucial role in shaping the future of any society. Notably, a significant portion of Pakistan's current population consists of young individuals. Therefore, it becomes increasingly imperative that young drivers receive adequate attention to improve their understanding and practices regarding road safety. To achieve this goal, it is highly recommended that road safety seminars be organized in educational institutions, including schools, colleges, and universities. These seminars would serve to improve students' awareness about road safety and equip them with the knowledge and behaviors needed to become responsible and safe road users.

VI. CONCLUSION

In Pakistan, crashes are generally unreported due to several reasons, including misconceptions about legal formalities, victim and family negligence, and an insufficient data collection system. Therefore, it is challenging to establish reliable estimates of the road crash fatality rate patterns, making it difficult to compare these rates with those of developed countries. However, based on the available data, an alarming average of 5,013 people in Pakistan annually lose their lives in road crashes. Many of these tragic fatalities could be prevented, but substantial efforts are required to address this issue.

In this regard, the present study offers a comprehensive overview of road safety issues in Pakistan from five different dimensions: infrastructural, institutional, socio-economic, socio-cultural, and educational. The findings highlight the significant risks associated with inadequate road infrastructure and various engineering deficiencies, leading to an increased likelihood of road crashes. Also, the socio-economic disparities in Pakistan play a pivotal role in road safety issues, as lower-income individuals rely on unsafe modes of transportation and poorly maintained vehicles. Moreover, socio-cultural factors, including behaviors like aggressive driving, unauthorized parking, and the inappropriate use of high-beam lights, contribute to the higher number of road crashes in the country. Lastly, the absence of organized road safety education in educational institutions further exacerbates road safety

challenges, leaving young, inexperienced drivers ill-equipped to navigate the roads safely.

In order to improve road safety in Pakistan, it is important to go beyond interventions since the interventions are not viable without adequate implementations. Therefore, institutions should be established to uphold road safety regulations and foster a culture of safety within the country. In parallel, conducting thorough research to gain insights into the current safety situation and developing appropriate countermeasures is essential. Furthermore, there is a pressing need for road safety awareness campaigns. In this regard, seminars can be organized across various institutions, including schools, colleges, and other organizations. These seminars can play a pivotal role in educating a broader audience about safe and efficient road use.

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Authors Contributions

The authors namely Amjad Pervez, and Ammar Oad, equally contributed their efforts in this research work.

Conflict of Interest

The authors declare no conflict of interest and confirm that this work is original and not plagiarized from any other source, i.e., electronic or print media. The information obtained from all of the sources is properly recognized and cited below.

Data Availability Statement

The testing data is available in this paper.

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