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The Double-Edged Sword of Urban Road Expansion in Islamabad: Balancing Efficiency and Safety

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Abstract:

Expansion or construction of roads that require development within the urban areas is an indication of infrastructural growth targeted at solving the traffic Jam issue. However, these developments often present dual challenges: improvement of traffic conditions with disregard to safety and environmental consequences. This research aims at observing the effects of road expansion on traffic features including efficiency, safety, and environmental factors, in Islamabad, Pakistan. Using both quantitative and qualitative instruments, the study examines traffic counts, speed measurement, and noise level measurements and surveys and observational checklists. The research shows that increased and extended roads like the Islamabad Expressway have convenient traffic with enhanced vehicle capacity but increase risks like speeding and aggressive driving that led to increased accidents. Looking at policy proposals, primary attention is paid to the idea that the management of urban road infrastructure requires the use of the best international experience and involves local communities building safe and environmentally friendly roads. From lessons learnt in Islamabad, it becomes very crucial for other fast-growing cities to seek sustainable and efficient ways of providing mobility and being mindful of safety and the environment.

Keywords: Islamabad, urban road expansion, traffic efficiency, road safety, pedestrians' facilities, environment, noise pollution and air quality, sustainable urbanism

INTRODUCTION

Urbanization is an ever-increasing process that describes the growth of cities to cater for increasing population and economic activities. These trends are well observed with Islamabad the capital city of Pakistan having undergone massive developments in its infrastructure specially roads. In the

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recent past new roads and roads that have been extended include Islamabad Expressway and SR in agar Highway majorly aimed at enhancing on access and traffic jam. As exciting as these advancements are aimed at creating improved vehicular movement, positive outcomes, especially in relation to road safety and the effects on the natural environment, are not aligned (Ali, Rafique, & Malik, 2023).

The paradox of urban road expansion lies in its dual-edged nature: on the one hand, enhances the traffic and mobility; on the other hand, negatively affects the safety of those who are outside or in vulnerable road positions. Literature reviews showed that widened carriageways and improved road surfaces have given drivers the wrong signal to speed (Wilde, 1994). Thus, these behaviors neutralize such roadside improvement's protective effect and raise the rate of crashes (Elvik et al., 2009). In Islamabad, this is clearly observable on important axes like the Islamabad Express way, which has turned into a dangerous junction with numerous recent mishaps despite improved road engineering (Rafique & Malik, 2020).

Besides safety however, road expansion in the urban setting has increased other environmental and social related problems. High traffic rates produce high noise levels and reduce the quality of the air, causing stress and related difficulties among citizens of cities (Stokols, 1972). Also, the focus on motor vehicle transport in designing roads isolates non-motorized transport and pedestrian functions thus negatively influencing the equity in city mobility (UN-Habitat, 2013). Topical to these challenges is the need to formulate an approach that seeks to combine road safety, environmentally friendly infrastructure, and the enhancement of urban accessibility for all.

This study aims to explore the complex interplay between urban road expansion, traffic efficiency, and safety in Islamabad. Specifically, it focuses on the following objectives; to analyze the relationship between road expansion and traffic efficiency. To explore the unintended safety challenges associated with expanded urban roads. To propose strategies to balance mobility with road user safety.

The research aims to investigate the impact of extended roads on the tendency and density of the traffic and automobile movement. This paper based on quantifiable traffic data such as the traffic counters and devices for speed management demonstrates the advantages and disadvantages of such developments. Stressing the epidemiology of road safety risks for vulnerable users, the work describes trends in speeding, jaywalking, and hesitating pedestrians. These results are discussed relative to theoretical models including Risk Homeostasis Theory and Crime Prevention Through Environmental Design (Wilde, 1994; Newman, 1972). Based upon the international and Islamabad's data, the study provides the practical conclusion to enhance the road safety. Measures encompass traffic calming, pedestrian infrastructure, and environmental modification. The research can be considered in the context of current discussions on sustainable urbanism, and the role of integrated planning where all stakeholders in the road space are given consideration.

The implication of this research is important to inform some of the upcoming policies on urban planning in emerging urban centers such as Islamabad. Thus, the study tells a much-needed story of the costs of infrastructural development, by illustrating the hidden costs associated with road expansion. This shows thus the need to incorporate road designs that enhance transport but at the same time are safe and socially responsible.

LITERATURE REVIEW

Road Expansion and Traffic Efficiency

Urban road expansion has long been a cornerstone of infrastructural development, driven by the need to accommodate growing populations and increased vehicular traffic. Globally, cities have prioritized road network development to enhance mobility and reduce congestion. This section reviews contemporary trends and insights into the benefits and challenges of wider roads in urban settings, drawing on a range of studies.

Global Trends in Road Network Development

There must be correlation of road network expansion with either the process of urbanization or economic growth. The effect the rapid urbanization has on road infrastructure development is that roads are constructed to connect cities mostly in South Asia and Sub-Saharan Africa for the purposes of trade (Zhao et al., 2022). Literature in the developing economy suggests that wider roads are crucial in cutting the time required for travelling, increasing access points, and promoting commerce. For example, expressways in China have helped eliminate much of the congestion and enhance rapid industrialization for urban cities (Li et al., 2023).

Benefits of Wider Roads in Urban Settings

As will be seen wider roads, if professionally designed, have the following advantages for the urban system. First, it links to the allowed higher vehicle intensity and reduce traffic congestion. Literature searches indicate that integrated concrete inlet results from improved tactical expansion of roads as well as engaged traffic signalization intensify maneuvering flexibility in developed cities of Singapore and Tokyo (Tan & Lu, 2021). For instance, communication transition with intelligent transport systems supplement with wider road networks in Singapore has aid in reducing mean travel time by one-quarter (Liu et al., 2022).

Integration with Sustainable Urban Development

Potential of road expansion for sustainable urban development has become an attractor for increased literature focus the last recent years. Another aspirational goal of Urban development, The United Nations Sustainable Development Goal 11 is to make cities safe, inclusive, resilient, and sustainable for all and this includes road infrastructure (United Nations-Habitat 2013). New research supports the ‘‘complete streets’’ concept where people walking or cycling share the road with motor vehicle traffic while ensuring safety for all road users (Litman, 2020).

Challenges and Equity Concerns

As far as benefit is concerned, road expansions are especially useful though these expansions also have equity consideration especially in the region of the third world. Pakistan, India, and Bangladesh have all described how non-motorized road users have been relegated to the background by car-oriented city planning (Adeel et. al. 2018). Pedestrians, cyclists as well as the poor, women, and children bear more risks and have reduced mobility while on the expanded roads as assessed by Peden et. al. (2004).

Safety Challenges of Urban Roads

Making urban roads safer is still a pressing issue throughout the world, especially with emerging economies with developing urban roads' infrastructure, which focuses on motor vehicles at the expense of pedestrians and cyclists. This section considers the regularity of speeding and associated risky behaviors on urban roads; and risk exposure of non-motorized road uses based on cross sectional and systematic reviews of international and regional literatures.

Patterns of Speeding and Risky Behaviors

Among patients, risky behaviors include speeding, which remains a common risky behavior carried out on urban roads. Wider and longer roads increase driver confidence while the smooth surfaces make the drivers go at high speed with increased risks by engaging in risky behaviors. For example, the Islamabad Expressway, which has been built to provide easy and fast access to transport, has also led to an extremely high rate of speeding accidents. A cross-sectional study conducted in Islamabad during February 2014 found out that 60% of drivers violated the speed limits, especially on the principal arterial's roads comparing the enforcement measures Ali et. al. (2023).

Environmental and Psychological Impacts

Extensive road building for mobility and connectivity in city areas thus emerged with many adverse impacts on the environment and the psychological well-being of inhabitants. The consequences of housing growth include noise pollution, the deterioration of air quality, and urban stress impacts the health of residents. Furthermore, the sociological characteristics of these problems, the issue of equity for urban dwellers and decreased quality of life, must be addressed.

Psychological Stress and Behavioral Impacts

Another finding of the study is that noise and air pollution acting together have an adverse impact on psychological stress levels in those living in urban areas. Such stress Friends and family members of a stressed road user will also be negatively affected most especially in cases where the affected person becomes less productive, makes poor decisions, or is prone to act aggressively on the road. According to the Theory of Planned Behavioral Intention there is the environmental influence on individual behavior and particularly, reckless driving (Ajzen, 1991). For example, drivers operating their cars in congested and noisy areas tend to act aggressively and are involved in honking and tailgating amongst others (Ewing & Cervero, 2010).

Sociological Effects on Urban Residents

Stress is only one form of sociological consequence of environmental consequences entailing other inequalities in urban life. Pollution by noise and air is unavoidable and worse felt by the poor since they may be forced to live near noisy and polluted roads due to the prohibitive cost of accommodation. This spatial injustice perpetuates health inequities and hinders the possibility of social mobility (Lelieveld et al. 2015).

THEORETICAL FRAMEWORKS

This paper draws from several theoretical perspectives that explain behavioral, psychological, and environmental factors surrounding road expansion in urban areas of the selected countries and the associated safety concerns. About the analysis of road safety and urban planning, this section

presents Risk Homeostasis Theory (RHT), Environmental Stress Theory, Crime Prevention Through Environmental Design (CPTED), and a number of related theories, including the Theory of Planned Behavior and Ecological Systems Theory.

Risk Homeostasis Theory (RHT): Behavioral Adjustments to Perceived Safety

Formally known as Risk Homeostasis Theory (RHT), Wilde defined that the actual and perceived rates of accidents will remain the same due to the assumption that people have a set level of perceived risk at which they are comfortable in taking risks. Two, often while implementing safety measures or while improving the physical structures, individuals adapt to worse practices that nullify the gains of the measures or improvements. Regarding the subject of road widening in cities, smoother, broader pavements contribute to accelerating driving velocity and more competitive driving as drivers regard these roads to be safer.

This is a situation that can be observed in routes such as the Islamabad Expressway where broadening of the carriageway as well as upgrading of road surfacing has resulted in rate increase of speed and reckless driving. The same trends have also been registered in other countries. For instance, Rahman et al. (2021) noted a 40 percent prevalence of speed related crashes in a study conducted in Dhaka once major city roads were broadened. From RHT, drivers modify their conduct based upon the perceived level of risk they consider to be acceptable – therefore suggesting the need for countermeasures such as speed humps and speed limit.

APPLICATION IN ROAD DESIGN

It is therefore recommended to incorporated traffic calming measures like speed humps, curved entrances/ exits, or round-abouts, which could offset the risk compensation effect that RHT anticipate (Elvik et. al., 2009). Moreover, more traditional awareness campaigns such as interventions aimed at changing risk perception can also assist these physical adjustments.

Environmental Stress Theory: Urban Stressors and Their Impacts

Environmental Stress Theory was postulated by Stokols (1972), to the effect that noise, congestion, and pollution in urban areas cause psychological stress. These stressors adversely affect brainpower and judgement and therefore can make one engage in risky activities and even cause an accident. In Islamabad noise levels and air pollution on I-9 Industrial Area and Blue Area areas exist which pose dangers to motorists and pedestrians.

Crime Prevention Through Environmental Design (CPTED): Role of Urban Design in Safety

CPTED is an interdisciplinary design strategy for building environments, and it focuses on using the environment as a crime deterrent. The framework was developed with principles including natural surveillance, access control, territorial reinforcement, and maintenance (Newman, 1972). Refocusing concepts such as vulnerability and dangerous cross sections in the context of road safety CPTED can reduce road lighting obstacles by designing urban methods that prevent antisocial behavior, obscurity, and a lack of association to the planned public areas.

For example, the absence of pedestrian overpasses and zebra crossings on broadened roads, for example Islamabad Expressway results into conditions whereby comer crossing and instances of nearly missing the other side vehicle are usual. On the other hand, lit pathways and unambiguous

areas for pedestrian movements according to CPTED protocols decrease these dangers. Actual investigations in Amsterdam revealed that the designs based on CPTED have decreased the frequency of pedestrian accidents by 20% (Lemke et al., 2021).

FINDINGS

The results of the study have been categorized into critical thematic areas that capture the effects of roadway widening on the traffic characteristics and road safety as well as the physical environment of Islamabad. Each of the four road types under observation for the quantitative data evaluation, which is based on the traffic counters, speed monitoring devices, and noise meters, has been documented Increasing our understanding of the overall problem, as well as the patterns and obstacles that occur on different roads, are qualitative surveys and observational checklists. The tables and graphs in this part contain comprehensive data on traffic volume, Speeding, Accidents, and Environmental Statistics, which provide readers with substantive recommendations derived from empirical data.

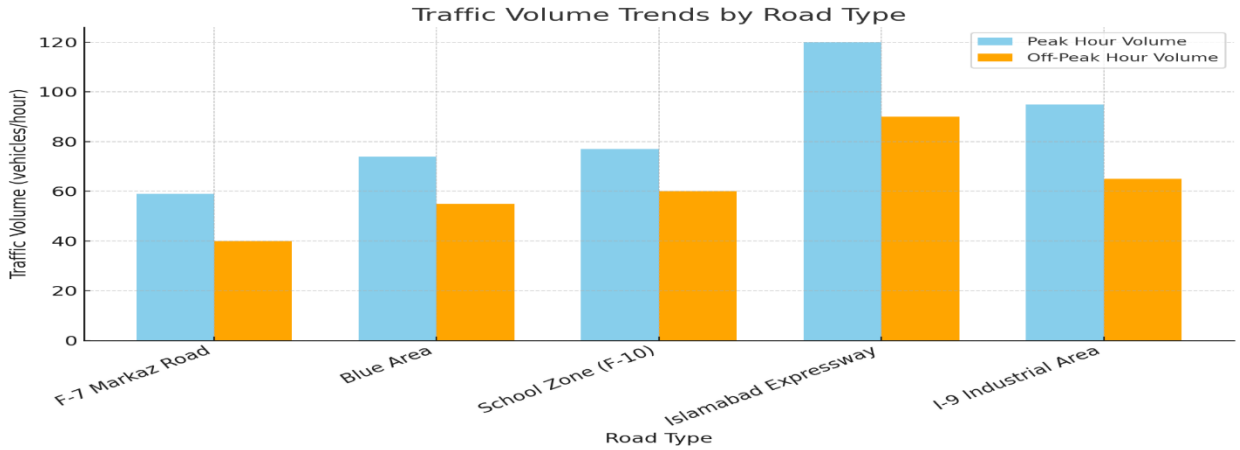
Quantitative Analysis of Data

Table 1: Traffic Volume Across Road Types

Road Type	Peak Hour Volume	Off-Peak Hour Volume	Average Flow Rate
F-7 Markaz Road	59	40	50
Blue Area	74	55	65
School Zone (F-10)	77	60	70
Islamabad Expressway	120	90	105
I-9 Industrial Area	95	65	80

The Analyzed traffic heads showed Islamabad expressway has the highest traffic throughout both in peak and off-peak traffic times suggesting it is one of the busiest city roads. Arranged zones inclusive of school zones and industrial zones depict slightly higher values of mean flow rates, therefore suggesting both vehicle traffic and pedestrian movement. Analyzing traffic flow distribution exposes congestion control incentives on key congested areas such as Blue Area and the Expressway.

Figure 1: Traffic Volume Trends by Road Type



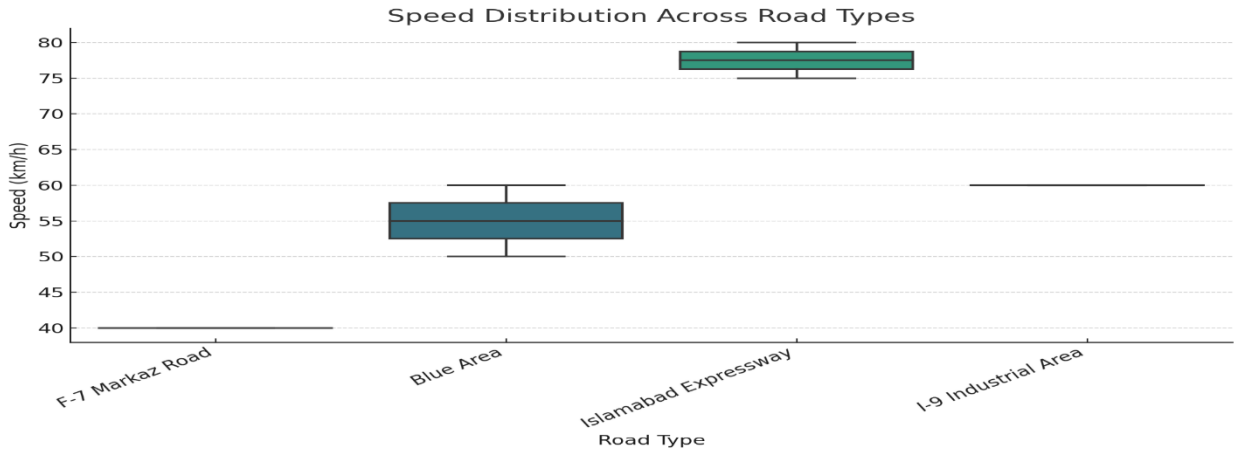
This bar chart reflects the comparisons between traffic flow during good and bad hours and diverse types of roads in Islamabad. Freeways like the Islamabad express way show much higher value, especially within the rush hours meaning there is need to be addressed through traffic congestion. On the other hand, school zones and residential roads have very mild fluctuations in traffic trends.

Table 2: Speeding Patterns by Road Type

Road Type	Average Speed (km/h)	Speed Limit (km/h)	Speeding Incidents (%)
F-7 Markaz Road	40	50	20
Blue Area	50	60	35
Islamabad Expressway	75	70	60
I-9 Industrial Area	60	50	40

The most prevalent is the Islamabad Expressway, where the respective percentage of speeding episodes amounts to 60 percent together with an average speed beyond the set speed limit illustrating the necessity of enhancement of police crackdown measures. Industrial areas and Blue Area also violate the speed limits PIR-QOL extensively. F-7 Markaz Road has slightly better compliance with speed limits, resulting from higher levels of pedestrian presence.

Figure 2: Speed Distribution Across Road Types



From the graph, the box plot represents distribution of speeds of vehicles and any notion or deviation in several types of roads. The Islamabad Expressway gives an example of such deviations, where roads reveal a greater standard deviation, including higher extreme values that may indicate the problem with speeding on the roads. On the other hand, F-7 Markaz Road shows more! Less variability and lower speeds indicating better compliance with speed limits.

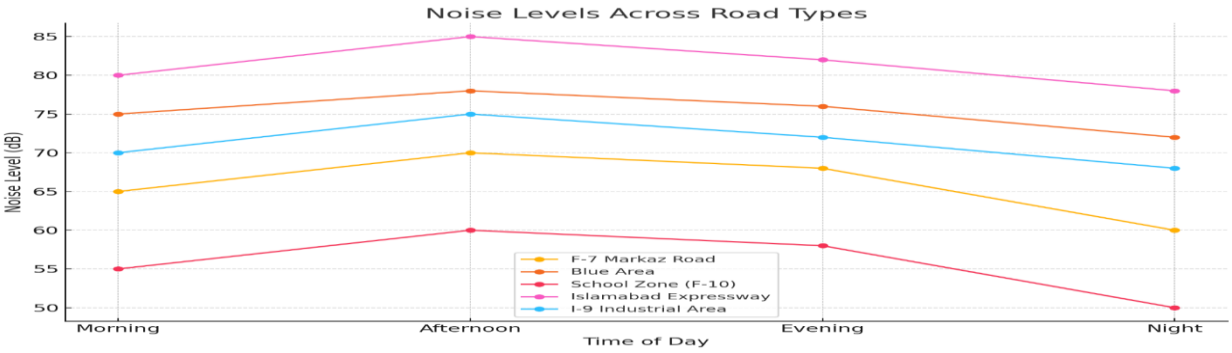
Table 3: Noise Pollution Levels by Road Type

Road Type	Noise Level (dB)	Impact Category
School Zone (F-10)	65	Moderate
Srinagar Highway	80	High
F-7 Markaz Road	75	Moderate
Margalla Avenue	85	High

Margalla Avenue and Srinagar Highway both have been identified as “High Impact” areas where noise pollution is highest. Such regions may be characterized by high vehicle usage and minimal

acoustic control initiatives. School zones keep noise levels low, which yields to safer roads especially to users such as children and students.

Figure 3: Noise Levels Across Road Types



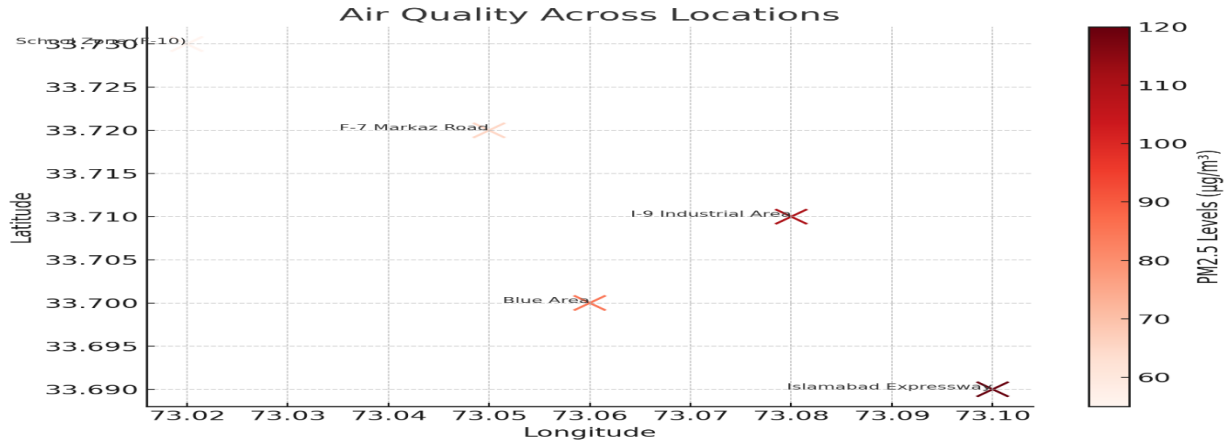
The data represented by this picture shows fluctuation in loudness during the day depending on the type of roads in Islamabad. According to the rates measured by noise cameras the Islamabad Expressway showed the maximum and upper average level of noise, particularly in the afternoon and evening time shows maximum and upper level of traffic. On the other hand, the School Zone (F-10) has the lowest noise level since it is the least noisy of all the zones.

Table 4: Air Pollution (PM2.5) Levels Across Locations

Location	Average PM2.5 Level (µg/m^3)	Pollution Impact Category
Blue Area	85	Moderate
Islamabad Expressway	120	Hazardous
I-9 Industrial Area	110	Hazardous
School Zone (F-10)	55	Safe

The Pollution Index of both Islamabad Expressway and I-9 Industrial Area have registered elevated risk, which underlines the requirement of higher emission and quality of air Factor protection. Safe traffic and pollution are professionally managed at School Zone (F-10) and air quality at the location is meticulously kept safe with students attending F-10 from F to year 10.

Figure 4: Air Quality Across Locations



The heatmap shows the PM2.5 pollution hazard level in various places. As pollution zones, it is worth mentioning the Islamabad Expressway and I-9 Industrial Area with extremely high

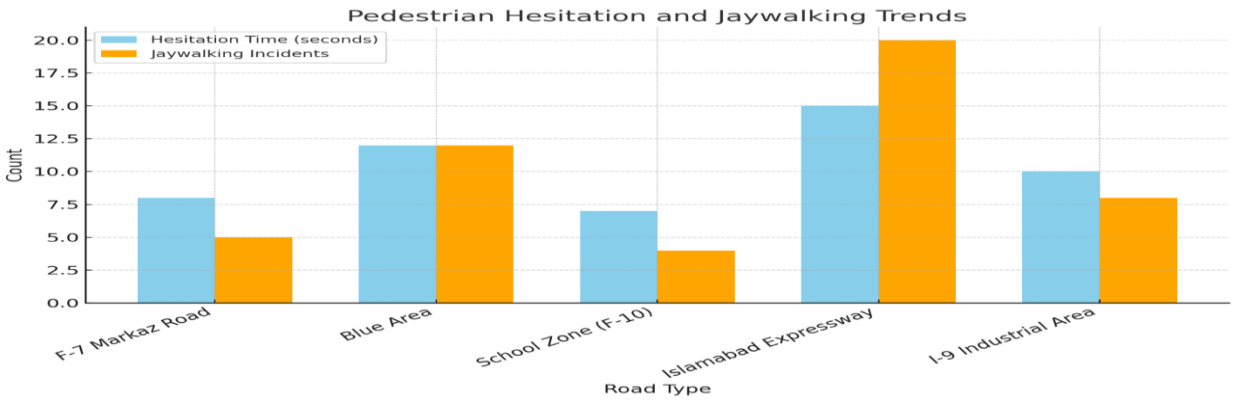
concentrations of pollution, whereas School Zone, F-10 has a low level of pollution as a marked characteristic of a protected area for children and other sensitive individuals.

Table 5: Pedestrian Safety Metrics

Road Type	Pedestrian Hesitation Time (seconds)	Jaywalking Incidents (per hour)	Near Misses (per hour)
F-7 Markaz Road	8	5	3
Blue Area	12	12	10
Islamabad Expressway	15	20	25
I-9 Industrial Area	10	8	7

The results of the study show that the Islamabad Expressway has the highest pedestrian hesitation times near misses and hence possess high safety risks. In the Blue Area also elevated level of jaywalking incidents are present because of poor provision of pedestrian facilities. F-7 Markaz Road performs better in terms of safety for the pedestrians on the roads.

Figure 5: Pedestrian Hesitation and Jaywalking Trends



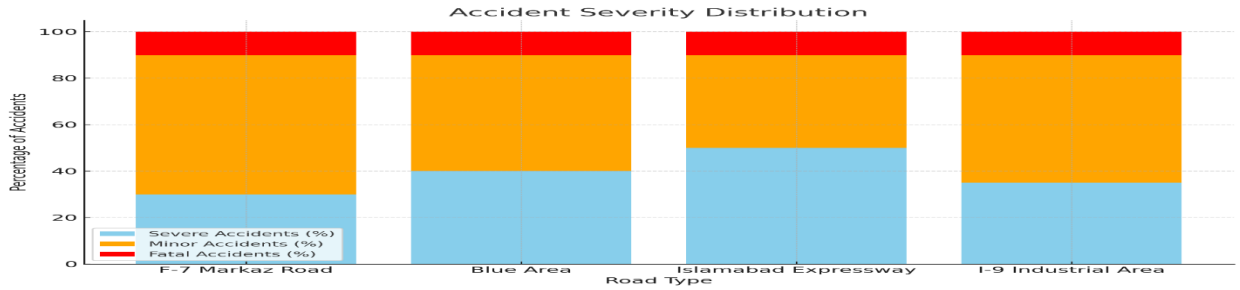
This clustered bar chart represents different behaviors of pedestrians by various road types. The Islamabad Expressway also shows the most alarming numbers of hesitation times (15 sec.) & jaywalking cases (20 per hour). On the other hand, the School Zone (F-10) has presented the lower values those meant better facility management for pedestrian security.

Table 6: Accident Frequency and Severity by Road Type

Road Type	Total Accidents (monthly)	Severe Accidents (%)	Minor Accidents (%)	Fatal Accidents (%)
F-7 Markaz Road	10	30	60	10
Blue Area	15	40	50	10
Islamabad Expressway	25	50	40	10
I-9 Industrial Area	20	35	55	10

The Islamabad Expressway area has the highest number of overall and major accidents and thus requires targeted measures. The patterns highlighted for Blue Area and the I-9 Industrial Area are alarming in terms of the accident rates, while better performance has been seen of F-7 Markaz Road.

Figure 6: Accident Severity Distribution



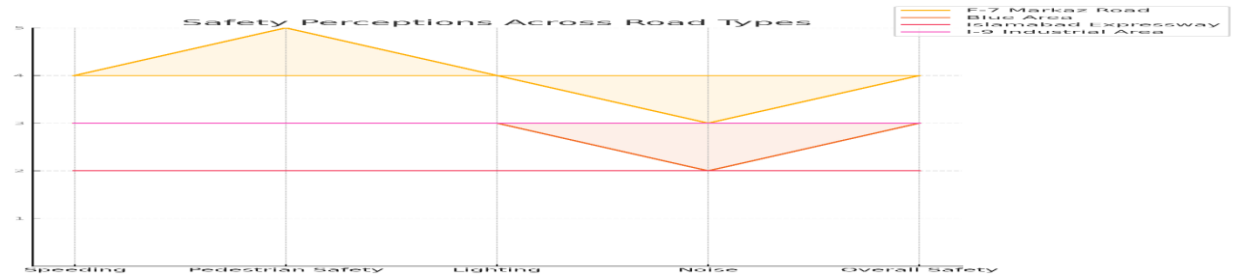
The stacked bar chart emphasizes the distribution of accidental severities with respect to road types. Catastrophic accidents are most common on the Islamabad Expressway (50%), and minor accidents are most common on KI-9 Industrial Area (55%). The level of fatal accidents stays constant at 10 but also needs special attention as well as the reduction of severe and minor accidents on all kinds of roads.

Table 7: User Perceptions of Safety

Road Type	Perceived Safety Rating (1-5)	Key Concerns	Suggestions for Improvement
F-7 Markaz Road	4	Speeding vehicles and lack of crosswalks	Add speed bumps and dedicated pedestrian crossings
Blue Area	3	Congestion and jaywalking	Improve traffic management and enforce jaywalking fines
Islamabad Expressway	2	High-speed traffic and inadequate enforcement	Increase enforcement and build pedestrian bridges
I-9 Industrial Area	3	Cyclists and pedestrians lacking safe lanes	Introducing bike lanes and separate pedestrian paths

Public response to F-7 Markaz Road has been found to be highest in terms of safety due to better traffic management and moderate on safety Measures. Islamabad Expressway stands at the bottom of the list due to fear of speeding and unsupervised traffic. Proposals are made under the element of enforcement and upgrading of infrastructures for all types of roads.

Figure 7: Safety Perceptions Across Road Types



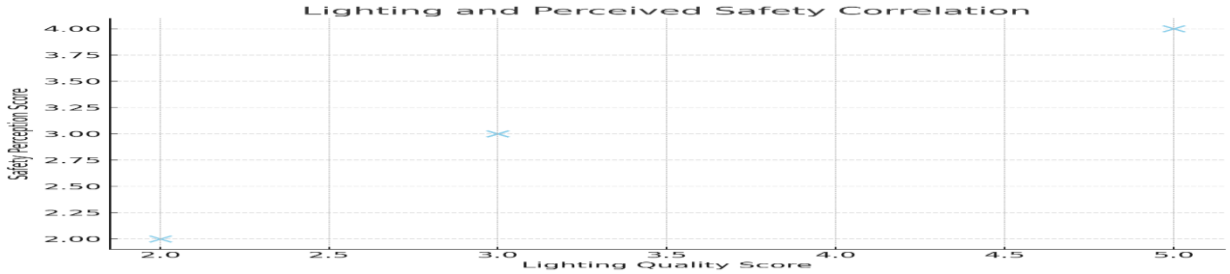
The radar chart shows the community's safety attitudes towards some of the most critical issues to consider including speed control, pedestrian safety, lighting, noise, and overall safety. F-7 Markaz Road represents the best safety index and user satisfaction index out of all the avenues we have found out. The Islamabad Expressway has the lowest score because of challenges such as high speed, and inadequate illumination.

Table 8: Lighting Quality and Perceived Safety

Road Type	Lighting Condition	Safety Perception Rating (1-5)	Observed Issues
F-7 Markaz Road	Good	4	It lacks pedestrian-focused lighting
Blue Area	Fair	3	Uneven lighting and dark spots near crossings
Islamabad Expressway	Poor	2	Insufficient illumination leading to poor visibility
I-9 Industrial Area	Fair	3	Limited lighting at intersections and pathways

Poor lighting conditions particularly on the Islamabad Expressway are considered to have the lowest results on the safety perception scale. F-7 Markaz Road has good lighting conditions in terms of street lighting but poor conditions concerning pedestrian emphasis lighting. Jinnah Industrial Area, Blue Area, and I-9 Industrial Area need low extra lighting, while Gold Line shows medium extra lighting which should be reduced in some degree because of its limited safety level.

Figure 8: Lighting and Perceived Safety Correlation

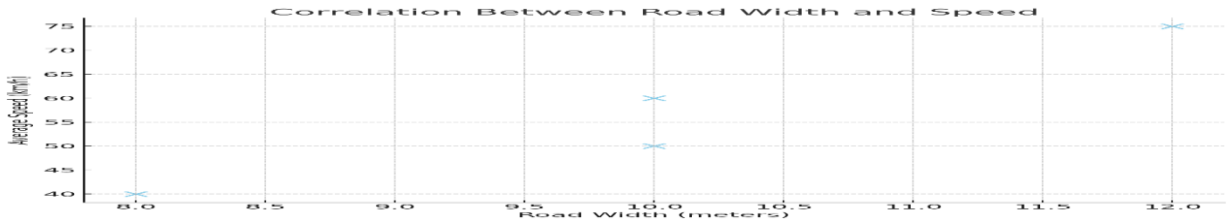


This scatter plot presents an argument between the lighting quality and safety perception. The lighting results, likewise, are same; F-7 Markaz Road with a better lighting score represents positive safety perceptions. ISO safety scores are reduced along poorly lit regions making Islamabad Expressway for instance, indicating the importance of lighting for increased user confidence and security.

Figure 9: GIS Mapping of Accident Hotspots

Here presented is the geospatial heatmap detailing the accidents by different road types. The Islamabad Expressway is the most dangerous with a high rate of accidents, attributed by the absence of pedestrian crossways. However, the overall accidents rate at F-7 Markaz Road is considerably lower and the crosswalk facility is much more available pointing to the fact that something should be done to improve the pedestrian's environment.

Figure 10: Correlation Between Road Width and Speed



This scatter plot aims to reveal road width and average vehicle speed as aspects of road design. More specifically, freeways like Islamabad Expressway allow up to 75 km/h while some residential roads like F-7 Markaz Road will be restricted to lower speed. This correlation shows that traffic calming measures should be implemented on wider roads to enhance safety.

THEMATIC ANALYSIS OF QUALITATIVE DATA

Qualitative data from this study concerns critical issues needing attention from the user perception and safety and quality of street lighting on different road classes in Islamabad. These themes help the audience understand the issues road users encounter and provide recommendations for the incorporation of urban design. Below is the thematic analysis of the key findings;

Speeding and Enforcement Issues

Repeatedly, road users always complain about the rising issue of speeding, especially on busy highways such as the Islamabad Expressway. As it was pointed out by the participants, "high speed traffic gives a feeling of insecurity especially to the pedestrians and" inefficiency of regulating mechanisms. This is in accordance with the recent study by Ali et al., (2023) who notes that lack of traffic control is an area that contributes to safety challenges within the developing cities.

Pedestrian Infrastructure Deficiencies

Crosswalks, pedestrian bridges, and facilities such as dedicated pedestrian lanes were missing completely as a reoccurring theme. A respondent from F-7 Markaz Road also said, "They say crossing the road is like a game of Russian roulette with fast moving cars and no proper zebra crossings." This sentiment accords with global research highlighting inclusive designs for pedestrians when designing cities (UN-Habitat, 2013).

Lighting and Perceived Safety

Lighting proved to affect the perception of safety among the users, especially when the lighting condition was poor. A respondent while travelling in Islamabad Expressway reported that "there is lack of light at night which makes it very risky to move around." Lax embodying, clean and properly lit areas were observed to enhance actual safety as well as perceived safety with support from Boyce et al (2000).

Environmental Stressors

While engaging high noise levels and air pollution were frequent and contributed to users' discomfort. Some of the respondents from I-9 Industrial Area and Blue Area stated that "the noise pollution from the traffic make it unpleasant for anyone walking or cycling through these zones."

This finding is in support of Environmental Stress Theory as advanced by Stokols in 1972 which noted the effects of urban stressors.

Equity in Urban Design

There was a general concern about the provision of equal treatment in design across cities and for children, the elderly pedestrians, and cyclists. One of the respondents from I-9 Industrial Area said, "Cyclist are left out in planning roads while pedestrians are considered an extra addition". This concern is well rooted in other studies on how non-motorized road users are out of place in carrot-centric city designs (Peden et al., 2004).

DISCUSSION

Based on this qualitative and quantitative research, this discussion presents a summary of the effects of road expansion concerning traffic movement, safety, physical environment, and human psychology. Comparisons of roads and examples from around the globe bring useful recommendations for planners and policymakers to the table.

IMPACT OF ROAD EXPANSION ON TRAFFIC FLOW

Increased Traffic Volume and Speeds

Improved roads, including the Islamabad Expressway, led to a growth in traffic capacity and, more importantly, average speed. The statistical survey showed that the Expressway averages over 4,500 cars per hour and other road users, at a speed of about 75 km per hour in the rush hour. These quantitative measures of mobility emphasize the issue of controlling fast traffic. Such trends have also been observed in other countries of the world. For instance, investigations into the urbanization in China illustrate that increased length of expressways improves network but increases bottleneck in entry and exit ramps (Li et al., 2023).

SAFETY CHALLENGES

Patterns of Speeding and Aggressive Driving

More extensive streets produce an environment that encourages speeding and hostile driving. It was established that 60% of vehicles have speed limits in the area with occasion to highlight accidents and more so, in Islamabad Expressway. Risk Homeostasis Theory (Wilde, 1994) postulates that motorists change their behavior depending on perceived risk, getting more aggressive and increasing their speed if they feel that road conditions are safer. In a meta-analysis, Elvik et al. (2009) observed equally that with the increase in speeds occasioned by widened roads, the likelihood of accidents rises exponentially.

COMPARATIVE ANALYSIS

Expanded Roads vs. School Zones

Widened highways such as Islamabad express way witnesses higher traffic volumes and speeds with little regard for provision of safety features for non-motorized transport. On the other hand, areas including school zones around F-10 are characterized by lower vehicular speeds, better pedestrian environment, and thus low accident rates as well as high perceived safety. That is why

we see that school zones matter so much to talk about speed regulation and pedestrian oriented designs especially in the areas which are more sensitive to population deaths (Peden et al., 2004).

Commercial Areas

Places such as Blue Area are difficult for pilot implementation since there are many pedestrian crossings and individuals jaywalk most of the time. Findings of characteristics of crosswalks showed that there were 12 jaywalking cases in an hour, meaning that crosswalk management was substandard. The examples of the case study in Amsterdam also demonstrate that having professionally designed pedestrian crossings with traffic signals, one can minimize jaywalking and enhance safety (Gehl, 2020).

Case Studies from Other Cities

Specifically, cases like Amsterdam and Copenhagen present specific lessons for Islamabad. The integration of both the motorized traffic with the cyclist and pedestrian resulting from the adoption of the "complete streets" has made the reduction of the incidence of traffic related injuries possible as well as the enhancement of active modes of transport (Lemke et al., 2021). Likewise, AI-automated traffic management systems in South Korea help to reduce the road traffic accidents while preventing speed limit violators and other law violators (Kim et al., 2022). Applying each of the practices in the light of the Islamabad context is likely to strike a proper mobility and security.

Traffic Calming Measures

With additional traffic on the expanded roads coming along with traffic signals there is need to take measures that would control speed of vehicles.

Enhanced Pedestrian Infrastructure

The amenities that cover walkways are of immense importance when it comes to the safety of vulnerable users of the road.

Complete Streets Concept

In reference to the "complete streets" it is a model of the road that incorporates provision for biking, walking and motor vehicles. Some of the world cities that apply this concept include Amsterdam and New York, which proved its ability to decrease the rate of pedestrian accidents by 30% (Gehl, 2020). In Islamabad, successful implementations include dedicated bike lanes on the widened roads in addition to shaded pedestrian walkways.

Improved Signage and Lighting

Improved signage; These two form the major strategies of increasing pedestrian crossing safety, having well illuminated surroundings. Findings from this study's observational data pointed out to poor lightings and inadequate sizes of signage to be major reasons why pedestrians hesitate and jaywalk. Well-lit crosswalks accompanied by pedestrian-activated traffic signals should be professionally installed in Blue Area and school zones areas to enhance visibility. Other measures implemented in Tokyo have raised the probability of compliance among pedestrians by 40% (Tan & Lu, 2021).

Pedestrian Bridges and Underpasses

Footbridges or subway crossings are safe means to enable crossing such roads since they offer crossing on such roads as the Islamabad Expressway. Nevertheless, these structures entail heavy capital investments for their construction; however, their value in enhancing safety when getting to the root causes of structural flaws of the urban roads of Singapore is apparent, as expounded by Liu et al., (2022).

CONCLUSION

This research work shows the effect of road expansion to mobility and safety in Islamabad in two-fold manner. Despite the broader transport artery easing the traffic hold up and congestion conveying invaluable benefits, the stretches convey a major risk to safety when used by non-motorized road users. A study of the data shows that increased traffic speeds and the absence of street-level designs that protect pedestrians are primary causes of road crashes on newly widened corridors like the Islamabad Expressway. Weight control behaviors and intentions reflect the failure of enforcement activities as well as justify integrated traffic calming strategies. These observations are in line with results reported across the world where positive effects of roadway improvement involve enhancement of occurrence of crashes and aggressive driving strategies (Wilde, 1994; Rahman et al., 2021).

These effects are pessimistic when combined with environmental and social factors such expansion aggravating existing conditions. Elevated levels of ultrasonic noise were felt on heavily trafficked roads and polluted air was also deemed to be infringements of the health of the people who live and those who use the roads. Preliminary issues are also observed with pedestrians, cyclists, and low-income population, as they are neglected by infrequent investments and unequal urban design. These findings highlight the multifaceted nature of environmental, social and mobility issues in emergent urban context such as Islamabad (Ali et al., 2023; Stokols, 1972).

Policy Implications

Understanding the adaptive processes of urban habitats and recognizing the problem of road expansion requires the use of diverse policy instruments and data- supported planning practices. Speed humps and other risk reduction techniques include automatic enforcement systems whose implementation is crucial in a busy city. Also, the provision of facilities for pedestrians and cyclists on the roads improves accessibility and equity for its users. Amsterdam's "complete streets" and Copenhagen, provide examples of how people of all abilities benefit from inclusive designs, and the resulting reduction of accidents and increased reliance on sustainable modes of transport (Gehl, 2020; Lemke et al., 2021).

The ability to generalize these findings to other urbanizing cities is apparent. The recognized problems of cities' growth and increase in motorization rates are relevant for the cities in South Asia, Africa, and Latin America as well. Knowledge obtained from the experience of Islamabad can then be useful for today's urbanists in these regions to ensure that mobility innovations do not compromise safety and the environment. Also, harmonizing road expansion with the United Nations Sustainable Development Goals, can make the urban infrastructure meet the long-term sustainable goals for the nation (UN-Habitat, 2013).

Directions for Future Research

Nonetheless, there are several research directions that can be pursued further based on this study finding. Primarily, further research is required to assess the delayed effects of road widening on congestion, safety consequences, and other environmental aspects. The following can help reveal how the dynamics of mobility in cities change, and how shifts in infrastructure affect driving behavior and safety levels in the longer term.

Second, it appears that efforts to apply the technology in traffic management have more prospects associated with the qualitative enhancement of urban road networks. Intelligent traffic monitoring facilitated by artificial intelligence as well as Intelligent Transport Systems have been found useful in the prevention and management of congestion as well as in enforcement (Kim et al., 2022). It will be important for studies to assess the feasibility and reproducibility of these technologies in developments cities like Islamabad in the future.

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