

HETEROGENEOUS TRAFFIC AND FRAME WORK ANALYSIS FOR PEDESTRIAN ROAD CRASHES

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ABSTRACT

Various Road users have different and often conflicting requirements. Pedestrians need clear site visions, pavements and shaded areas as well as frequent traffic gaps for crossing roads. Private transport modes and automobiles prefer uninterrupted flow, fewer stops and minimum delays at intersections, whereas public transport buses require frequent stops for picking and discharging passengers. Motorized four wheeled vehicles like car, buses etc perform better if they move in lanes with minimum braking and acceleration. Traffic system is classified by off road and on road population of road users. The unfortunate condition in our existing situation is that the design does not account for the conflicting requirements of Pedestrians and Passengers (Off road users); this is due to the space requirements and other limitations, all modes have to share the road space and operate in sub optimal conditions. In the condition discussed above, Pedestrians are the vulnerable road user group in the Injury Surveillance database.

In this paper, Traffic crashes of Pedestrians received in connection with the heterogeneous traffic flow are in depth analyzed. According to the facts and figures of the research deliverables, 60% of the fatalities are recorded during the year 2009 in Pedestrians and Passengers while 45% of the contributory causes for these crashes are directly linked with improper off road infrastructure facilities. Cross classification analysis of various Pedestrian accident parameters is carried out. The Outcomes and intervention strategies related to the mushroom standards of Pedestrian facilities is the key perspective of this research study. Experience of past decades of long term integrated land use system suggest that the existence of the informal sector and their travel needs must be recognized for preparing effective plans. This should be encouraged by mixed land use patterns and infrastructure facilities especially designed for the Pedestrians. This aspect is mandatory due to the high involvement of these road users in road crashes. Future traffic models must account for the users of different modes having conflicting requirements. These models must account for the needs of vehicles for clear roads, at the same time they must address the needs of

Pedestrians, their properly designed facilities at shorter distances. Standards should be followed and in practiced for providing better services meant for Pedestrians that is the ultimate and heavily dependent cause for the increase in severity rate of Pedestrian's road casualties.

KEYWORDS

Traffic Accident, Pedestrians, Motorized vehicles, land use, urban roads

1. INTRODUCTION

In the past transport planning has tended to concentrate on providing for the needs of vehicular movement to the detriment of pedestrians. This has resulted in an imbalance in the provision of quality transport. It is important to recognize the factors influencing the demand for provision of more and better pedestrian facilities. Undoubtedly one important factor has been the increased awareness of the environmental problems created by the rapid national and world wide growth in vehicle travel, but of equal importance has been the recognition by many people of the need for physical fitness and the role that walking can play in achieving this. Pedestrian crashes are directly and indirectly related to the vehicular traffic movements, absence of pedestrian facilities, lack of use of facilities and direct involvement of road users on major arterials of big city of Karachi, Pakistan which is the enhanced and encompassed idea of this research study.

2. OBJECTIVES

- Following are some of the tangible and productive objectives of this research study:
- Elaborating the Pedestrian Accidents (Serious injuries and fatalities) through in depth detailed analytical facts
- Associated and emerging problems for pedestrians and passengers with the need for pedestrianization
- Outcomes and intervention strategies for reducing pedestrian injuries and fatalities on major arterials of Karachi, Pakistan
- Enhancing the minimum requirements with related features of Pedestrians and Passengers

3. PEDESTRIAN FACILITIES AND FREEDOM OF DEMAND

The demand for pedestrian facilities is influenced by number of factors [1] of which some of the important are:

The Influence of Topography: Pedestrian activity tends to be at higher level in flat areas than in hilly ones.

The nature of Local Community: walking is more likely to occur in a community that has a high proportion of young people.

Car Ownership: The availability of private cars in the city reduces the amount of walking even for the short journeys and there will be the increased crash rate in between the lower percentage of pedestrians and higher percentage of various road users.

Local Land use activities: walking is primarily used for short distance. The important influencing factor comprising of the level of demand based on the consecutive distance between local origin and destinations.

Quality of provision: If good quality pedestrian facilities are provided then the demand will tend to increase.

Safety and Security: It is important that pedestrians perceive the facilities to be safe and secure. For pedestrians this means freedom from conflict with different road users as well as minimal threat from personal attack and the risk of tripping.

4. URBAN LAND USE TRANSPORTATION AND PEDESTRIANS

Unlike traffic in cities in high income countries, Pedestrians and other non motorized modes are present in significant numbers on arterial roads and highways [2]. Their presence persists despite the fact that engineers designed these facilities for fast moving uninterrupted flow of vehicles. The planning framework as adopted in the preparation of master plans in many Asian countries has been completely divorced from resource assessment. The process also does not invoke any procedures for involving community and bringing about consensus on contentious issues. In mega cities where half or more of a city's population are located in illegal or informal settlements, urban planners still rely on traditional masters planning approaches with their role restricted to servicing the minority. Few weak attempts have been made to bring some coordination of development and services to informal area or in other words proposal can be made for the development of Katchi Abadis.

Increase in level of congestion has been a major concern for planners and policy makers in metropolitan cities. In Delhi, average speeds during peak hour range from 10 to 15kph in central areas and 25 to 40kph on arterial streets [3]. Compared to Delhi, average speeds in other mega cities are less. In 1993, Delhi's traffic fatalities in coordination with the pedestrians were more than double than that of all other major Indian cities combined [4]. Clearly the criteria for recommending optimal speeds, congestion reduction and reduction in pedestrian injuries do not include the desired level of safety and land use patterns.

5. IDENTIFYING NEEDS AND PRIORITIES FOR VARIOUS ASPECTS

It is always necessary to put plans in implementation priority order. A number of important considerations have to be taken into account if the most effective

recommendation is to be identified for Pedestrians and Passengers and subsequently implemented. Among them the most important are:

5.1 Safety

In planning any transport proposals safety must be of prime importance. Most developed countries have either specific or implied accident reduction targets at which to aim. When it is considered that in Great Britain approximately 36 percent of all road fatalities and 23 percent of all road accidents involve pedestrians [1].

5.2 Conflict

Accident risk based on actual accidents is not the only measure which needs to be taken into account [5, 6]. There are relatively rare events at any particular location but the actual conflicts between travelers are much more common and often result in 'near misses'

5.3 Satisfying Policy Objectives

The satisfying of any formal transport policy objectives must be an important factor when identifying priorities.

If an important local transport policy objective is to provide an extensive pedestrian route system aimed at increasing the amount of walking by elderly people, than those road crossing points in the vicinity of concentrations of such groups of people are likely to have a higher priority than those elsewhere.

5.4 Cost Effectiveness

Planning should support the affectivity in terms of the benefit of the road users as well as in the lines of cost ratio. Surveys should be planned in order to better identify the intervention.

6. METHODOLOGY ADOPTED FOR RESEARCH PAPER

Road Traffic Injury Research and Prevention Centre located in Jinnah Post Graduate Medical Centre, Karachi is the prominent institution which is working with the Department of Urban and Infrastructure Engineering, NED University of Engineering and Technology, Karachi. One of the major and important task of the centre is the gathering of Accident record and details in Trauma Emergency centre. In this connection five major hospitals of Karachi are deputed from which the data has been presented in this paper.

The centre was started in September, 2006 and is still in the running phase but due to the detailed correspondence of data, particularly year 2008 is selected for this research study. From the list of data related to various road users, Pedestrians and Passengers are in depth analyzed and their features are briefly discussed. The next step was to identify the major and generic problems faced by Pedestrians and

Passengers on major arterials of Karachi. After enhancing the features of road users, important intervention strategies are also discussed as a role model in order to reduce the fatality rate.

7. ANALYTICAL DATA RECORD OF ACCIDENTS FOR PEDESTRIANS AND PASSENGERS

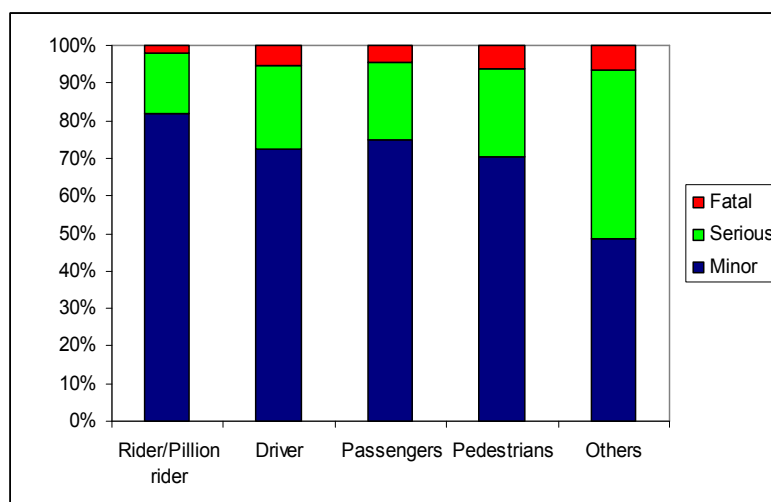
Some of the real facts and figures related to road accident data of Road Traffic Injury Research and Prevention Centre during the year 2008 are discussed below. Analytical figures are examined by various modes of Traffic and road users.

7.1 Injury Severity of Various Road users (Year 2008)

“Table 1 – Road User Severity”

Road users	Minor	Serious	Fatal
Rider/Pillion rider	16042	3112	441
Driver	618	193	44
Passengers	2726	753	163
Pedestrians	5037	1674	457
Others	600	557	80

It can be predicted from the above table that high fatal accidents were recorded during the year 2008 when considering the road users like Passengers and Pedestrians. It shows that among all road users, Pedestrians and Passengers are the vulnerable road user group. It can be more understood through the graphical representation as shown below.

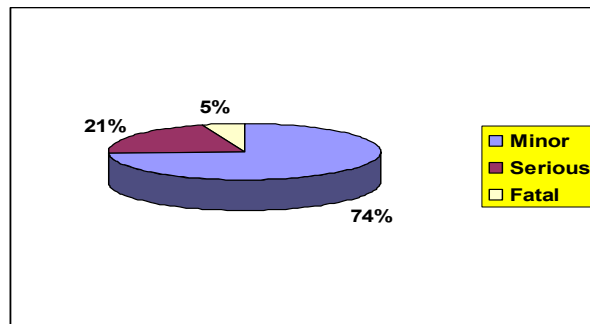


“Figure 1 – Graphical Representation of Injury Severity by Road user group”

7.2 Accident Rate considering the prominent issues of Pedestrians and Passengers (Year 2008)

“Table 2 – Severity rate corresponding major issues”

Minor	Serious	Fatal
5227	1474	345

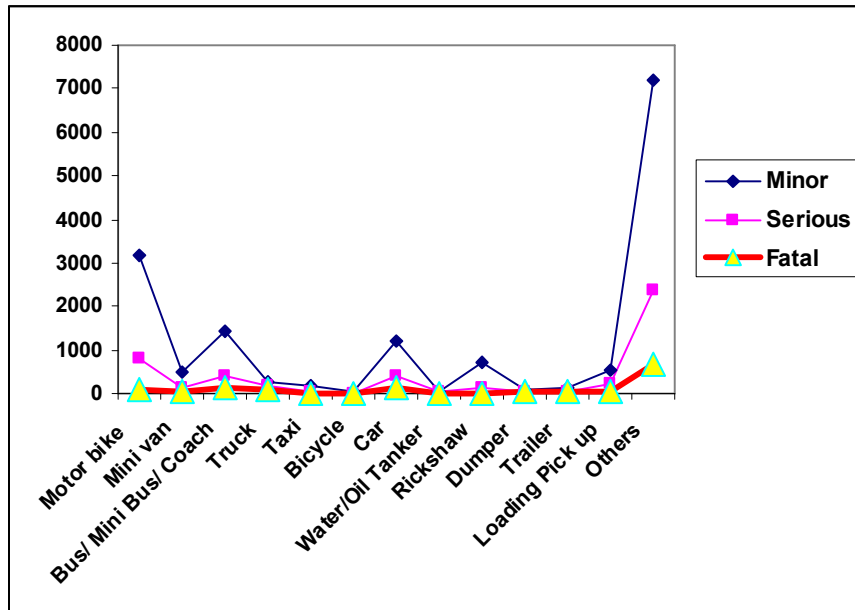


“Figure 2 – Graphical Representation”

As per the graphical and tabulated facts shown above, it is quite evident that the involvement of minor and serious injuries is more for the considered road users. The severity rate is clearly defined for the above based on the issues that are directly related to the Pedestrians and Passengers. These include Road Crossing action, Improper Pedestrian facility, Lack of Bus stops, Encroachments, Alighting and Boarding actions during traveling and Encroachments as well.

7.2 Severity rate in between Heterogeneous Traffic, Pedestrians and Passengers

For consideration of Traffic accident data several modes of transport are defined including Motorbike, Car, Buses, Trucks, Taxis, Bicycles, Dumper, water and oil tankers etc. These modes are interrelated with the colliding actions of Pedestrians and Passengers. Data statistics reveals that Motorbike riders and car users are more common when comparing with other modes of transport as shown below



“Figure 3 – Traffic Accidents of Pedestrians and Passengers with various modes of Transport”

8. ISSUES AND PROBLEMS FACED BY ROAD USERS ON DIFFERENT ARTERIALS OF KARACHI WITH TENTATIVE MEASURES IDENTIFIED

Among the major problems of road users, one of the important issue faced by Pedestrians and Passengers is the Road Crossing. Nagan Chowrangi, Shahrah-e-Usman ramz is highly affected by the serious and minor injuries of the related road users. The important reason behind is the presence of shopping plazas and centers. A part from that at main roads sharp horizontal curves are allocated and the road users face difficulty for crossing it. Riders and pillion riders may get involve in slippages due to the sharp bends.



“Figure 4 - Problems faced by Pedestrians and Disabled persons on sharp bends”

It has been proposed to the concerned authorities surface textured pavement should be provided in order to avoid the accidents of riders while Transverse bars will be the suitable application with the involvement of community wardens.

Another important area which needs consideration is the absence of bus stops at suitable refuges at suitable located intervals. In this connection various locations are prominent namely Shaheed-e-Millat Express way, University road, Korangi road etc.



“Figure 5 - Absence of Bus Stops and Overloading on Buses”

It is the usual practice that bus stops are not properly located and road users are prominently involved in the traffic crashes. Another important factor is due to the unassigned dwell times for buses and coaches they are becoming overloaded and ultimately rolled over on main roads and get stuck with the on spot waited passengers and pedestrians.

For high speed roads and arterials, there should be proper at grade or grade separated pedestrian facility. Treatments should be provided in the arterial comes under the head of construction work zone. Jail Chowrangi is the focused example of this issue, due to the high rate of injuries this problem is now solved as discussed in the part of intervention strategies.



“Figure 6 - Absence of Ladder and Manned Zebra crossings at sharp bends”

All the related issues correspond at the moral of the emerging rate of severity rate. Karachi is abruptly provided with the facilitation of pedestrians and passengers but the problems are indirectly related to these facilities. A part from the above discussed issue and problems road users especially female gender also complain for hoardings on pedestrian bridges. While at some locations fencing is not provided with the existing facility. It needs to be standardized at all respects Education, Engineering and Enforcement.



“Figure 7 - Two Major and Reported Accidents of Karachi involving Pedestrian and Passenger with the Bicycle action”

9. PEDESTRIANS CHARACTERISTICS AND REQUIREMENTS INFLUENCING DESIGN

9.1 Walking Speeds

An important design element particularly when planning at grade road crossings is need to provide sufficient crossing time to enable all pedestrians to complete the road crossing maneuver [7].

Some research in the road crossing speeds has indicated an average value in the range of 1.2 m/s to 1.35 m/s. Proposals should be identified as per the desired speed.

9.2 Walking Distances

The walking capability of elderly and disabled people is considerably lower. They are important not only walking along a footway, but also for the pedestrian area [8]. Too much long distances should not be preferred by the road users. It has been argued that any design provision should be based on satisfying the needs of 80 percent of the pedestrians within a particular disability group and passengers.

9.3 Seating

Two types can be identified:

- Primary Purpose built seating, e.g., benches and seats
- Secondary Informal Seating

Bus bays should be provided and they should not be affected by or hinder circulation nor be subject to adverse microclimatic conditions [9]. They should serve their purposes as an infrastructural behavior and aesthetically as well.

10. OUTCOMES AND INTERVENTION STRATEGIES IN KARACHI TRANSPORT CONDITIONS

Due to the increasing rate of road accidents involving Pedestrians and Passengers, several measures has been has been adopted by the concerned personnel for the safety of mankind. Some of the tangible outcomes of the research study are briefly discussed as follows:

As indicated previously that Shahrah-e-Usman Ramz is the vulnerable spot when considering Pedestrians. It has now been provided with Pedestrian bridges associated with fencing, Fenced U turns and Development of Bus bays [10].



“Figure 8 - Development of Grade Separated Facility and Fenced U turns”

One of the best advantage of fenced u turn is actually enforcing the Pedestrians to cross the road from Overpass, because the activity will not be repeated by the road user more than two or three times.

Another emerging design for the facilities of Pedestrians is interconnected bus stops with pedestrian bridges. This fulfils the demands of Pedestrians as well as for Passengers in order to avoid long distances at fewer intervals.

Another area Gulshan-e-Iqbal, Karachi is treated with the overpass facility in continuation with the Traffic Overpass which definitely a difficult task to design and built.

An important Signalized location of Karachi Gurumandar has facilitated with at grade crossing with the provision of fencing all along till the island of main intersection. This facility is providing better results in order to tackle the situation of road crossing. In other words, this could be the suitable alternative for signalized intersection.



“Figure 9 - At Grade Crossing with the provision of Fencing at Signalized Staggered Intersection”

Several other areas like Korangi Road, Qayyumabad, Chaudary Fazal Ellahi Road, Korangi Industrial Area etc has been facilitated with the application of Transverse bar, Installation of Studs and Delineators in order to calm the speed flow, Application of manned and Zebra crossings.

CONCLUSIONS AND RECOMMENDATIONS

Recommendations are to be planned and suggested as per the existing condition. In the heterogeneous traffic flow conditions, several issues has been resolved for the ease of Road users especially for Pedestrians and Passengers while some of the areas remain unresolved. In this connection measures that might be taken by the concerned and related authorities are discussed below:

- In order to have better recommended measure various and suitable survey techniques should be encountered for Pedestrians and Passengers. These include Manual Counts, Video Surveys and Attitude Surveys
- Measures should be identified and distinguished like At grade or Grade Separated facility as per the need of Road users. It should also follow the desired rules and regulations while the facility should be implemented as per the Jurisdiction
- Zebra or Ladder crossings should be provided with the interconnection of Fencing as well as fenced U turns
- Before the application of Crossings, Flashing Beacons should be installed in order to warn the car users
- Speed calming devices should be installed before entering to the zones of Pedestrians having high severity rate
- At curves, selection of facility is critical, calming measure that is planned to implement should fulfill the standards of curve radius
- Painted speed tables and raised platforms of retro reflective material should be used for locals and collectors
- Road users prefer to use Bus stops with interconnected Pedestrian bridges. Implementation of Bus bays would be the idealistic condition
- Bus stops or shades should present its role more to functional perspective but aesthetically too in order to trap the attraction of Passengers
- At construction work zones, manned ladder crossing would be the preferred implementation strategy but this facility should be diluted with another system after the overall construction
- Standard Foot paths with sufficient width should be utilized keeping in view the consideration of Clear Zone requirements while curb ramps should be considered for disabled persons
- Strict Enforcement action should be implemented through community wardens and Traffic police at major arterials of Karachi

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