

A strategy for pedestrian safety in Iran

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Abstract:

Pedestrian traffic accidents constitute a major part of all traffic accidents in Iran. Studies based on the year 2007 data, have revealed that out of a total of 27567 traffic accident fatalities, 6258(22.7 percent) have been pedestrians.

This is why the present study has been done in Transportation Research Institute to find practical pedestrian safety measures, having in mind how critical pedestrian traffic safety is. To do field studies with the objective of finding and classifying pedestrian traffic safety problems, two provinces of Gilan and Mazandran were selected for case studies in order to present the solutions and strategies for the improvement of pedestrian traffic safety. These provinces were selected because roadsides are full of different and irregular activities, traffic volume and speed is high, many people live along roadsides and commute all the time.

Considering the vastness of roads network in these provinces, and because of concentrating our studies on areas having various pedestrian safety problems, we first defined some indexes for the selection of proper areas and then prioritized them.

After a more precise study of prioritized areas, necessary object setting for improvement of pedestrian safety purposes was carried out.

This way, necessary strategies to meet predefined targets were determined by classifying pedestrian's safety problems and defining safety targets for each category of problems; and, for each strategy, safety improvement measures, under three titles, named engineering, education and enforcement measures were presented.

Keywords

Pedestrian Safety, Traffic Accident, safety Measures, Strategy

Introduction

Trauma is the leading cause of years of potential life lost in most developed countries and due to an epidemiological transition during which the frequency of infectious diseases is declining and instead, injury related problems are becoming more prominent, it is emerging as the major cause of mortality and morbidity especially among young population of developing countries [1].

In any kind of injury control activity and especially in traffic safety research, correct diagnosis of the high risk groups and quantifying the risk of injury is the key point for further interventions. Due to the nature of the transport-related injuries, such diagnosis should be based on well designed community-based studies [2]. Intercountry or regional differences in patterns of injury in different categories of the road users (i.e. pedestrians, car passengers, motorcyclists and bicyclists) have significant implication for prevention policies [3].

Motor vehicle-pedestrian accidents are a significant source of injures leading to death and disability and a major concern for public health, trauma medicine and traffic safety[4].traditional views of pedestrian traffic safety trend to place the burden of responsibility on the behaviour of pedestrians and emphasize education as the means to prevent accidents. This perspective has been challenged by data showing that educational efforts are less effective than efforts aimed at modifying the physical and social environment of the transportation system [5], a viewpoint that underscores the importance of thoroughly investigating all injury-producing accidents. Detailed analysis of traffic fatalities is crucial in understanding the

interaction of human and environmental factors that contribute to accidents as well as vehicular and biological factors that influence the severity of injuries [6].

Even though few countries in both developed and developing countries have implemented effective strategies to control transport-related injuries [7], with the passage of time, the magnitude of problem is going to be understood better and better in more countries and the implementation of comprehensive strategies to decrease injuries seems imperative.

According to studies of successful and developed countries regarding traffic safety, the most important factors influencing the occurrence and severity of pedestrian accidents that have been the basis and presenting the targets and strategies for pedestrian safety plans are location and time of accident, and recognition of the agents that facilitate the accident[8].

In general, pedestrian accidents are more in urban area roads because people are more active in cities and traffic volume is high. But, due to high speed of vehicles in interstate roads, accidents are more severe and people usually get killed or badly injured. Also, in many places that are far from city centres, pedestrians are very much at risk of vehicle accidents because of poor pedestrian facilities [9].

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Table 1 shows pedestrian traffic safety indexes in Iran and three other countries.

Table 1: pedestrian safety indexes in Iran and three other countries (W.H.O. And Word Bank, 2004)

	Pedestrian fatalities/year	Percentage of pedestrian fatalities out of total fatalities	Percentage of pedestrian fatalities change during recent years	pedestrian fatalities per 100000 population
U.S.A	4750	15	-10	1.63
ENGLAD	774	22	-32	1.28
SOUTH AFRICA	2600	24	-30	5.6
IRAN	6100	21.6	+11	9.1

Methodology of study

Pedestrian safety study was carried out in four major phases in this research. In the first phase, after analysing the existing situation, pedestrian safety condition in Gilan and Mazandaran provinces were studied as compared to other provinces in the country. In this part we studied the measures taken regarding the safety improvement of pedestrian traffic. Effort was made to study the measures taken and also the trend of evaluation of safety projects in other countries, as compared to Iran, by studying pedestrian accident data, laws and regulations related to pedestrians.

In the second phase, pedestrian safety data, related to some selected sections, were studied and analyzed, using traffic performance and safety indexes and doing field studies, and a set of prioritized sections were selected for the purpose of pedestrian safety improvement. The set of roads in our case study was that of Gilan and Mazandaran provinces out of which 100 kilometers had the first priority.

The third phase of this research is related to the study of prioritized selected sections and the conditions that reduce traffic safety. In this phase, the traffic safety condition was studied through comprehensive data collection, origin-destination survey, analysis of traffic statistics, and more precise analysis with the help of field studies.

After a more precise study of prioritized areas, necessary object setting for improvement of pedestrian safety purposes was carried out.

This way, necessary strategies to meet predefined targets were determined by classifying pedestrian's safety problems and defining safety targets for each category of problems; and, for each strategy, safety improvement measures, under three titles, named engineering, education and enforcement measures were presented

Scope

Considering the objective of this study, which is presenting some ways for the improvement of pedestrian safety, Gilan and Mazandaran provinces were selected for field studies to determine and classify traffic safety problems, because these problems are various and numerous in interstate roads of these provinces.

Selection and prioritization of the sections

The most important indexes for the selection of suitable sections were the number of pedestrian accidents in 5 kilometers- sections, population density and vehicle traffic volume. To have a thorough consideration to all influential indexes in the selection of sections and simultaneous use of all the effective factors and parameters, the above mentioned indexes were combined together appropriately. Since increase in the number of pedestrian accidents in 5 kilometer sections is directly related to the selection of the road, this number was considered the most important factor in the determination of safety index. Police traffic accident reports of the years 2002 to 2005 have been used for this purpose.

To find pedestrian high risk areas, total number of pedestrians who use a specific section or zone affects the number of accidents. Also, the more is the time of the pedestrian trip, the more will be the probability of accidents. In other words, with an increase in pedestrian walking time, there will be an increase in the probability of accidents. To determine the performance index, population of the area containing the road section was taken as the influential factor in pedestrian safety, because pedestrian traffic volume is related to the area population and also previous pedestrian studies are not many in Iran. So, the related index is the population density of the area where the section is situated.

Environmental conditions and traffic volume in the area, greatly affect the number and severity of pedestrian accidents.

Considering what was mentioned above, the following was taken as the combined index, which involves all affecting elements and the way they affect, in the final selection of the sections.

Number of pedestrian accident in each section per 100000 vehicle-km traveled per population in one km² of an area

Based on the above index, prioritization of the sections was done and 21 first priority sections were selected.

Results

a) Data analysis

The analyzed data were many, so we have mentioned only some of them in the accident data analysis. The selected sections show that these were located in the vicinity of residential areas and population centers.

Pedestrian and vehicle traffic volume affect the occurrence of accidents. In fact, increase in pedestrian accidents is directly related to the increase in pedestrian and vehicle traffic volume.

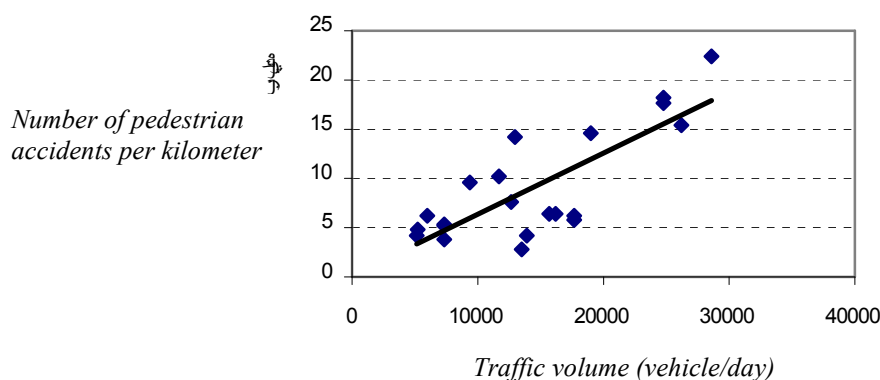


Figure 1: relation between vehicles traffic volume and pedestrian accident

Results show that heavy vehicles traffic volume is related to the number of pedestrian accidents in such a way that with an increase in heavy vehicles traffic volume, there is an increase in the number of pedestrian accidents with such vehicles.

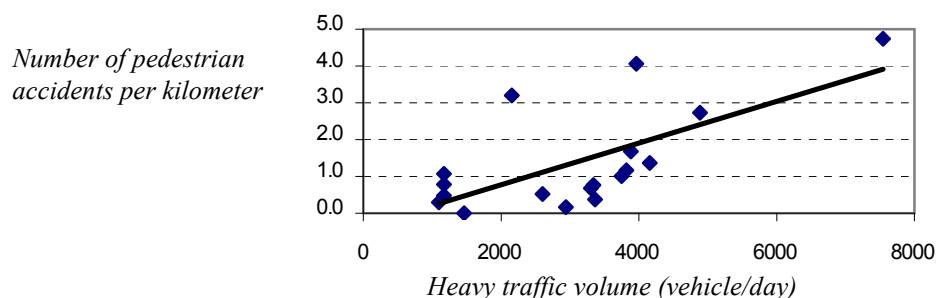


Figure 2: relation between heavy vehicles traffic volume and pedestrian accident
 Traffic laws violations are the most important completing factors in the chain of pedestrian accidents. It has been reported that almost 60 percent of the cause of pedestrian accidents is speed limit violation and the rest 40 percent is insufficient front attention.
 In both provinces, almost throughout all months of the year, number of pedestrian accidents is considerable. The reason could possibly be their tourist attraction potential and the large number of tourists that travel there in all seasons.
 In both provinces, proportion of daytime pedestrian accidents is greater than that of night time. In spite of the fact that 68.24 percent of Gilan and 73.15 percent of Mazandaran pedestrian accidents have occurred during the day, remarkable percentages of night time pedestrian accidents must be noticed. Also, 71.19 percent of Gilan and 71 percent of Mazandaran pedestrian accidents have occurred during the week days.

b) Pedestrian safety problems

In our case studies, pedestrian safety problems were determined by using some techniques such as filling questionnaires, doing interviews, analyzing accident data and inspections. Then, based on the degree of validity of each technique, we gave weight to different items and prioritization was done using AHP (Analytic Hierarchy Process). The results are shown in table2.

Table2: prioritized safety problems

Priority	Identified safety Problems
1	Lack of observance of road' right of way regulation
2	Traffic calmming not used at pedestrian crossings
3	Non-homogeneous combination of land uses(drivers do not expect to cope with residential areas; schools not bring safe along roadsides)
4	Inappropriate or lack of appropriate pedestrian facilities(e.g. non existence of walking lanes along roadsides or lack of over/under passes for pedestrians)
5	Inefficiency in information rendering in high- density pedestrian regions
6	Lack of appropriate speed limit and related signs and signals in pedestrian activity spots
7	Geometric design regulation not considered (e.g. pedestrian and car routes not channelized)
8	Lack of observance of traffic regulations and laws by road users (pedestrians& drivers), risky behavior
9	Speed limit violation
10	Poor visibility (Poor road lighting ; poor delineation at pedestrian crossing; Poor visibility because of fog and climate conditions; wearing dark cover specially for women)
11	Existence of sight obstruction between pedestrians & vehicles
12	High vehicle volume
13	High share of heavy traffic volume

c) Specifying safety improvement targets

After pedestrian safety problems were found, appropriate targets were presented so that, based on a specific target, strategies and executive actions may be codified in the form of guidelines.

A set of pedestrian safety promoting targets, based on known problems, including collision risk reduction, lessening the pedestrian' exposure, visibility improvement, behavior/awareness improvement and improvement of laws and regulations, has been found that is shown in table3.

Table2: targets based on identified pedestrian safety problems

Target aimed at solving the problem	pedestrian Safety problems
Reduction of pedestrian conflict area (exposure with traffic)	<p>Lack of /inappropriate walk crossing places</p> <p>Geometric Design regulation not considered</p> <p>Traffic laws and regulations not considered by road users (pedestrians & drivers) & having risky behaviors</p> <p>Non-Homogeneous combination of Land uses in the vicinity of roadways</p> <p>Lack of observing the law on roadway right of way</p> <p>Poor visibility because of fog and climate conditions</p>
vehicles & pedestrian visibility improvement	<p>Vision obstruction between pedestrians & Vehicles</p> <p>Geometric Design Manual not considered</p> <p>Traffic laws and regulations manual not considered by road users (pedestrians & drivers) & having risky behaviors</p> <p>Non-homogeneous combination of land uses in the vicinity of roadways</p> <p>Poor visibility because of fog and climate conditions</p>
Increased Awareness & improving the behavior of pedestrians & drivers	<p>Drivers' carelessness, not minding their way ahead</p> <p>Speed violation</p> <p>Poor public Information at heavy traffic places</p> <p>Lack of appropriate speed limit and related signs and signals in pedestrian activity spots</p> <p>Not using traffic calming methods in the area</p> <p>traffic laws and regulations manual not considered by road users (pedestrians & drivers) & having risky behaviors</p> <p>Non-Homogeneous Combination of land Uses in the vicinity of Roadways</p> <p>Schools not being safe along roadsides</p>
Law enforcement improvement	<p>Speed Violation</p> <p>Drivers' carelessness, not minding their way ahead</p> <p>traffic laws and regulations manual not considered by road users (pedestrians & drivers) & having risky behaviors</p> <p>Non-Homogeneous combination of land uses in the vicinity of roadways</p> <p>lack of observing the law on roadway right of way safety</p> <p>Geometric design regulations not considered</p> <p>Lack of appropriate speed limit and related signs and signals in pedestrian activity spots</p> <p>Non – Homogeneous Combination of land uses & lack of expectations of drivers in coping with Residential Areas</p>

d) Strategies to meet targets

Generally, for each target, there exist some strategies through which we may meet the target by taking proper actions and considering necessary points. Actually, by strategy we mean presentation of a method by which the proposed actions may help meeting our targets. On this basis, a list of a set of targets and the related strategies is shown in table 4.

Table 4: Relation between objectives & Strategies for improving pedestrian safety

	Targets	Strategies
1	Reduction of pedestrian conflict area (exposure with traffic)	route separating for pedestrians and vehicles improvement of pedestrian crossing promoting safety in vicinity of schools
2	vehicles & pedestrian visibility improvement	Visibility condition improvement Promote pedestrian education
3	Increased Awareness & improving the behavior of pedestrians & drivers	Law enforcement in residential areas Improvement of awareness with new methods Education of road users Using traffic calming methods
4	Law enforcement improvement	Enforcing traffic regulations and law effectively

To meet the targets a set of executive measures, framed in engineering actions, education and enforcement complied and codified.

e) Pedestrian safety measures

Because executive measures are many, some of them are explained below to meet each target.

Target1:

- Construction of pedestrians sideways with proper access to school, work, home, etc;
- Construction of raised medians and longitudinal refuges;
- Use of suitable guardrails and fences at pedestrian crossings;
- Use of school buses and allocation of specific bus stops near schools;
- Construction of pedestrian over/under passes.

Target2:

- Supplying sufficient sight distances at access driveways and removal of vision obstructions
- Removal of pedestrian crossings at horizontal and vertical curves;
- use of light reflective materials or stripes in pedestrian dark cloths specially women dark covers (outfits);
- use of light reflective materials or stripes in children' clothing etc;
- lighting improvement of pedestrian crossings and delineation of road markings;

Target3:

- Installation of roads signs, signals and use of road marking and lighting;
- General and parallel education of pedestrians, drivers and the police to promote their awareness about traffic;
- Using transverse raised markings and rumble strips especially near residential areas and people's gathering places;
- Correction of the idea that pedestrians can cross any part of the road anytime;

Target5:

- Increasing fines for traffic law violations like going through a red light, exceeding the speed limit, stopping on zebra lines, not observing pedestrians right of way etc.
- Passing laws for fine non observant pedestrians
- Using special traffic police for schools and other crowded places
- Fining those drivers who cause pedestrians not to be seen by parking their vehicle at improper places
- Use of children in police cooperation plan to encourage parents to obey traffic laws.

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