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Research Article

An Overview of Interchanges and Ramps in Case of Sabzevar

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Abstract: Due to increase of the urbanization and raising the number of the vehicles road traffic incident and delay time in traffic jam are the main concern of countries in all over the world. Due to this problem drivers face an elevated crash risk especially when drivers on freeway ramp interchanges compared with other sections of freeways. The definition of ramp was based on the type and number of lanes used by traffic to freeways. The vehicle accidents are prevalent on highway ramps because of over-speeding, related to the characteristics and circumstances of ramps. Site survey and observation has been done for each location to identify the road condition, adjacent environment and vehicle operations. SPSS is used to analysis the accidents that they are collected data from case study. Descriptive analyses are performed by output of the analyzing data of accident. Differences in accident rates are due to driver behavior, weather potential safety issues were identified at interchanges. Ramps are scheduled for auditing based on descending road speed limits.

Keywords: Delay time, highway, interchange, ramp, traffic incident

INTRODUCTION

Nowadays, because of increasing the number of the vehicles in many cities in the world, drivers are facing many serious land transport challenges (Shokri *et al*., 2010). Increase of traffic congestion is the cause of environmental, social and economic implications (Shokri *et al*., 2012a). With the proportion of the world's population residing in urban areas projected to increase to more than two-thirds over the next 20 years or so, and with rising car ownership, more cities will find themselves facing the potentially crippling problems of vehicles accidents (Ambak *et al*., 2011; Shokri *et al*., 2009b). In most Asian countries such as Tianjin, Tehran, Kuala Lumpur and Jakarta fast growth and expansion of urbanization have led to an increased demand for urban transport, namely automobiles (Altef *et al*., 2013a, b). This application is accompanied by an alarming increase in the transport mechanism with consequent high levels of road traffic congestion, obstacles to economic development, pollution peaks and elevated costs for energy, which is often imported (Blaikie, 2008; Ismail *et al*., 2012). Road accident is one of the major causes of death and injuries in Iran. Iran has long paved road system linking most of its towns and all of its cities. In 2007 the country had 178,152 km (111,000 mi) of roads, of which 66% were paved. In 2008 there were nearly 100 passenger cars for every 1,000 inhabitants. At present, the fatality rate is about 20,000 people annually. In 2002, 44 deaths occurred for every 100,000 people. The same factor in the same year for Germany and Canada were 9 and 6 respectively. In 2008, it was 12.25 for the United States. Last year, during a period of focus on traffic accidents, the media announced that the car accident fatality rate in Iran is 25 times more than Japan and 2 times more than Turkey, which has similar cultural conditions to Iran (Khorashdi, 1998).

It is a shocking fact that road accidents kill more people in other developing countries too, every year, than war and Sis ease. The social and economic, economical cost of these accidents is also so high that it would be sufficient to buy the world total production of cereals each year. Furthermore, the number of accidents is in constant increase throughout the world. Although traffic accidents on congested freeways do not usually result in fatal or even very severe injuries, they are responsible for a substantial fraction of the unpredictable delays many of us now regard as unavoidable aspects of urban life (Shokri *et al*., 2012b). Frequently, such accidents occur when a platoon of vehicles successively brakes and the braking deceleration of at least one vehicle is not sufficient to

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prevent it from colliding with the vehicle ahead. Reducing the frequency of such collisions, for example by improving the competency of drivers or deploying in-vehicle collision-avoidance technology, could help reduce travel delays without resorting to expensive additions to highway capacity (Ismail *et al*., 2013; Shokri *et al*., 2009a)

HIGHWAY INTERCHANGES

Highway design is very crucial that is enable to include some characteristics of grade separations, multiple lanes of traffic, a median between lanes of opposing traffic and access control (ramps and grade separation). Highways can also be as simple as a two-lane, shoulder less road. Highways are usually divided with at least two lanes in each direction. Because traffic never crosses at-grade, there is generally no traffic or stop signs. Highway interchanges are systems of minor roadways designed to connect two or more major roadways. The major roadways connected at an interchange may consist of two fully access-controlled freeways, one freeway and one arterial highway. An interchange is a grade-separated intersection (one road passes over another) with ramps to connect them, to perm it traffic on at least one road to pass through the junction without crossing any other traffic stream. It differs from an intersection, at which roads cross at grade. Interchanges are almost always used when at least one of the roads is a freeway, though they may occasionally be used at junctions between two surface streets. Furthermore, a complete interchange has enough ramps to provide access from any direction of any road in the junction to any direction of any other road in the junction. On the other hand, a free-flow interchange is an interchange in which all roads are grade-separated and where movement from one road to another does not require the driver to stop for traffic (for example, the interchange may not include traffic lights or roundabouts). Free-flow interchanges are less likely to induce traffic congestion than non-free-flow, but are typically more expensive both in money and in land. Some free-flow interchange bring additional problems such as weaving or left exits that may be necessary to avoid additional costs, but lead to congestion and accidents and ultimately to an upgrade to another type of interchange (Pigman *et al*., 1981).

RAMPS ON THE HIGHWAYS

Many highways have controlled access that it means can enter or leave the highway only where there are entrance or exit ramps. Interchanges have many different possible configurations. Ramps come in various configurations appropriate to the design of the interchange in which they are located. Many ramp types are named after the interchange types in which they are most commonly used. Thus, the ramps of a diamond interchange is typically known as diamond ramps, and the loop ramps within a partial Cloverleaf (parclo) interchange is typically known as parole loop ramps. A ramp that leaves a mainline freeway facility is known as an off-ramp or exit ramp. The speed-change lane for an off-ramp is known as a deceleration Jane, while the speed-change lane for an on-ramp is known as an acceleration lane (Wenlong Jin, 2001). Design speed is a selected speed used to determine the various geometric features of the roadway. The assumed design speed should be a logical one with respect to the topography, anticipated operating speed, the adjacent land use and the functional classification of the highway.

Entrance ramps are short, one-way ramps used to get on the highway. At the end of most entrance ramps is an acceleration lane. Use the ramp and acceleration lane to increase the speed to match the speed of the vehicles on the highway. The central concept in the control of a freeway system is the control of each individual entrance ramp. An exception to this may occur where a parallel type ramp has a large radius upstream of the convergence point and where motorists view of the freeway while on the ramp is unobstructed. In addition, exit ramps are short, one-way ramps. At the beginning of most exit ramps it's a deceleration lane. The parallel type exit terminal is similar to the parallel entrance ramp (Troxel *et al*., 1994).

This study tries to overview and evaluates the impacts of ramp factor, type and geometry that caused accident which based on analysis of the accidents and roadway environment data. The technique has three basic phases, namely identification, diagnosis and remedy. The sequence of phases is to identify the causes and contribution factors to safety problems at Accident prone locations and to suggest appropriate countermeasures.

MATERIALS AND METHODOLOGY

This study presents the various aspects of traffic accidents in Sabzevar city in Iran. Data on accidents were collected from department of road and accident. From data collected we selected four accident black spot interchange ramps near Sabzevar city in 2011. Site investigation has been done separately for each location to check road condition, surrounding environment and vehicle operations. These investigation involved examination for ramp geometric design, design speed, singing, pavement marking and road safety features. Through this project analysis has been conducted for each location separately based on detailed accident data

to evaluate factors and parameters related to these accidents, therefore we will be able to specify appropriate recommendations and countermeasures. This analysis is containing over speeding, bad driving behavior, Lost control, Sleepy driver, Bumper to bumper, Hit and Run, Loss of wheel.

The increase of road accidents is in link with the rapid growth in population, economic in development, industrialization and motorization encountered by the country in 2011, reaching more than 4372 Accidents. It is found that an increase in traffic volume associated with an increase in traffic accident. A study concluded that an accident along sections Central Region with the average daily traffic. Site investigation has been done separately for each location to check road condition, surrounding environment and vehicle operations. These investigation involved examination for ramp geometric design, design speed, singing, pavement marking and road safety features. The collected data are entered to SPSS software to calculate the statistical analysis and find out the relevant variable of accident in the selected case study.

VALIDATION AND DISCUSSION

The distribution of accidents according to various causing factors will be statistically analyzed to check the association of these factors and the frequency of accidents. Data will be presented as percentages and frequencies. F Test was used to find out if the number of accident was equally occurred between day and night times at the selected black spot interchange ramps. The descriptive statistics showed that the highest number of accident in term of severity with damage only is at 41%. The highest percentage of accident is statistically different from those accident occurred with serious injury of 29% and slight injury of 12%. As shown in Table l. The statistical difference could be proved by probability less that alpha (0.05).

This goodness-of-fit test compares the observed and expected frequencies in each category to test either that all categories contain the same proportion of values or that each category contains a user-specified proportion of values. In this case Test was used to analyze statistically the distribution of accidents according to their cause. There are several elements that they have impact on the crashes which is identify for the selected spot locations that they are bad driving behavior, weather condition, drivers behavior and over speedy that the below tables reveals the statistical information for the selected black spots (Table 2).

To identifying the problems on ramp accidents, was the principal purpose of the analysis undertaken in this study. The crash data analysis results

Table 1: Accident frequency and severity

Severity	Frequency	%
Damaged only	41	41
Serious injury	29	29
Slight injury	12	12
Total	100	100

Table 2: The distribution of accidents according to their case

Accident	Frequency	%
Driving behavior	12	12
Weather condition	5	5
Lost of control	11	11
Over speedy	72	72
Total	100	100

show that the accidents ramp have highly associated with driving behavior, over speedy, weather condition and lost of control. It has been noticed that the distribution of accident among different conditions of weather are equally shared, however, the weather is statistically not strong factor in accidents as implied. Furthermore, most of the studies in this field highlight the design speed due to contribution of that with reduction of the hazards and incidents in the highways. Beside, to reduce the accident rates along the locations by check the curve to current design standards and check road condition to improve the safety of interchange highway at these locations. In addition, most of the incidents occur between day and night time, even though streets lighting has been provided. It is recommended to create additional lighting near the black spot ramps to provide better visibility for drivers to avoid unexpected problems.

CONCLUSION

This study evaluated the impacts of interchange ramp on the safety performance of freeway diverge areas. The definition of ramp was based on the type and number of lanes used by traffic to freeways. Crash data were collected from Sabzevar highway at four interchange segments. Cross-sectional comparison was conducted to compare crash frequency, crash rate and crash severity between different interchange ramps. The crash data analysis results show that the ramp has the best safety performance in terms of the lowest crash frequency and crash rate at freeway diverge areas.

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