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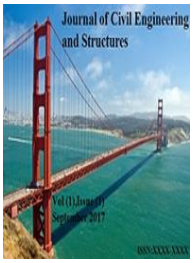

A Study of the Effects of Road Deficiencies on Traffic Accidents in Iran

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Abstract: Many researchers have studied different factors effective on traffic accidents. This is, however, among all the factors, road deficiencies have got little attention. In this study we use the results from 'Order Logit' model to review the accident tension model. Based on the results, the existence of the studied factors has been effective of the accidents. Among the road deficiency factors, lack of safety, has been the most important one. Also, non-standard slopes, lack of standard pavement safety, a sudden change in the road shoulder and the tarmac, sharp road bents, lack of proper signs, lack of parking or road shoulders, bad blacktop, lack of vertical signs, lack of light posts and speed humps are among the factors that increase the possibility of car accidents.

Keywords: Traffic, Accident, Order Logit model, Safety.

1. Introduction

Traffic accidents in Iran are counted as the third factor for people's death, which is 5 times higher than the world's medium [1]. Indeed, the number of death from car accidents in Iran equals huge earthquake casualties such as the biggest one in Iran that was Bam's earthquake. The accidents also bring about huge financial loss, which is estimated over 100,000 million rials, being 7 percent of GNP [2]. This is while in developed countries the loss from car accidents is 1.4 to 2 million dollars, which is 1 to 2 percent of GNP [2].

Reduction of traffic accidents has always been the aim of researchers in road safety studies. Therefore, focusing on these issues has attracted a lot of attention. Contrary to many other studies which have focused on the general factors causing traffic accidents, this study tries to care about the road deficiency factors as well. Paying attention to some factors that increase the accident possibility besides other factors can be significant and can help managers decide better.

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We can also say that the aim of this study is reducing the traffic accidents in the country and stop people from dying in accidents. As mentioned before, despite the great number of death and traffic accidents in Iran there have been few studies on the causing factors. Indeed, this study can help improve the comparison in Iran and especially in Tehran besides expanding the literature of the subject matter. Also the results will be used to identify the pattern and the factors causing traffic accidents and bringing about human and financial loss. If the proper actions be taken by the responsible agencies we can reduce the loss, even though for 1 percent.

Because of the importance of studying the matter we have review the previous literature which is summarized in the table below. Some factors such as bends, tarmac, the speed limit and two way roads have had great influence on reducing the accidents. This is while the accidents in urban areas have increased the statistics of accidents.

Our review showed that there has been no study of the road deficiency factors in traffic accidents' studies. This is while there has been few studies on the geometrics and road safety. For instance, Goharpour and Nikseresht [3] studied the geometric of the roads and its effect on traffic accidents. The results showed that lack of the sameness between the road geometrics and driving rules is effective on increasing road accidents.

Table 1. Brief review of the factors effective on road accidents

The variable	Increasing accident possibility	Decreasing accident possibility
Slope	Khattak [4], Wang et al [5], Xie at al [6], Quddus et al [7], Pei et al [8]	Rana et al [9], Xie [10]
The dry blacktop status	Chang and Mnryng [19], Chung and Mnryng [20], Lee and Mnryng [21], Das and colleagues [13], Wang and colleagues [5], Zhyh and colleagues [6], Hu and Donnelly [15], Qddvs and colleagues [7], helium and of [22], Hu and Donnelly [18]	
The wet blacktop status	Khattak [4], Lee and Mnryng [21], Avlfarsvn and Mnryng [23], Ryfat& T [24]	Khattak and colleagues [25], Rnsky and colleagues [26], Zhang and colleagues [12], Hvldryj and colleagues [27], Islam and Mnryng [28], Gray et al [29], Avbng [30], Li et al. [31]
The frozen blacktop status	Zhang et al [12], Khattak [4]	Khattak et al [25], Shankar and colleagues [11], Rnsky and colleagues [26], Hvldryj and colleagues [27], Gray et al [29], Yamamoto and Cooperating [32], Ryfat & T [24], Malyshkyna and colleagues [33], Rana et al. [9]
On intersection	Zhang and colleagues [12], Hvldryj and colleagues [27], Islam and Mnryng [28], Ryfat & T [24], Malyshkyna and colleagues [33]	Alqmdy and colleagues [34], Avlfarsvn and Mnryng [23], Gray et al [29], Yamamoto and Cooperating [32], Zhyh and colleagues [6], helium and Abdl-Alty [35]

The road with low speed		Chang and Mnryng[19], Chung and Mnryng [20], helium and AbdlAlty [35], pallets and colleagues [36], helium and of [22]
The road with high speed	Zhang and colleagues [12], Lee and Mnryng [21], Khattak and Rocha [37], Islam and Mnryng [28], Savlynn and slice [14], Hu and Donnelly [15], Rana and colleagues [9], Nastaspvlvs et al. [17]	
Increasing the speed limit	Khattak [4], AbdlAlty and Keller [38], Hvldryj and colleagues [27], oh [39], Gray et al [29], Malyshkyna and Mnryng [40], Jung and colleagues [16], Chiu and Fu [41]	
On interstate freeway	Islam and Mnryng [28]	Chang and Mnryng [19], Chung and Mnryng [20], Malyshkyna and colleagues [33], Zhyh and colleagues [10]
In urban area		Khattak and colleagues [25], Chung and Mnryng [19], Chung and Mnryng [20], Islam and Mnryng [28], Malyshkyna and Mnryng [40], Malyshkyna and colleagues [33], Rana and colleagues [9], AbdlAlty and colleagues [42]
Two-way street	Avlfarsvn and Mnryng [23], Ryfat& T [24]	

Review of the study on 'Identification of Severe Crash Factors and Countermeasures in North Carolina' [43] is shown in Figure1. As you can see the road with no shoulder has had the highest severe accident rate in suburban two-way streets.

Since the severity of the accident is directly related the casualty of the passengers, especially the diver, age and gender are among the important factor of traffic accidents. The age and gender of the driver is important in two ways. Firstly, age and gender are directly effective on the injury rate; and secondly, dangerous behavior while driving is related to the age and gender of the driver. These factors have been studied widely and the results show a higher injury rate among young male driver and less among female drivers.

Mercier at al [44] in their study showed that age is a significant factor in injury rate aside from gender, in a way that older divers tend to have higher injury rates. The study proves that age and gender are the most important factors in severity of traffic accidents. Another study by Mercier et al [44] showed that age is the most important factor in injury in traffic accidents and that is more relevant for female drivers. The study shows that the importance of gender gets critical if we study other factors separately. For instance, based on the study, fastening seatbelts reduces the severity of the accidents for male drivers, but the reduction for female drivers is not as clear.

Since the severity of the accident is related to the injury rate of the driver, determining the physical condition of the driver can help us evaluate the accident's severity. Although there have been few studies

on the matter based on engineering not medical condition, one of the limited studies by Parenteau et al [45] showed that the weight of the driver less than 55 kg face the highest injury rate and drivers with more than 86 kg weight, if the airbag works properly, face the lowest rate. Also, it was proved that drivers shorter than 160 cm get less injury.

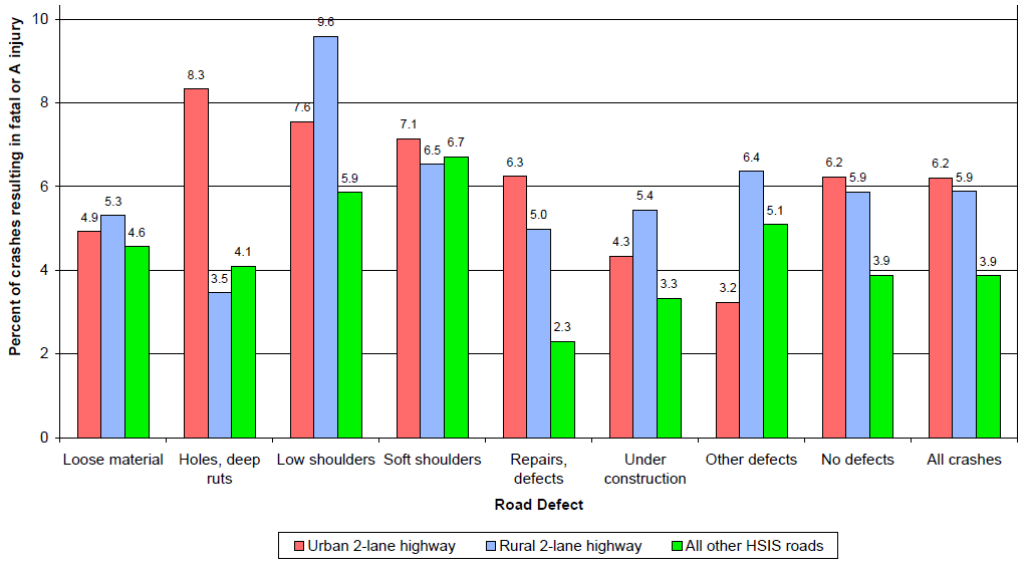

Figure 1. Identification of Severe Crash Factors and Countermeasures in North Carolina

2. Methedology

In a condition that the data are ordinal, because of the discrete nature of the options it is more common to choose discrete modeling over multiple modeling. This model estimate less coefficients and consequently the result will be more tangible. The situation is seen more in determining the accident severity due to the discrete nature of the options. In this condition, using discrete models is really common in studies over the severity of accidents.

The assumption in discrete modeling is that constantly Latent Variable is related to Discrete variable. The general equation is as below:

$$Y_n^* = \beta X_n + \varepsilon_n \quad (1)$$

Where:

Y_n: latent variable

X_n: descriptive variables (the accident features-driver n)

β: the vector for descriptive variables

ε_n: latent error

Mathematically, and can be stated as below:

$$Y_n = j \quad \text{if only if} : \mu_{j-1} \leq Y_n^* \leq \mu_j \text{ and } j = 1,2,3 \quad (2)$$

Where, the thresholds for latent variables that define the accident severity. J is the level of the accident severity. Based on 1 and 2 equation we can state:

$$Y_n = \begin{cases} 1 & \text{if } \mu_0 < \beta X_n + \varepsilon_n \leq \mu_1 \\ 2 & \text{if } \mu_1 < \beta X_n + \varepsilon_n \leq \mu_2 \\ 3 & \text{if } \mu_2 < \beta X_n + \varepsilon_n \leq \mu_3 \end{cases} \quad (3)$$

3. Data

In this study, we have used the date from suburban road in Tehran from 2009 to 2010. The date based contained 9294 accidents. This is while the traffic police used to save the data in five different databases in Microsoft Access software. The data included the accident description, the driver information, the pedestrians involved, the vehicle passengers and the age of all the people involved in the accident.

Due to unclear data about the other drivers, that is because of wrong serial numbers, the data about the other driver involved in the accidents were deleted. After deletion of partial data only 1410 models remained. This is while other information on the traffic load and other variables were not available.

After choosing the database, we determined dependent and independent variables. The dependent variable in this section is the accident severity. Therefore, choosing a proper criterion to describe the severity is crucial. The accident severity is defined as damage, injury and fatality levels. The severity of an accident is determined by the number of injured people. Accordingly, a fatality type accident is an accident with at least one dead victim. An injury type accident is when at least one person is injured but not dead and damage type is when there is no human catastrophe but only financial loss.

Independent variables include a large range of Descriptive variables, which is categorized based on the literature, local situation, the driver characteristics, the accident details and the road features. Also based on the practicality of the variable in the study the variables will be prepared to create the model. The statistical criterion of the given data is shown in table2. In this table, Reference Variable for each variable is determined. As you can see, among the accidents in suburban road, 26.4 percent are damage type, 67.2 percent injury type and 6.4 percent fatality type. The high rate of injury and fatality type accidents, show the insecurity of the roads.

Table 1. The statistical criteria of the given variable in accident severity

The variable type	The variable name	The variable description	Frequency percent
Dependent variable (Accident severity)	Damage Injury Fatality	-	26.4
		-	67.2
		-	6.4
The road features	The road deficiency	None*	40.7
		Lack of light posts	1.4
		Lack of horizontal signs	4.9
		Lack of vertical signs	6.8
		Lack of road lane lines	1.2
		Lack of guardrails	1.4
		Non-standard guardrails	1.2

		Sharp bents	1.3
		Non-standard slope	1.2
		Lack of road shoulders	1.3
		Sudden change of level in	1.3
		tarmac and shoulder of the road	1.3
		Bad blacktop	1.2
		Road breakings	1.4
		Slippery road	1.7
		Road humps	8.0
		Low width road	23.6
	Seeing obstacles	The driver cannot see	11.6
		The driver can see*	88.4
	Geometric features	Flat and direct*	82.5
		Flat and bent	12.0
		Slope and direct	3.2
		Slope and bent	2.3
	Blacktop condition	Dry*	96.4
		Wet	3.6
	The area usage	Industrial*	2.1
		Office and business	0.4
		Not for business	34.0
		(entertainment, ...)	63.4
		Other	
Local and environmental features	The day of accident	Holiday	19.2
		Working day*	80.8
	Season	Spring*	20.9
		Summer	37.2
		Fall	32.0
		Winter	9.9
	Brightness	Day*	68.4
		Night	27.1
		Dawn	0.6
		Sunset	3.9
	Weather condition	Cloudy	93.1
		Rainy*	4.1
		Foggy	0.5
		Snowy	2.0
		other	0.3
The driver criteria	Age	Younger than 25	40.3
		Between 25 to 60 *	49.9
		Older than 60	9.8
	The license type	Possesses driver's license*	91.2
			8.8

		Does not possess driver's license	
	The driver's educational background	Illiterate*	7.6
		Guidance school	41.0
		Diploma	42.3
		Higher education	7.5
		Other	16.0
	Seat belt	Fastened*	27.8
		Not fastened	72.2
	Role of the driver	Guilty	62.8
		Innocent*	37.2
	The driver's error	Disrespecting Priority	11.9
		Sudden change of direction	6.3
		to left or right	0.6
		No entry	1.7
		Tailgating	0.8
		Low transverse distance	9.4
		Low concentration	0.4
		Low driving skills	5.1
		Losing the vehicle's control	10.2
		Passing speed limit	3.5
		Overtaking and change of	3.7
		direction	2.9
		Driving opposite the current	43.5
		Sudden change of direction	
		No error*	
Collision criteria	The vehicles involved	Personal cars	47.8
		Vans	7.4
		Minibus	1.5
		bus	0.6
		Heavy vehicles	1.2
		Motorbikes	9.2
		Bikes	4.9
		Others*	27.4
	The collision type	With a parked car	2.5
		With an object	5.5
		Overturning	9.6
		With an animal	0.7
		With a pedestrian	9.1
		With another car*	72.6
	Kind of the crash	Side by side	8.7
		With angle	31.4
		Head-on-head	17.3

	Head-to-tail	16.8
	Other kinds	25.8
The accident location	The driving lane*	91.6
	other	8.4
Human error	Disrespecting rules	49.4
	Fatigue	3.9
	Being in hurry	18.6
	Not knowing the road	1.1
	Using alcohols or drugs	0.7
	Other involved human	4.7
	factors	3.6
	No human factors*	

* Basic fake variables

4. Modeling

Based on the studies on the traffic accidents it is best to study the recorded accidents in relation with different factors. There has been a lot of work to model the accident severity that we talked about them in previous sections. As we said, every witness is an accident. We divided the given data in damage, injury and fatality types. As you can see the columns are discrete to each other. Based on the above description, we have used discrete modeling. This is while many researchers have used the same methodology to estimate the accident severity. The criteria we used in the method were the driver, the local condition and the accident condition. The aim of this study was to review the effective factors of road deficiency on traffic accidents in suburban roads.

The modeling process was started using all the variables. We should mention that, all the variables used here were reference variables. Also we explained how to create fake variables. To explain more we studied different variables using different modeling process. For instance, the age factor was first divided to 16 to 19, 20 to 24, 25 to 34, 35 to 45, 46 to 54, 55 to 64 and older than 75. We used the t-test to get the coefficient for the fake variables. In the end, using a combination of coefficients, 16 to 24, 25 to 60 and older than 60 were chosen as the model. Also the variable of the area usage was divided into industrial, business – office, not for business and others. We used some other categorizations for these variables. For instance, the variables of fake entertainment area, agricultural and accommodation were studied separately. The results showed that all the three variables were different from each other and their coefficient is so much the same. Therefore, all the three variables were inserted into the model as not for business usage. Other variables were also classified in this way.

The final model is shown in table 3. All the variable coefficients are put in α=10% significance. Abased on the model criteria in the table, the coefficient is a good estimation for 0.1402 models and the accuracy level was 68.2 percent which is accepted based on the aims of the study and the current literature. The positive coefficient model for descriptive variable shows that a raise of variables the number of accidents increases and the negative coefficient shows that a higher descriptive variable reduces or stabilizes the accident severity.

Table 3. Model Results

The variable type	The variable name	The variable description	Suburban	
			T statistics	Coefficient
The accident severity (dependent variable)	Damae	-	-	-
	Injury	-	-	-
	Fataliy	-	-	-
The road criteria	The usage of the area	Not for business (entertainment, agriculture, accommodation)	4.63	1.944
	Road deficiency	Lack of the light posts	2.11	0.581
		Lack of horizontal signs	3.64	0.793
		Lack of vertical signs	2.58	0.644
		Lack of guardrails	4.18	1.075
		Non-standard guardrail	3.69	0.982
		Sharp bent	2.97	0.812
		Non-standard slope	3.21	1.015
		Lack of road shoulder	5.44	0.771
		Unbalanced road and shoulders	2.84	0.867
		Bad blacktop		
		Road breakings	5.87	0.723
		Road humps	3.31	0.667
			2.42	0.345
	The blacktop condition	Not dry	2.79	1.297
	Geometric condition	Flat and bent	1.99	0.313
	The accident date	holiday	3.01	0.359
	Season	Fall	2.78	0.318
		Winter	2.16	0.278
	Brightness	Night	2.53	0.267
		Dawn	3.39	2.116
	Weather condition	Cloudy	2.07	0.346
		foggy	3.21	2.773
	Age	Younger than 25	2.17	0.242
		Older than 60	2.91	0.952

	The license type	Has license	2.92	0.531
	The driver's educational background	Diploma	-2.01	-0204
		Higher education	-2.55	1.721
	Seat belt	no	12.71	1.322
	Role of the driver	guilty	4.44	1.284
	The driver's error	Change of direction	0.308	1.93
		Low concentration	0.423	3.07
		Losing control	0.495	2.66
		High speed	1.072	3.12
		Overtaking and over turning	0.658	3.42
	The vehicles involved	Personal	-0.267	-1.99
		Bus	2.340	2.38
		Heavy vehicle	0.757	3.27
	The collision type	With object	0.895	2.43
		Getting out of road	1.765	2.07
		With pedestrian	0.959	5.08
	Kind of the crash	Angular	0.304	2.43
		Head-on-head	0.425	2.89
	The accident location	other	2.47	0.405
	Human error	Disrespecting rules	0.653	5.23
		Fatigue	1.558	2.83
		Being in hurry	0.755	5.32
μ threshold		The damage and injury level	2.817	
		The injury and fatality level	7.213	
The model criteria		The number of witnesses	1410	-
		LL(0)	-1942.82	-
		LL(β)	-1670.44	-
		ρ^2	0.1402	-
		The accuracy percentage	%68.2	-

5. Discussion on modeling results

At first we review the effects based on the modeling results. The results in table 3 shows that accidents in not for business roads is more compared to industrial ones. In suburban areas you see different agricultural, accommodation areas that passage of people and bikes and disrespecting the signs and rules causes the accidents.

The most important part of this study, is reviewing the accident severity. The results showed that road deficiencies bring about more accidents in suburban roads and good driving needs good road conditions.

Among the road deficiency factors only some of them were meaningful in the model. The first factor is the guardrails beside the road which in case when the vehicle loses control or overturns the guards help the car to stop an reduce the severity. Lack of guards on bents and next to valleys can increase the severity.

The second factor is lack of vision on slopes. Slopes are the important engineering deficiencies that can harshly increase the severity by blocking the vision. Non-standard slopes are among the important factors.

The third factor is non-standard guardrail. As we said the first factor is lack of them but non-standard or improper guards also increase the possibility. Non-standard guards include short guards or improper start and end of the guards that brings about accidents and also increases the severity and can hurt the passengers seriously.

The fourth factors is inequality of road and road shoulder where the tarmac level is higher than the shoulder so that the driver will lose the control since it is hard for the car to get back to the tarmac after it has moved out and that will cause an accident.

The fifth factor is the sharp bents, as we said, road deficiency can be due to geometrics and road bents are a direct cause of that and causes accident since the driver may not be able to react fast enough or act too fast so the car will overturn or hit the other cars.

The sixth factor is lack of horizontal signs where the road lacks color lines so that it is hard for the drivers to see the end of the road so they will hit each other while heading for the margin or the shoulder. The results are from logical model.

The seventh factor is lack of road shoulder and parking so that when a car breaks down the driver has no option other than occupying a part of the road. In this way the other moving vehicles will hit the parked car and that will result in injury.

The eighth factor is bad blacktop. The road must always be flat with no breaks or humps. Lack of flat road will force the drivers to change direction suddenly while not having time to think and that will cause loss and injury. And if the speed is high the damage will be bigger and more sever.

The ninth factor is road breaks. Like the last factor bad blacktop makes drivers to decide fast while there is no time and that increase the possibility of accidents.

The tenth factor is lack of vertical signs such as warning signs or information signs that helps the deriver with what is ahead on the road. As a result the driver will have enough time to react and lack of signs seems to be directly connected with accidents.

The eleventh factor is lack of light. In such case the drivers will have low vision and they will not be able to see the signs and this will be worse in bad weather conditions and will result in accidents.

The twelfth and the last factor is road humps that are among the most common road deficiency features and has the same result and reason as the other factors.

Non-dry pavement path is to increase the severity of accidents. When the road surface is slippery. In this context, factors such as wear and low friction road tires make the vehicle even at speeds below 70 kilometers per hour with little effect brake to be diverted from the road. This will cause more accidents.

The geometric profile is flat and has a horizontal arc compared with planar straight sections of road accidents associated with greater severity. Arch severity of accidents on the roads; have been reported in many studies. High speed driving on flat roads and surprise and their inability to control the vehicle in a horizontal arc can cause an increase in the severity of accidents in this section come. Also, due to the two-wheeled vehicles, the arches and in turn, the balance will be less direct sections, and hence high-speed arc can be an important factor in the balance of drivers and cause accidents more intensity.

As mentioned before, the day of the accident, weather conditions and light as factors related to the characteristics and environmental status is classified. Modeling results indicate that the accidents occurring

on holidays have been increased compared with the working days. Holidays increase the travel excursions and suburban roads to follow. It seems that after trips due to more traffic on the road and driving, accidents are more severe.

Autumn and winter increase the severity of vehicle crashes on rural roads. In general, suburban streets, traffic flow rate is higher than other lamps and drivers of vehicles moving at higher speeds. It can be more difficult due to the result of vehicle control in poor weather this spring and summer seasons to know. The less control suburban street in winter and autumn by police officers, because of the cold weather and the lack of cameras recorded violations in most rural roads, would be a violation More drivers this season. Therefore, further investigation authorities to the issue of human control or planting Infraction cameras, can reduce the severity of vehicle crashes strategies are in this season.

Modeling results show that accidents occur at night and at dawn with more intensity than a day's accidents occurred. In general, the severity of accidents at this time of the day, as drivers in such cases will have fewer days. As well as recognition by other drivers of vehicles due to lack of sufficient light in the dark night in suburban streets, daylight is very difficult. The reason could justify an increase in the severity of injury to vehicle crashes at night. Accident at dawn, is another factor that according to the results, affecting the severity of accidents. It seems that fatigue and sleep-pollution vehicle drivers in such situations, it is more severe accidents. Also on the rise, due to delays in the drivers adapt to changing ambient lighting conditions, their ability to identify risk and reduced their reaction time and increases the likelihood of severe accidents. The intensity in the dark night far is eye-consuming.

Among the variables related to weather, the worst increase in the severity of accidents, weather is foggy. Undoubtedly, the fog visibility less drivers and detect other vehicles becomes more difficult and it would be a cause of increasing accident. As well as favorable weather conditions (clear and cloudy the sky) in the sky, increases the severity of vehicle crashes. Perhaps the lack of driving in rainy conditions is the conditions for such an outcome.

According to Table 3, drivers' gender has no effect on severity of accidents in suburban vehicles. In general, young drivers (under the age of 25 years) and older (over 60 years), compared with drivers aged (25 to 60 years) significantly increase the severity of accidents. It seems to reduce the concentration of power and maneuverability for drivers over 60 years because of aging as well as increased physical vulnerability, the severity of vehicle crashes are the drivers in this age group. On the other hand, also see the risky behavior of young drivers is to be expected. Therefore, it seems more severe accidents in young drivers, the result of this risky behavior in this group.

Other features of the drivers that have been used in modeling the severity of accidents, driver's education. According to final results, the drivers with a diploma and a university degree compared to those illiterate, less severe accidents. It seems that higher level of education leads to greater awareness of the consequences of careless and dangerous driving, as accidents with less intensity among this category of drivers there.

Use or non-use of seat belts is variable in many studies, the severity of vehicle crashes have been used in the modeling. The results of this study suggest that the use of safety belts in vehicles has increased significantly the severity of accidents. Head injury in an accident, is the main reason for the result. These results no doubt, need to seriously control the drivers on suburban streets by means of efficient and effective policies in order to further demonstrate the safety belt. In the first stage, the drivers in the field of education and explain its effect on crash severity, and reduce the number of drivers who do not use seat belts, can help to improve traffic safety and reduce the severity of accidents suburban vehicles. Later, these

solutions can increase the amount of fines, seizure of vehicles and drivers, trespassing, temporarily banned from driving and ultimately revocation of their license them.

Positive factor variable guilty driver, the driver at the scene of the accident shows that accidents are blamed, has been more severe. Another of the variables relating to the characteristics of the driver, creating a complete cause of the accident is entered in modeling. According to results from multiple factors, non-compliance with speed limits, overtaking and the deflection, failure to control vehicles, lack of attention to the front and deviation to the left and right, respectively, have the greatest impact on crash severity. Several studies do not observe speed limits by drivers, has been introduced as increasing the severity of accidents.

On the front of the vehicle involved in the accident can be said that the results of modeling, collision with bus passenger vehicles and heavy vehicles increases the severity of accidents. It has also been reported by other researchers. While riding together in vehicle crashes than any other conflict severity of accidents has decreased. Size and weight difference buses and heavy vehicles compared to passenger vehicles, causing damage to the driver in dealing with the vehicles on the roads outside the city. The overall vision of bus drivers and drivers of heavy vehicles compared to cars because of the large size of these devices is limited. This limited vision, the vision of drivers is intensifying and could be a factor in the occurrence of serious accidents with vehicles is riding.

The final results show models of various types of vehicle crashes, leaving the track, collision with pedestrians and collisions with fixed objects, resulting in a collision with another vehicle are more severe. Increased severity of accidents in vehicles with pedestrian and colleagues also obtained in the study of the Holy One. It is obvious that dealing with pedestrians in residential areas and roads surrounding villages due to the negligence of drivers about speed limits in these areas will be of very high intensity. As explained in the second quarter, due to the limited data in this study to measure crash severity is defined by most people hurt in the accident. So in collision with pedestrian vehicles, generally pedestrian injury is increased crash severity. Increasing vehicle crashes against a fixed object also has been reported by many researchers.

Another feature of the accidents vehicle collisions with other vehicles. Accidents and head-on collisions angle in comparison with other types of vehicles is an increase in the severity of accidents. Clashes head-on crash severity and intensity angular accidents have been reported in previous studies.

In situations other than lane roadway accidents that happen, with a positive coefficient and significant in the final model appeared. This result shows that such accidents compared with the accidents that occur on the roadway are more severe. This result could be due to non-compliance and out of the way drivers.

Among the human factors causing the accidents, factors such disregard for the rules, and hurry undue fatigue and drowsiness in drivers (drivers or drivers of other vehicles) increased crash severity in crashes that involved human factor was not found. According to the results, a set of variables represents a technical problem affecting the accident; none were significant in the final model. This means that in this study a technical fault in the vehicles had no effect on the severity of accidents.

6. Conclusion

This study was aimed at the effective factors in road accidents in suburban road in Tehran province. To do so we used the accident information from 2009 to 2010. Descriptive variables were divided into different factors including road deficiency and local and environmental features of the accident points.

In this section we review the accident severity model and suggest some ways to reduce them. In the end we discuss the limitations of this study and give some suggestions for the other studies.

In this study, we reviewed different factors such as the accident point, the driver features and the accident details in suburban road of Tehran. We used the highest injury rate to categorize the severity. Due

to the discrete nature of the accidents we used discrete modeling and ultimately determined the results based on them. We will describe some of the results and offer our suggestions in the following paragraphs.

The accidents in not for business areas were more than other areas. We can reduce the accidents by applying speed limit and controlling drivers' behaviors.

As we discussed in the previous section, among the road deficiency factors, only some of them are meaningful in the model, yet all of them increase the severity. Thus, we suggest building guardrail in the roads as soon as possible. The results suggest more fund on the matter. Since, fatality forces more expenses to the society directly or indirectly. This is while the need for guardrail in sharp road bents with not clear vision must be a priority.

Based on the severity model, the third effective factors is non-standard guardrails. Thus in the maintenance budget repairing the guardrails must be a priority. Repairing the guards includes making them higher or changing them.

Among the other factors are the non-standard road slopes that increase accidents. We know that the slope must be decided by engineers before building the road and it needs more work after it is built. The fourth factor is the inequality of tarmac and road shoulder. Since the road shoulder includes a little part of the road repairing the blacktop must be a priority, since it needs less expense than the other actions but can reduce the accidents.

According to the results, sharp bents are the fifth factor of road deficiency that increases accident possibilities. Usually sharp road bents are created because of the limitations, thus fixing them is expensive, while we have to fix them as it is possible.

Lack of horizontal and vertical signs are the sixth and tenth factors, respectively. The suburban roads in Tehran must be check out to find all the deficiencies with horizontal signs. Also, vertical sign deficiencies that may be caused by the constructions must be solved.

As we said, lack of road shoulder and parking spaces are the seventh factor. We suggest to build shoulder in the road with no shoulder and create enough parking spaces in nice orders.

The bad blacktop and road breakings or road humps increase the accident possibilities. Road where vehicles pass must be flat with no humps or breaks, this can be check and fixed in a period of time. Otherwise, sudden change of direction will bring about loss for cars and increase accidents.

Lack of light is the other factor. Usually lack of budget causes this and that must be a priority.

Not dry blacktop also causes accidents, this makes the road slippery and cars cannot stop properly. Making cars with ABS brakes and proper training for drivers can reduce the accidents.

In general, road deficiency causes more accidents. More attention from authorities will reduce the rate. Road with better geometrics bring about less accidents compared to other roads.

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