

## Evaluating the Impact of Environmental Variables, Drivers Behaviors and Traffic Congestion on the Amount of Damages Estimated by Insurance Companies in The Crashes Inside Tehran City

Morteza Araghi

Faculty of Engineering, University of Birjand, Birjand, Iran

**Abstract:** The research was descriptive and correlational and also a field study, a questionnaire was used. The study population was citizens of Tehran City that 403 people filled questionnaires with reliability coefficient of 0.77. To ensure the normal distribution of data the Kolmogorov-Smirnov test was used. Validation using confirmatory factor analysis and structural equation models was done. Four hypothesis were accepted and the results showed that environmental factors, driver behavior and traffic congestion can affect the amount of accidents. Accident estimations variable can also affect damage rate estimation. To examine the propriety of structural model we used some of important indexes and this showed that study data had proper propriety with factorial structure and its theoretical infrastructure that is study questions are consistent with theoretical structures. Finally, the sample was determined by calculating the efficiency index and the present sample results can be generalized to the population under study.

**Key words:** Environmental factors, driver behavior, traffic congestion, accident, insurance

---

### INTRODUCTION

Exploring the experiences of other countries show the formulation and implementation of incentives and punishment policies or any other measures to reduce accidents and increase traffic safety are well-coordinated in such a way that the performance of parallel organizations is in conflict with each other. For example, in Sweden, all organizations that are active in relation to transportation accidents like the traffic organization, roads information organization, roads regional organizations, roads maintenance organization, auto insurance companies, etc. all are acting in a same complex as the road management organization (Chehui *et al.*, 2011). The coordinated action of all organizations and agencies related to transportation and traffic, in a whole much more effective than individual, independent actions of any organizations and institutions such as insurance companies, the traffic organization that sometimes may be one of the measures to deterring other organizations or have a negative impact on the entire community.

Chehui and Zhangxingyang (2011) stated that insurance companies using models based on detailed assessments of professional and technical personnel can provide insurance for motor vehicles more scientific and appropriate measures on the rates covered to control their risks. It is vital to create a practical model for the promotion of motor vehicle insurance that guarantee risk management process. Cohen and Dehejia (2003) in a study

concluded that driver behavior and the behavior of economic agents are affected by financial problems. Reduction in financial costs expected to reduce accidents by law or by purchasing liability insurance increased, the mortality rate in accidents.

Manan and Varhelyi (2012) concluded that police statistics on people injured in traffic that are giving to hospitals are not associated with the transportation type and the age of victims. They also introduce behavior of drivers of motor vehicles, using of addictive substances, alcohol and deciding to suicide as the most important behavioral causes of traffic accidents. Karacasu and Er (2011) found that men are involved in traffic accidents more than women. Most men crossing illegally the intersection with priority and women beat more from behind to front cars. They determined that driving faults are similar among same sex and age groups.

Crigone in his study, “due to serve traffic accidents, mental-social approach” on 160 Romanian students found that causes of fatal accidents are acting against the law, lack of attention in driving, fatigue, recklessness, alcohol, illegal and driving over the speed limit. Yang *et al.* (2013) in a study entitled “Estimates of the economic costs of traffic accidents in the city of Louis, Missouri based on GIS” concluded thaty areas with high economic costs and low rates of accident over the Mississippi river free ways and possibly severe accidents in the area for at least a truck in the accidents. They also found more accidents at intersections.

Huang *et al.* (2012) found in a study of the safety of road traffic accidents in China that there are 6.5 accidents daily and almost 20 people die everyday because of it. They suggest that the rate of accidents due to the human factor is about 88%. Kazmi and Zubair (2014) in their study titled "The estimated cost of damage to a vehicle in road traffic accidents in the city of Karachi, Pakistan" found that using GIS techniques and remote sensing in determining areas of high and low economic efficiency and GIS analysis to find factors that cause accidents and prevent them are useful. Wakabayashi *et al.* (2014) suggest that an integrated approach to the management of traffic safety, traffic engineering, vehicles engineering and driver psychology is required. They also found that promotional literature on the edge of roads and streets leading driver distraction, diverting him from the path and thus increase the likelihood of accident.

**Research purposes:** The overall goal of this study is, "Effect of traffic congestion on the amount of damage in accidents inside the city and determining the required changes in estimations of insurance companies (Case Study of Tehran)" and sub-goals expected of them as follows:

**Scientific purposes:**

- The effect of environmental factors on the rate of traffic accidents in the city of Tehran
- The effects of driver behavior on accidents in Tehran
- The effect of traffic congestion on accidents in Tehran
- The effects of the accident on the amount of damage estimated by the insurance companies

**Practical purposes:** The study of the amount of compensation paid by insurance companies in Tehran. The study of the effects of driver behavior on the number of traffic accidents in Tehran. Solutions for insurance companies to determine the amount of car insurance fee in big cities.

**Research hypotheses:**

- Environmental factors effect on the estimation of the amount of accidents
- Driver behavior effects on the estimation of the amount of accidents
- Traffic congestion effects on the estimation of accidents
- Estimations of accidents effects on the amount of damage estimated by the insurance companies

## MATERIALS AND METHODS

Research methodology is descriptive and correlational and also a field study and a questionnaire were used. The population of this study includes various classes of citizens in Tehran (8, 154, 051 people) and the sample by using Morgan table were 389. Various stages of study conducted in the fall and winter of 1393 in Tehran. Data collection tool was a questionnaire that was provided with library studies and relatively similar reviews. The questionnaires were randomly distributed among subjects (citizens, insurance experts from Sarmad, Sinai and Shahr insurance companies; experts from traffic control and police traffic control; traffic studies experts from the transport and traffic studies company in Tehran) was. Those who have completed the questionnaires must respond to 34 items that was designed in 2 pages. The first page of questionnaire included 4 items about the personal information and 15 items of questions and the second page contains 16 items designed in Likert 5 rating scale (strongly agree, agree, somewhat, disagree or strongly disagree).

Questionnaires were analyzed using descriptive and inferential statistics variables as well as, SPSS software package version 22 and package LISREL version 8.8. First, to ensure the normal distribution of data Kolmogorov-Smirnov test was used and variables of descriptive statistics (mean, standard deviation and minimum and maximum) to describe the data and Pearson correlation test was used for inferential analysis. To determine the validity of the questionnaire designed by the researchers it has given to a number of specialists and traffic control, insurance experts and university professors of business management after delivering some minor bugs were used by them and eliminate ambiguity.

To measure the reliability a pilot study was conducted, questionnaires were distributed among 25 residents of the city of Mashhad (outside the research community) and collected and using statistical variables (Cronbach's alpha) reliability coefficient was 0.77. Twenty four were valid and one was removed.

## RESULTS AND DISCUSSION

**Observations descriptive study:** From 403 subjects participated in the study, 161 samples equal to 40% were women and 242 about 60% men. About 1.19% of respondents in the study were aged between 20-29 year. Frequency of other age ranges were respectively 172 equal to 42.7% in the age range of 30-39 year, 135 equal to

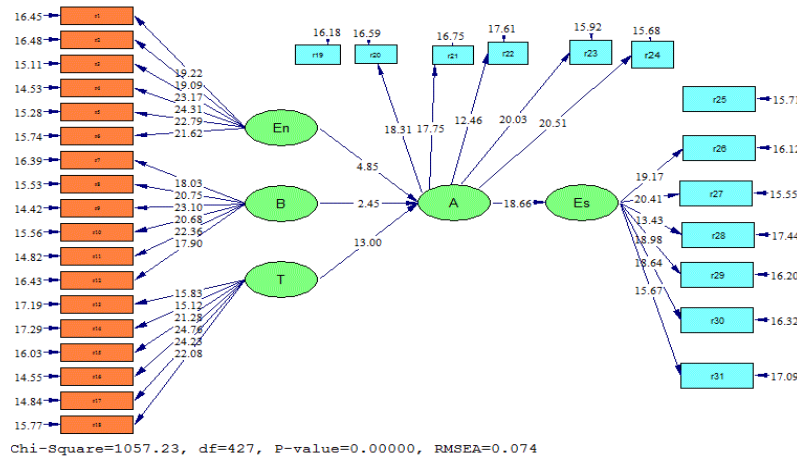


Fig. 1: Structural equation model in significant case (t-value)

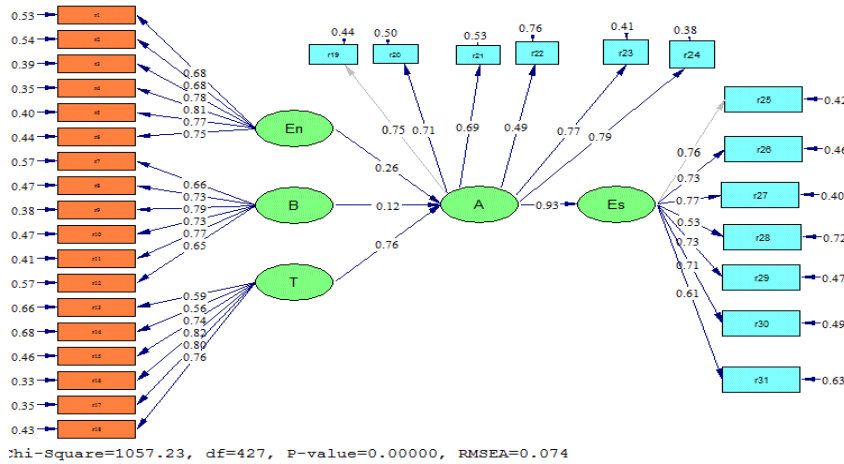


Fig. 2: Structural equation models in the standard coefficients

33.5% in the age range of 40-49 years and eventually 19 equal to 4.7% of the respondents on the range over 50 years of age.

Education of respondents were as: MA and above 72 equivalent to 17.9%, BS 207 equivalent to 4.51%, 79 associate equivalent to 19.6%, 45 diploma equivalent to 11.2%. This is the frequency of respondents in terms of job: 30 insurance expert equivalent to 7.4%; 51 traffic studies expert equivalent to 12.7%, traffic controller 55 equivalents to 13.6% and 267 cases in the other jobs.

**Normality test of the pattern components:** To investigate the pattern of normal components of the KS test was used in all tests, statistical hypothesis as follows:

- $H_0$ : data are normal (the data are from normal population)

Table 1: KS test results for the variables

Variables	Test statistic
Environmental factors	0.079
Traffic congestion	0.103
Driver behavior	0.085
Estimations of accidents	0.075
Estimations of damage	0.066

- $H_1$ : Data are not normal (the data are not from normal population)

As shown in Table 1 significant level in all components is  $>0.05$  errors and then the null hypothesis is concluded, the components of the study are all normal.

**Validation of studymodels using confirmatory factor analysis and structural equation:** Figure 1 and 2 shows structural equation model in estimating the standardized coefficients and significant coefficients (test t). All

**Table 2: Summarizes the results of the study hypothesis**

Hypothesis	Path		Path coefficient	t-statistics	Significant level	Results hypothesis
	From	To				
1	Environmental factors	Estimations of accidents	0.26	4.85	>0.01	Confirmed
2	Driver behavior	Estimations of accidents	0.12	2.45	>0.05	Confirmed
3	Traffic congestion	Estimations of accidents	0.76	13.00	>0.01	Confirmed
4	Estimations of accidents	Estimations of damage	0.93	18.66	>0.01	Confirmed

**Table 3: Pearson correlation coefficients, reliability and validity and descriptive**

Variables	1	2	3	4	5
Environmental factors	1				
Driver behavior	0.95	1			
Traffic congestion	0.88	0.92	1		
Estimations of accidents	0.96	0.93	0.85	1	
Estimations of damage	0.73	0.74	0.84	0.78	1
AVE	0.75	0.71	0.69	0.89	0.78
MEAN	2.34	2.34	2.34	2.34	2.42
SD	0.290	0.300	0.320	0.298	0.436

variables of the model converted into two categories become covert and overt. Obvious variables (rectangles) or directly observed by researchers while the latent variables (oval) were not directly seen or measured but on relationships or correlations between variables. Hidden variables are divided to two groups: endogenous or exogenous variables or the recipient and the donor. The chart numbers or coefficients are divided into two categories. The first set of measurement equations are as hidden relationships between variables (oval) and apparent variables (rectangles). These equations called factor loadings. The second set of structural equations that are concealed and hidden relationships between variables are used to test hypotheses (14, 15). The coefficients are so, called path coefficients. The load factor are a measure that will have the greatest loadings, the measured variable is the larger share of a smaller index that factors have played a smaller share in the structure measured.

In Fig. 2, the abbreviated name for the variables used. The names of the variables are as follows: En variable environmental factors; B variable of behavior and stress for drivers; t-variable of traffic congestion; A variable of estimation accidents; Es estimation the extent of damage variable.

**Hypotheses test:** According to the results presented in Table 2 and the values of the parameter, the null hypothesis of four hypotheses with 99 or 95% confidence rejected and there fore these hypotheses are accepted.

**Investigation the reliability and descriptive and correlation coefficients:** Table 3 shows Pearson correlation coefficients to investigate the relationship between hidden variables mutually.

The correlation coefficient of environmental factors variables, driver behavior and traffic congestion on the estimated amount of accidents are >0.85. The variables

**Table 4: Indicators of research structural propriety model**

Index title	Index value	The amount of acceptable fit
$\chi^2/df$	2.743	Value between 1 and 3
Goodness of Fit Index (GFI)	0.84	GFI>90%
Adjusted Goodness of Fit Index (AGFI)	0.81	AGFI>90%
Root Mean Square Error of Approximation (RMSEA)	0.074	RMSEA<10%
Normed Fit Index (NFI)	0.97	NFI>90%
NNFI (Non-Normed Fit Index)	0.97	NNFI>90%
CFI (Comparative Fit Index)	0.97	CFI>90%

**Table 5: The adequacy test of research sampling**

KMO and bartlett's test (bartlett's test of sphericity)			
-----			
Kaiser-meyer-olkin measure of sampling adequacy	Approx. $\chi^2$	df	Sig.
0.783	3426.773	10	0

can be concluded that environmental factors, driver behavior and traffic congestion have been able to estimate the amount of accidents and variables explained well. The correlation coefficient for the impact of estimated variable of the accident on the amount of damage is estimated 0.78. On this basis, we can conclude that the estimated variable rate of accidents 0.78 of variables to estimate the amount of damages explained and the remaining 22% is the forecast error and may include other variables affecting accountability.

**Model propriety test:** Any obtained indexes are not lonely the reason for being or not being the model propriety but these indicators should be interpreted in conjunction with each other. To assess confirmatory factor analysis models and the propriety path, there are several characteristics. In this study, to evaluate the model we used confirmatory factor analysis of seven important criteria that results were stated in Table 4. As the characteristics of the fitness show, a factor structure and developed based on research data of this study is a good fit and this results in line with the questions of theoretical constructs. Also confirming 3-5 statistics is enough to proper stating the model (14, 15). Kaiser-Meyer measure is shown on Table 5. The numerical value of 0.6 for this indicator shows that a good enough sample to conduct exploratory factor analysis is done. Thus, according to the table of sample results of this study can be generalized to the population of this study.

## CONCLUSION

The results showed that the most important factor in predicting car accidents than urban respondents are factors related to traffic congestion. This means that by adopting strategies that focus on traffic accidents within the city we can change the variable rate. On the other hand, we can say, people which their assessment of effective factors in accidents within the city is more, their damage estimations are even more. According to the first hypothesis test results showed that environmental factors play an important role in predicting urban accidents in Tehran. This means that people pay more attention to environmental factors such as the car park at the edge of the street, non-compliance with traffic rules by some motor cyclists and safety and down the streets and there are many obstacles and disadvantages in them, they are more likely to see the rate of accidents.

The results have shown that driver behavior plays an important role in predicting the rate of accidents within the city in Tehran. This means that people less focus in driving, increases the risk of accidents. Based on the results traffic congestion has the most important role in predicting the amount of traffic congestion within the city in Tehran. Among the factors contributing to traffic congestion, increasing the possibility of accidents and lack of space, vehicles also cited the high number of single-seat cars. Due to the correlation coefficients can be concluded that the variables are correctly due to these factors and can significantly reduce the amount of urban accidents.

## SUGGESTIONS

Based on the research findings suggest the possibility of accidents in areas where most of the legislation, the amount of compensation reduced. In this category can, be divided into different areas to identify high and low risk areas in Tehran and in the event of accidents in each region in proportion to the amount of risk in that area paid damages. Getting premium drivers not only by distance but by the choice of direction this

means that drivers who are at highest risk are the more distance than those who must travel shorter distances, safer and more insurance premiums to pay. Finally, it should be noted that future studies may use different methodologies for data collection; methods such as focus groups, observation and deep interview and thereby is able to identify the factors influencing attitudes and explore new models achieved.

## REFERENCES

- Chehui and Z. Zhangxingyang, 2011. Research on motor vehicle insurance underwriting risk management model. *Procedia Eng. J.*, 15: 4973-4977.
- Cohen, A. and R. Dehejia, 2003. The effect of automobile insurance and accident liability laws in traffic fatalities. *J. Law Econ.*, 47: 357-393.
- Huang, P., X. Xuan, R. Qiu and G. Liu, 2012. Statistical analysis on production safety accidents of heavy casualties of the period 2001-2011 in China. *Procedia Eng.*, 45: 950-958.
- Karacasu, M. and A. Er, 2011. An analysis on distribution of traffic faults in accidents, based on drivers age and gender: Eskisehir case. *Procedia Social Behav. Sci.*, 20: 776-785.
- Kazmi, J.H. and S. Zubair, 2014. Estimation of vehicle damage cost involved in road traffic accidents in Karachi, Pakistan: A geospatial perspective. *Procedia Eng.*, 77: 70-78.
- Manan, M.M.A. and A. Varhelyi, 2012. Motorcycle fatalities in Malaysia. *IATSS. Res.*, 36: 30-39.
- Wakabayashi, H., M. Ando, T. Kawaguchi, Y. Horie and K.H. Hotta, 2014. Sustainable traffic safety management at accident black spots combined with drivers psychology and vehicle engineering using eye mark recorder. *Transp. Res. Procedia*, 3: 90-99.
- Yang, S., S. Lu and Y.J. Wu, 2013. GIS-based economic cost estimation of traffic accidents in St. Louis, Missouri. *Procedia Social Behav. Sci.*, 96: 2907-2915.