Study Of Effective Factors in Performance Of Urban Transportation Network During Emergency Condition

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Abstract

Urban network transportation can have an important role in natural disaster management. This role can be influenced by three parameters such as: specification of disasters, specification of network and environmental conditions. Each of three characteristics can have special impact in improving or decline of management during emergency condition. The problem appears when demand of using increases while probably transportation network is damaged or influenced by incorrect human behavior, which arises from disaster or its result.

This research is trying to identify the most important factors that impact on the above mentioned parameters (1) to classify damages on the urban network by disasters (2) to study methods of combination these parameters for increasing the capacity of urban transportation network and improving performance in emergency conditions. Therefore part of Tehran transportation network will be studied to recognized portion of these parameters and its factors in emergency management after an unusual condition.

Introduction

Recent earthquakes have presented us important lesson of the role of transportation network in managing critical condition. After Bam earthquake (2003) and Kerman region earthquake in Iran, The role of accessibility of transportation network was considered more than before. Study of the transportation network should perform in two topics, one the urban transportation and second roads. (1)

In this research we studied the role of optimum performance of urban transportation network in modifying emergency management. However two components of network (urban and road transportation) have complementary role in transportation service presentation. (2) In Bam earthquake In Kerman region In Iran because of the form of urban and structural specifies of it, function of road transportation was more important than urban transportation. Hours after disaster in this region the original route of Bam was closed because of crowd travelers who wanted to enter the damage city. (3) This traffic flow did not permit to other travelers who wanted to leave the city and the road performance of network was stopped hours after

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disaster. The cause of this condition was not physical damage of earthquake but these conditions occurred because of at least two factors that have not physical origin. (4) Most of studies that did until now have concentrated on physical condition and factors but physical factor of transportation network is one of parameter that can be impact on managing transportation network in emergency condition. (5) In Bam earthquake two important factors which impact on road emergency rescue and relief were crowed flow of travelers who wanted enter the city and using the opposite line of road. This problem led to two consequences:

One – in spite of the fact that urban network had an agreeable performance the total function of earth network was unarguable.

Two - formation long line of vehicle, which blocked the road. This problem led to formation blocking condition in route.

Material And Methods

The objectives of this research are:

1) To classify damages on urban network transportation

2) To study the methods of combination three parameters, Specification of disasters, specification of network and environmental condition to identify manners for reinforcement of emergency response. After an unusual conditions - unusual condition describe on under status:

1) Catastrophic disaster, which impact on all lifelines of cities such as earthquake or flood. After an earthquake collection of reasons may cause on urban transportation network these reasons classify into two groups that are physical reasons and social parameters. (6)

2) Unusual conditions that result from an unexpected factor, which can influence on regulation travel in the network such as car accident. This branch of unusual conditions is more commonly compare of one group and have slight impact on traffic flow. Because of repetition of this group of unusual condition we can study on them and extend our research on the other unusual conditions. (7)

Researches have been until now were concentrated on physical specification of transportation network and have tried to explain the performance of network by physical measurements. (8) These indexes or measurements can measure the performance of transportation network by means of physical characteristics of road such as accessibility, open length of route, time of travel and other parameters. The result of using these measures concludes to inexact evaluation of performance of transportation network.

Zone of study was part of east section of transportation in Tehran city. This part of transportation network was studied by analyzing in two manners:

First: by using two suitable scenarios, which based on defined environmental conditions and distinguish kind of disaster, in this approach concentrated on second factors (Specification of network) the result of this part of study illustrated in figure 1 -a.

Second: with considering three factors and by method of changing one of them, analyzed the impact of varying one of them in value of others. The result of this approach illustrated in figure 1-b.

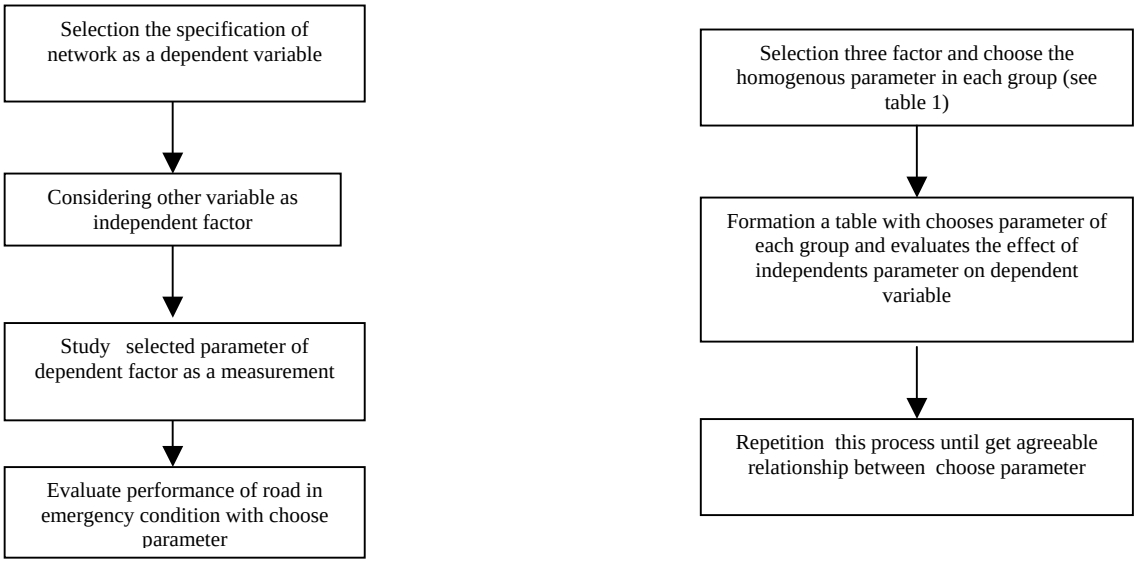

Figure 1- Method of execution of two approaches of analyzing performance of transportation network.

Collection of Factors	Parameters in each groups of factors
Specification of disaster	1. Kind of disasters (earthquake, flood, fire , accident,…) 2. Intensity of each disasters (this parameter can describe quantities or qualities) 3. Time of happening 4. Location of occurrence
Specification of network	1. kind of road (urban route or road) 2. Class of road 3. Geometrical specific of road (length, width, slope, hazardous locations)
Environmental conditions	1. Parameters that return to structure around road such as (height of structure around road, age of structure, limit of road and method of land use around route 2. Human behavior after disaster 3. Distribution of SOS in space 4. Geological condition (existence of fault, …)

Table 1- Collection of three groups of factors and sample parameters in each groups.

Collection of factor	Selected parameter for evaluation group one	Selected parameter for evaluation group two
Specification of disaster	Intensity of earthquake (M)	Date of happened (C_X) Class 1of time (00-06) Class 2 of time (06-12) Class 3 of time (12-18) Class 4 of time (18-00)
Specification of network	Open width of urban road (W)	Number of cross sections (N)
Environmental conditions	Open distance between road and first structure around (L)	Portion height of highest structure with width of road (p)

Table 2- Selected parameter in each group of factors. (We choose the first column of parameter for study)

	M	W	L
M	1.00	-0.6 3	-0.43
W	-0.6 3	1.00	0.76
L	-0.43	0.76	1.00

Table 3- co relationship coefficient between three-selected parameter in three groups in one scenario of earthquake. (Scenario with better condition)

	M	W	L
M	1.00	-0.68	-0.45
W	-0.68	1.00	0.81
L	-0.45	0.81	1.00

Table 4- co relationship coefficient matrix between three selected parameter in each group in second scenario of earthquake.

Findings

The result of this research presented in tables 1 to 4.

Result And Discussion

In our research to distinction parameters that can control the performance of transportation network in emergency condition, developed three groups of parameters. Considered factors are:

1- Specification of disaster
2- Specification of network
3- Environmental conditions.

Last index can classify in second group of factors. Second group of factors most concentrated on planning of road.

Study of spesification of disasters

Most disasters such as earthquake, flood, faire, road accident, storms…can impact on transportation network. Mechanism of impression of each disaster will return into three parameters, the kind of disaster, and the intensity of it and other specific of disaster that indicate interaction between disaster and around environment. Such as the time of happen that impact on injuries and behavior of people in critical conditions. The last parameter will discuss about interference between environmental condition (which will be explain later) and two characteristics, which were mentioned above. Remembering the kind of disaster, probable disaster, which influences on transportation network is earthquake. Research showed that road system is vulnerable lifeline in essential equipment in urban areas. All part of transportation network is vulnerable again earthquake but urban rail transportation and road are more sensitive again earthquake. In zone of study (part of urban route of transportation network in Tehran) we described two scenario of earthquake disaster. One scenario presented better condition compression with second scenario. With considering this two scenario and simulation the second unusual condition (mentioned above) with data of table 1 the parameter intensity of earthquake choose as suitable parameter in collection of disaster and the coefficient of correlation ship of this parameter in two scenario is illustrated in table 3 and 4. These two scenarios were based on two critical conditions that may occur. One scenario is related the earthquake with magnitude under M= 6, and second scenario indicate occurrence earthquake with M value more than 6.

Study of specification of network

Transportation network divide to four essential manner of use, which are air transportation, road, rail and marine transportation systems. This research concentrated on urban transportation network consists of urban roads. Urban road can divide into two groups of routes, Avenue and street. The definition of each component relation with kind of using. In this research we assumed that the deference between two components is clear. Our study was emphasizing on second component (avenue) because of more than 70% of rescue and relief travel in Tehran should doing in this component of network. For evaluated the performance of the urban transportation network in parameter in second collection in table 1, the open width of road after unusual condition choose as suitable parameter that can be measured. In 20 samples of points this parameter is measured under two scenario of earthquake and the result of correlation factor of this parameter is showed in table 3 and 4.

Study of environmental conditions

In the zone of study environmental conditions were most important factor, which can influence in performance of transportation network. These factors commonly forget because of difficulty method to quantification of them. Environmental conditions are un homogenous parameters that can divide to:

1- humanistic parameter: behavior of human can study qualifiedly and quantitative but presentation a model for predicting human behavior is more difficult. This problem originates from the act that human behavior in unusual condition is commonly do not following a especial pattern. In this situation people show difference behavior that classifying of kind of this patterns is more difficult.

For example car accident in this situation is most probable because of in concentration of drivers. The result of happening these problem is violence the conditions. (9)

2- environmental physical parameter: these factors related to around environment. These parameters can describe in exceeded group of variable that originate from around a road. Common parameters are the height of building around the route. The coefficient of height of

highest building to width of road and the other parameter that listed in table 1. We choose the minimum distance between first buildings from route as a essential parameter. This parameter can evaluate by basis of meter and showed it by index (L) in table 3 and 4 illustrated the co relationship coefficient.

In emergency condition the most important factor is the Time. Time have an important role in decreasing injuries of disaster but decreasing time of response related on difference parameters such as accessibility of transportation network. Without existence of safety transportation network most of trying is vain. In emergency condition accessibility into damaged region fulfillment serious task. Performance of transportation network in unusual condition can measured by means of opened length or opened width of the road. However by means of these instruments, measuring the work of network is possible but influence of environmental condition and type of each disaster can change all of predictions, which do by considering physical measurement. Attention to only physical condition for planning in critical condition may lead unexpected situation. High correlation coefficient between the free open width of road and magnitude of earthquake and (L) index demonstrate attention to three groups of factors in planning of transportation network in emergency condition.

Conclusion

The result of this research demonstrates that the co relationship coefficient between choosing parameter in each group of factor is acceptable. So dividing essential factor of performance of network into three groups of factor can help in simplicity of study performance of transportation network in unusual condition. This method helps us to select only one parameter in each group to study the impact of it in performance of network. This approach showed that environmental parameter that commonly forgot has an important role in physical factor and total in performance of network. The relationship between open widths of road after earthquake is most correlated into the environmental factor and type of disaster.

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