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ASSESSING FACTORS INFLUENCING ON PEDESTRIAN SECURITY IN WALKABLE ENVIRONMENT, CASE STUDY: OLD CONTEXT OF MARVDASHT CITY

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ABSTRACT
Walking as the healthiest way of transportation was always seriously in attention by city managers, and in all of the transportation planning, we try to encourage people to walking instead of using cars. One of the factors influencing on walking is to make a safe environment for walking and because of the fact that pedestrian safety is one of the main principles in walkable environment. So the aim of the present research is to pay attention to pedestrian security issue in walkable environment and therefore at first step by using literature the indices that define pedestrian security extracted and after that by using a questionnaire the effects of these indices on security in citizens viewpoints has been measured, Data analysis was done using factor analysis method in Lizrel software , Results show that the Fear of accident variable has the most impact equal to 45 percent and after that the Fear of crime with 42 percent in the second and the Passing safety with 39 percent in the third and the Security of women and children with 16 percent in the fourth rank and the presence of police with 10 percent in the fifth rank and the pathways lighting with 8.3 percent in sixth rank and the presence of people on the sidewalk with a 5.8 percent in seventh rank and the sidewalks structure with 2.8 percent have the lest effect on pedestrian security.

Keywords: Security, Pedestrian, Factor Analysis, Walkability, Marvdasht City

INTRODUCTION
From the perspective of urban planning, designing modern cities are depended on car. However, this type of urban planning had reduced life quality by removing life's mobility and good relationships between people in society and so that separation of peoples from public association caused reducing in social interactions, while walking on the sidewalks caused a lot of positive interactions between city peoples. On the other hand, the confusion and chaos in landscape and non-optimal use of landscape elements in city caused a gap in meeting the basic emotional needs of citizens.

The case study in this research is the old context of Marvdasht city that because of the lack of planning and development it seems that walkability in this neighborhoods are low and people tend to walk less. In this study author uses factors influencing the security of pedestrians in urban environments to explore the social and physical factors of the build environment that Increase or decrease the security of build environment.

Statement of the Problem
The active participation of the people in the city increases security in urban spaces that it is useful in continuity of life and its survival, which in the absence of it the quality of urban decrease and the meaning of city will goes out, in walkways, pedestrian should be always secure in front of vehicles and also the transportation should be strongly controlled (Mojtahed, 2008).

American society of urban planning (American of urban planning, 2008) about the issue of security said that: forms of urban design are used as facilitator in being seen for strangers. Natural surveillance will develop by using means that increase visibility, parking area and building entrance) like: windows overlooking the street and streets familiar with pedestrians).

Natural surveillance will be increased by using means that maximize the visibility of people, parking area and building entrance (like windows overlooking the streets, and streets familiar with pedestrians). John

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Lang in human needs model, examines hierarchy and relationships between the needs in the form of categorical include physiological needs, safety, dignity, confidence and dependence, etc. and name security as one of the basic needs in the second rank of this category.

Leonard believes that the ideal mode of healthy city is in introducing city typology needs and names security in the first category of basic needs. John Ashton one of the famous people in Healthy city point to the security as one of the non-replacement quality in making a healthy city. The aim of this study is to achieve a walkable environment for pedestrian so that they use fewer cars in their daily travels.

Literature Review

Pedestrian Security is one of the important factors in order to increase pedestrian activity since people would fear getting on the road by foot in an unsafe neighborhood. Two kinds of security concerns exist, one being the fear of accidents and the other being fear of crime. While a number of regulations and design standards exist to prevent accidents and discomfort to pedestrians, the reason for the hesitation to walk on streets is primarily caused due to the fear of crime. As Jane Jacob says, more "eyes on the road" are required to increases the safety of the neighborhood (Jacobs, 1969).

Loukaitou-Sideris (2006) and Timperio *et al.,* (2004) study the impact of safety of Neighborhood surroundings on the walking behavior of people. The study shows an established relationship between the perception of safety and the walking trips made and the study consequently proposes the interventions of both policy as well as design in order to reduce crime. Some of the suggestions it makes are to promote natural surveillance through design and to increase the presences of signs of care so that the environment does not look abandoned. Oscar Newman in his book "Creating Defensible Space" emphasizes urban design that avoids formation of hidden and obscured niches and corners on the streets so as to provide better visibility of the surroundings (Newman, 1996). Both Loukaitou and Newman advocate the Principles of Crime Prevention through Environmental Design (CPTED) which propose design strategies such as natural surveillance and territorial reinforcement in order to reduce crime on the streets. Natural surveillance aims at achieving public place design with greater user visibility of the surroundings and lesser hideouts where criminal activity could possibly occur. Territorial reinforcement intends to create a sense of belonging and maintenance which inhibits criminal activity from taking place (Crowe, 2000).

Litman believes that security is one of the elements of walkable environment. He said that the pedestrian security is influenced by the intensity and quality of lighting. In biking and walking route, lighting should be accordance to standards (Litman, 2010). There are potential synergies between the built environment attributes that contribute to an aesthetically pleasing streetscape for walkers and those that deter disorder and crime. For instance, Craig *et al.,* (2002) rated streets for various themes including: (1) safety from crime; and (2) potential for crime. Both contributed to a summary environmental score that was associated with walking to work. The crime-related elements included lighting, front porches; escape routes, property maintenance, graffiti, vandalism, disrepair, and the presence of other people (Craig *et al.,* 2002). In Walknomic Tool which measure street walkability by entering zip code it used factors such as Perception of safety and security, street cleanliness / gathering trash, the actual speed of traffic, the number of lights, sidewalks width, quality of street lights; sidewalks accessibility, Street crossing for pedestrians, respect to speed pumps and the number of street furniture and so on the walkability of that street measured. In walkonomic tool the fear of crime is defined as to some extent you may feel secure from crime? Other factors influencing on security are: lighting, inconvenience and presence of police (www.walkonomics.com).

Studied showed that distance to the destination has the more effect on pedestrian choosing for walking and is more than other factors like weather, physical problems, safety and fear of crime (Funihashi, 1985; Komanoff and Roelofs, 1993; Handy, 1996; Smith and Butcher, 1994).

MATERIALS AND METHODS

Research Methodology

The research process in a systematic and planned to find facts or understanding issues that seeks to find answers to the questions (Hafez, 2006).

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Yin (2000) Saied that when the main quastion of the resarch starts with why and how, and also when the research point at a contemporary phenomenon, we usually use case study for our research. So in this study we used case study method that this method is a kind of qualitative research.

In this study, first of all with studying literature we reached to the hypothesis that the pedestrian security is one of the factors influencing on pedestrians choosing for walking and after that for assessing security we used 8 Variable to measure the pedestrian satisfaction of environment security. Then to check the indicators in the study area we used questionnaire that its reliability has been checked by content analysis method which in this method the questionnaire was accessed by experts and the necessary correlation was done. Then we checked the validity of the questionnaire by help of Cronbach's alpha Test. Cronbach's alpha of the questionnaire was 0.804 that it shows high reliability of it.

Determination of the minimum sample size necessary for gathering data relating to structural equation model is a very important. Although there is not an overall agreement in the case of the sample size required for the structural equation model and factor analysis, but in spite of many researchers minimum sample size are 200 samples. Kline believes in exploratory factor analysis we need 10 or 20 sample for each variables. But the minimum sample size is 200 samples (Hooman, 2011). So 200 questionnaire were fully loaded which is the results are shown below:

Table 1: Indices were used for assess pedestrian security in Walkable environment

Factor	Indices	Reference
	The presence of Police	www.walkonomics.com
	Walkways Structure	Moeini,2011
	Security of children and women	Soltani and Pirozi,2013
	Fear of Crime	[Loukaitou-Sideris and Anastasia, 2006], [Timperio *et al.,* 2006] [Newman and Oscar, 1996]. [Crowe and Timothy, 2000] [Brown *et al.,* 2004] [Perkins *et al.,* 1992] [Craig *et al.,* 2002]
	Fear of accident	Moeini (2011) [Kumar, 2009], [Cerin *et al.,* 2006]
	Pedestrian Traffic	Moeini (2011)
Security	Lighting	Moeini (1390) [Bhattacharyyaa and Mitrab, 2013] [litman, 2010] [www.walkonomics.com]
	Presence of Pedestrian	Authors

Case Study

Region of Marvdasht have a very long History and had leaving behind great historical developments, but the city of Marvdasht has started developing by creating Sugar Factory in year 1933, The city has located in 48 kilometer in east of shiraz and near the Shiraz-Esfahan highway, From the Geographic location this city is located in the Center of Kor Rod plain between Cine aftabe Gondashlo Height at the west and Rahmat mountain at the east. The city Geographic coordinate is in 55 degree and 29 minute width Northern and 53 degree and 52 minute length within Eastern and its Height from sea level is about 1600 m from the sea. Based on official statistics in 1390, the population of the city is 138649 people that 70221 people were male and 68428 people were female. The number of family in this year was 37918 Family. City of Marvdasht Has passed away 80 spring from the First physical appearance by Created sugar factory, thus if we can name a place historical in definition that have more than 100 year, so the marvdasht city have not a historical context, but we can find the old context of city in the central area of the city that have more than 70 years. The oldest context of the city are in this place that Sugar factory is in its center and Municipality building are near it . So Marvdasht has expanded along the main streets over times and urban centers with different uses made. These centers became weaker as far as they are farthest from the city center. Old context of marvdasht city include 4 zones of 10 neighborhoods that its area is about 175529 m2 (net area of old blocks) and 2340524 m2 (old context impure). The population of old context is 42475 people and the population of neighborhoods is 81631 (Khod, 2009). In this study the

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author calls the old context as the old name because despite the renovation and improvement of some parts there are a lot of problems in this context, especially in terms of city infrastructure.
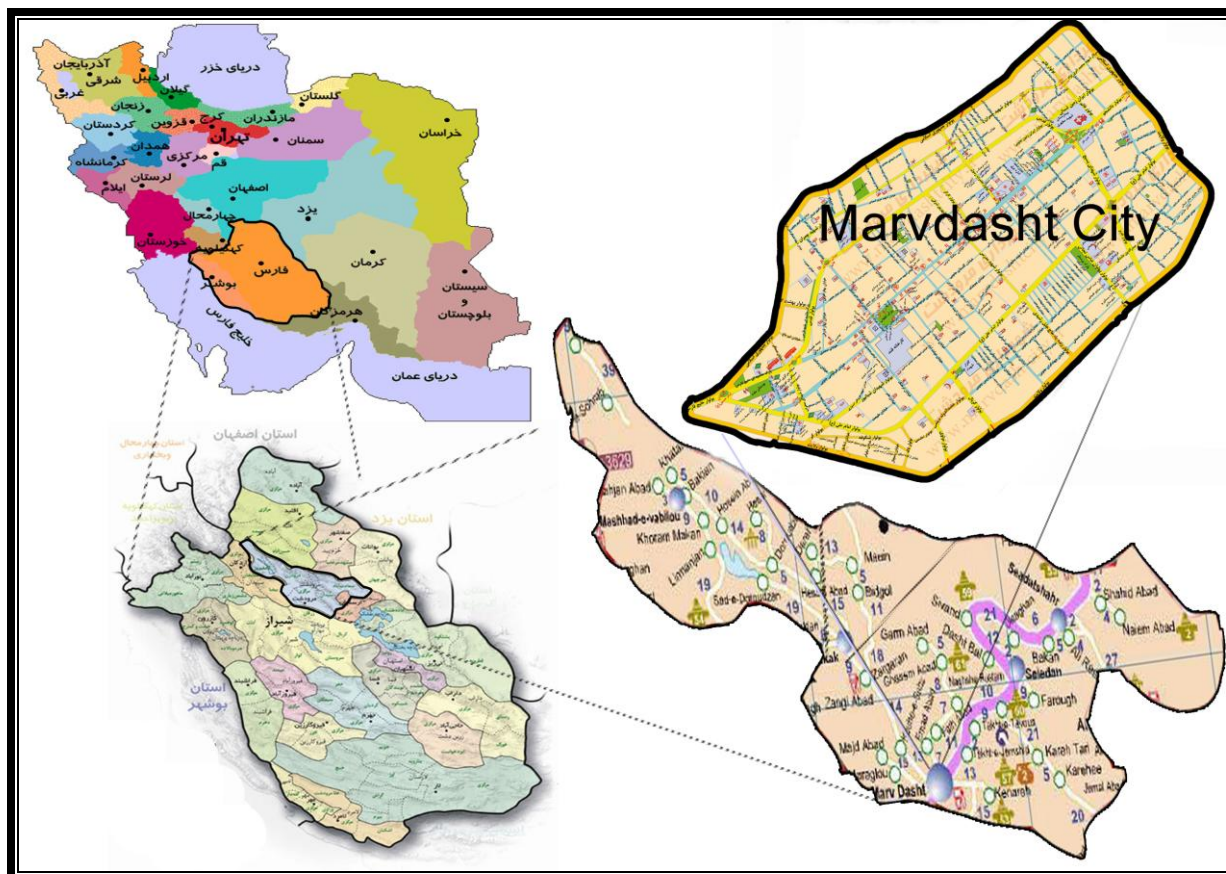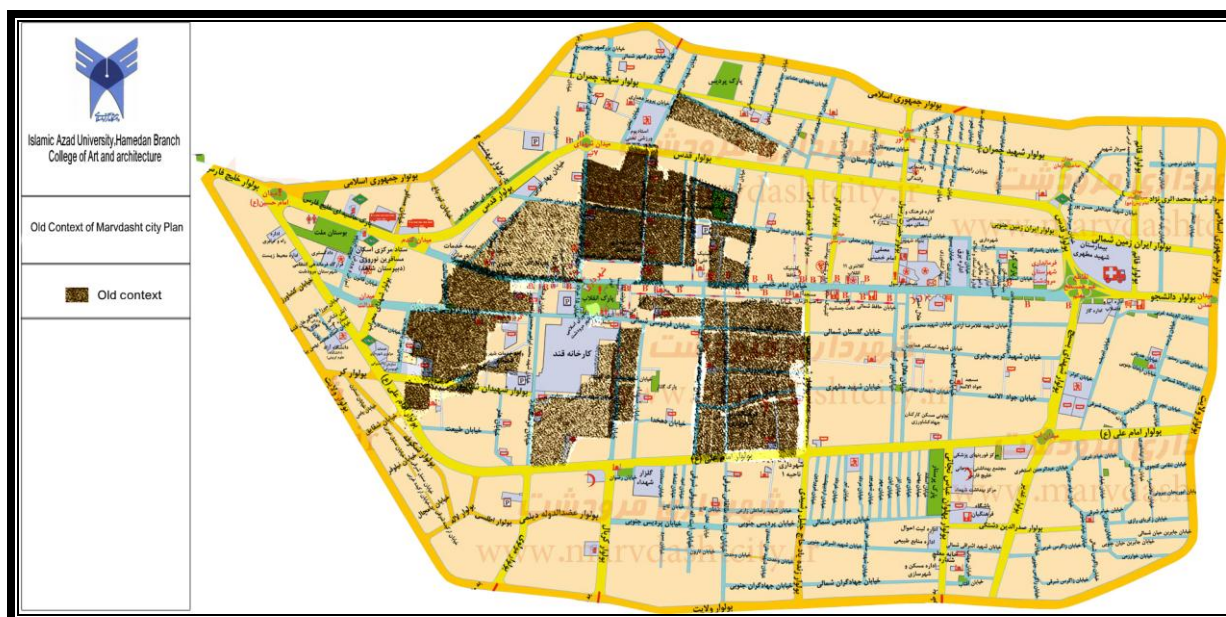

Figure 1: Marvdasht Map in Iran

Figure 2: Case study

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RESULTS AND DISCUSSION
Research Finding Analysis
To check the security of the study area,8 indices that are taken from literature are used that are shown in Table 2 then by using Factor Analysis Method, Factor loading on each index calculated and goodness of fit indices of model were checked that results are shown as follow.

Table 2: Indices indicate Security

Factor	Variable
Security	The presence of Police
	Walkways Structure
	Security of children and women
	Fear of Crime
	Fear of accident
	Pedestrian Traffic
	Lighting
	Presence of Pedestrian

Table 2: Descriptive analysis of answers to safety Factor

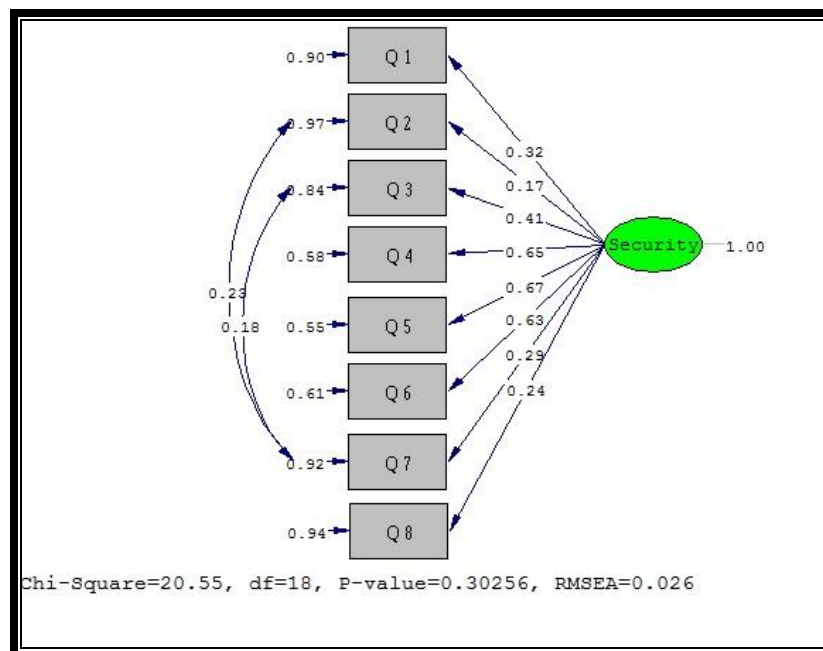| Factor	Variable	Very High	High	Normal	Little	Very little
Security	The presence of Police	1	10	40.5	28	20.5
	Walkways Structure	25	24.5	30.5	16	4
	Security of children and women	7.5	9.5	37	28.5	17.5
	Fear of Crime	3	7	31	31.5	27.5
	Fear of accident	5	**5.5**	50	27	17
	Pedestrian Traffic	1	13.5	48.5	25.5	11.5
	Lighting	12.5	13	31	24	19.5
	Presence of Pedestrian	6	14.5	25.5	31.5	22.5

Figure 3: Security Model with Standardized ratio
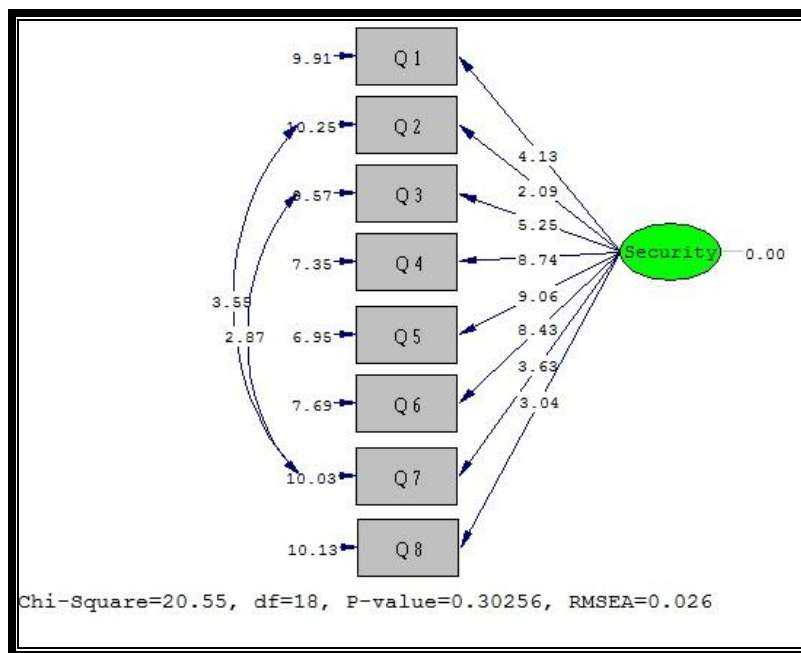
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Figure 4: Security Model with T-Value

Explore Model Results
The method for parameter estimation is maximum likelihood method which Path coefficient between the variable **Presence of police** and our latent variable (Security) is equal to 0.32 and its error is equal to 0.88. T-Value in order is 4.13 and 9.91 and it is meaningful at the level of less than 0.001. Also about 10% of the variance of latent variable (security) is defined by the presence of police variable.

Path coefficient between the variable **Walkways Structure** and our latent variable (Security) is equal to 0. 2 and its error are equal to 1.37. T-Value in order is 2.09 and 10.25, and it is meaningful at the level of less than 0.001. Also about 2.8% of the variance of latent variable (security) is defined by the presence of police variable.

Path coefficient between the variable **Security of children and women** and our latent variable (Security) is equal to 0.45 and its error is equal to 1.03. T-Value in order is 5.25 and 9.57 , and it is meaningful at the level of less than 0.001. Also about 16% of the variance of latent variable (security) is defined by the presence of police variable.

Path coefficient between the variable **Fear of Crime** and our latent variable (Security) is equal to 0.67 and its error is equal to 0.62. T-Value in order is 8.74 and 7.35, and it is meaningful at the level of less than 0.001. Also about 42% of the variance of latent variable (security) is defined by the presence of police variable.

Path coefficient between the variable **Fear of accident** and our latent variable (Security) is equal to 0.58 and its error is equal to 0.41. T-Value in order is 9.06 and 6.95, and it is meaningful at the level of less than 0.001. Also about 45% of the variance of latent variable (security) is defined by the presence of police variable.

Path coefficient between the variable **Pedestrian Traffic** and our latent variable (Security) is equal to 0.57 and its error is equal to 0.50. T-Value in order is 8.43 and 7.69, and it is meaningful at the level of less than 0.001. Also about 39% of the variance of latent variable (security) is defined by the presence of police variable.

Path coefficient between the variable **Lighting** and our latent variable (Security) is equal to 0.37 and its error is equal to 1.48 . T-Value in order is 3.63 and 10.03 ,and it is meaningful at the level of less than 0.001. Also about 8.3% of the variance of latent variable (security) is defined by the presence of police variable.

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Path coefficient between the variable **Presence of Pedestrian** and our latent variable (Security) is equal to 0.28 and its error is equal to 1.26. T-Value in order is 3.04 and 10.13, and it is meaningful at the level of less than 0.001. Also about 5.8% of the variance of latent variable (security) is defined by the presence of police variable.

Table 4: Path coefficient and its error with T-Value and Variance of security model

Question No.	Variable	Security Path coefficient	T-Value	Error	T-value	R^2
Q1	The presence of Police	0.32	4.13	0.88	9.91	0.10
Q2	Walkways Structure	0.20	2.9	1.37	10.25	0.028
Q3	Security of children and women	0.45	5.25	1.03	9.57	0.16
Q4	Fear of Crime	0.67	8.74	0.62	7.35	0.42
Q5	Fear of accident	0.58	9.06	0.41	6.95	0.45
Q6	Pedestrian Traffic	0.057	8.43	0.50	7.69	0.39
Q7	Lighting	0.37	3.63	1.48	10.03	0.083
Q8	Presence of Pedestrian	0.28	3.04	1.26	10.13	0.058

Goodness of Fit Indices

To what extent our model that has been based on a theoretical frame and literature is compliance with the facts is a question that we want to find the answer with the help of Goodness of fit. In other word, the scientific criteria for accepting model by using our collected data, is the main discussion in goodness of fit indices.

Those indices name goodness of fit because if it increases it show that our data support our model better and name badness of fit indices because the more it increases it means that the data support our model less (Hooman, 2012).

Table 5: Recommended indices by some Researchers

Researcher	Recommended indices							
	X^2	RMSEA	CFI	NFI	NNFI	PNFI	SRMR	R^2
McDonald and Ho (2002)	*		*	*	*			
Hu and Bentler (1999)		*	*		*		*	
Kline (2005)	*	*	*				*	*
Boomsma (2000)	*	*	*				*	*
Hooper *et al.*, (2008)	*	*	*			*	*	

Homan (2012) said that the acceptable values for mentioned indices are shown in table 6. So the author uses his indices for testing model fitness (Hooman, 2012).

Analyze Goodness of Fit for Security Model

Here the chi square with 18 degree of freedom is about 20.55 that is not meaningful because the meaningful level of it is large and equal to 0.3 (its larger than 0.05). So it means that chi square Test shows the exact model fit with the data.

In other hand the ratio of chi square to degree of freedom is equal to 1.14. Furthermore the RMSEA is equal to 0.026 and in 90 percent confidence level it is between 0.000 and 0.068 and because the low level of it below 0.05 so we conclude that the degree of model approximation in community is not large. The RMR is equal to 0.043 that is very small and shows the minimum error of model and it means that the model fit is acceptable.

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Table 6: Goodness of fit for security model

Indices	Acceptable Range	Calculated
Chi square) X^2(	Smaller is better	20.55
Chi square / degree of freedom	Below 2.0	1.14
Root Mean Square Error of Approximation) RMSEA(	Below 0.05	0.026
root mean residual) RMR(	Below 0.07	0.043
CFI	More than 0.9	0.99

Discussion and Conclusion

Every research aims to achieve their goals within its framework, and the results are the fruits of the research, that if it wasn't fruitful then all of the research is useless even if we used various methods and models for analyzing it.

Walking is a natural part of human behavior that has to be the size of the entire history of humanity. In walking not only the human organ work, but our mental and nervous system also include in. Therefore providing situation that pedestrian could easily and safely walk and enjoy the environment is very essential in satisfying human needs and also improve the quality of urban public space.

So in this century which human life is dominated by cars in the cities and because of that human is being away from its natural needs, this issue became very important.

So the aim of the present research is to pay attention to pedestrian security issue in walkable environment and therefore at first step by using literature the indices that define pedestrian security extracted and after that by using a questionnaire the effects of these indices on security in citizens viewpoints has been measured, Data analysis was done using the method of factor analysis in Lizrel software , Results show that the Fear of an accident has the most impact equal to 45 percent and after that the Fear of crime with 42 percent in the second and the Passing safety with 39 percent in the third and the Security of women and children with 16 percent in the fourth rank and the presence of police with 10 percent in the fifth rank and the pathways lighting with 8.3 percent in sixth rank and the presence of people on the sidewalk with a 5.8 percent in seventh rank and the sidewalks structure with 2.8 percent have the lest effect on pedestrian security.

The present study with the purpose of evaluation of pedestrian satisfaction of security in walkable environment which tested by using a questionnaire in the study area by Factor analysis method in lisrel software shows that between 8 indices define security , the variable Fear of crime has the most effect on pedestrian security that is equal to 45 percent and after that the Fear of crime with 42 percent in the second and the Passing safety with 39 percent in the third and the Security of women and children with 16 percent in the fourth rank and the presence of police with 10 percent in the fifth rank and the pathways lighting with 8.3 percent in sixth rank and the presence of people on the sidewalk with a 5.8 percent in seventh rank and the sidewalks structure with 2.8 percent have the least effect on pedestrian security.

Since the ultimate goal of urban planning is trying to improve the live conditions of community people, therefore in every study the ultimate goal is to providing solutions to improve the current situation and present problems.

According to the findings the most important reason for pedestrian dissatisfaction is fear of accident which is because of lack of urban traffic monitoring and lack of enough crossing for pedestrian, after that crime surveillance is low that caused pedestrian unwilling for walking and they fear from walking and also again for the reason of lack of traffic monitoring, pedestrian cant cross the street safely. So we try to make some suggestions to increase pedestrian security in old context of Marvdasht city, these suggestions are listed below:

• Create a pedestrian crossing to enhance security while crossing the street

• Monitoring on car parking in the right places to encourage drivers to use public parking lots instead of Street Park

• Increase the amount of police presence in urban spaces to enhance pedestrian security

• Increase walkways lighting by installing lights in walkways and streets.

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