Investigation of Passive Defense Components in the Design of Urban Parks (Case Study: Jannat Shiraz Garden)

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Date of submission: 18 July, 2018 *Date of acceptance: 13 Aug 2019*

Original Article

Abstract

INTRODUCTION: Cities as human settlements have always been at risks. Therefore, they need to have a mechanism to keep safe against dangers automatically. Moreover, this self-safety mechanism happens when passive defense principles observe in the city design. Public spaces should have multi-purpose applications so that their defensive function can also be utilized in addition to the main purpose. The aim of this research is to investigate the passive defense components in the design of urban parks.

METHODS: This study is practical-developmental based on purpose and descriptive-analytical based on the nature that was carried out in the Janet Garden of Shiraz, Iran in 2017-2018. The statistical population is Shiraz citizens using random sampling method. The sample size was 384 according to Cochran formula. Data were collected using questionnaire and was validated based on Cronbach's alpha (above 0.7) and binomial test and one-sample t-test were used to test the hypotheses. The confidence level and the error rate were 95% and 5% respectively for all three hypotheses.

FINDINGS: The results show that observing the principles of passive defense are effective in urban parks designing based on four criteria such as citizens' security, stability of natural elements, variability of performance of park components, and park space. Most people using the park were 21-35 year olds with a diploma and associate degree and a monthly visit.

CONCLUSION: Observing the principles of passive defense in designing or redesign urban parks in addition to improving defensive performance increased the sense of security of citizens' health and leads to the stability of the elements, components, and park space.

Keywords: Passive Defense; Urban Parks; Jannat Garden (Iran); Urban Design

How to cite this article: Hesampour M, Adibi-Larijani H, Rouhian MH, Kazemi S. **Investigation of Passive Defense Components in the Design of Urban Parks (Case Study: Jannat Shiraz Garden).** Sci J Rescue Relief 2019; 11(1): 42-8.

Introduction

Given that humans have always been involved in war throughout history, cities and population centers are undoubtedly among the most important targets for the enemy during a war (1). As high-density human settlements, cities have always been exposed to natural and human hazards (2). These risks can threaten urban life, or at least have an impact on the quality of life (QOL) of citizens, thus they must be equipped with a mechanism that is automatically secure against these risks and threats with the lowest level of vulnerability. This auto-safety mechanism of a city is actually

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[DOI: 10.52547/jorar.11.1.42]

realized when passive defense is observed in the design and construction of the city (3). Passive defense is one of the issues that has been addressed in urban planning in recent years and is in fact a strategy to reduce the vulnerability of cities to the natural and man-made environmental hazards (4,5). The concept of vulnerability of the physical and human capital during crises in cities is one of the most important issues that has been addressed today in many fields of study, including passive defense. Reducing the vulnerability of urban land use to reduce damage can be fulfilled by adopting novel crisis management approaches such as passive defense that can be effective in creating a safe environment in cities. Passive defense principles must be adhered to in all layers and physical elements of the city so that its vulnerability is minimized when exposed to potential hazards (4-6). It is very important to identify the hazards of an area and parts of the region where the risk is most likely to occur, because in this case one can plan to prevent catastrophic events and to respond to emergencies in a timely, accurate, and prepared manner (7). Paying attention to passive defense considerations and regulations in urban planning is one of the most effective and sustainable ways of defending against crises that has always been favored by most countries worldwide. City parks are among the most important open spaces in which focusing on passive defense, in addition to reducing the vulnerability of the city, can also be effective in the relief and reconstruction process. Paying attention to the appropriate design of open spaces based on defensive ideas by urban designers and the rules of urban planning will increase the safety factor of these spaces and consequently reduce the human casualties. The damage can be minimized by smartly integrating natural elements, architectural elements, and passive defense principles (8,9). Among the architectural design principles, the three principles of optimized form, robust and shapely appearance, and simple and legible interior architecture are the most effective and important principles of passive defense design (10). Public spaces, as spaces used by the public, are of a particular importance in terms of urban security and safety, and city managers and officials need to take a special look at ensuring the safety and security of these public and semi-public spaces. Besides, the use of green spaces and parks as one of the multipurpose land uses can have a significant impact on the defensive performance of the cities. As parks and green spaces are well designed based on passive defense principles, their safety, and overall city safety will increase; in fact, their defensive function can be utilized along with their main function (11-19). Thus, the establishment of multipurpose and dual-purpose land uses and consideration of these types of land use in urban development projects contribute to optimal crisis management and the creation of mechanisms for the resident security and sustainable urban development (5). Investigating passive defense components in the design of Jannat Garden city park with a view to identifying vulnerabilities, problems, and bottlenecks associated with crisis risk management and adhering to the passive defenses principles seem to be necessary and among the best solutions it can play an important role in resolving security and safety issues in city parks if regarded by the managers. Given its strategic position and economy, Iran has experienced at least 31 of the 42 known disasters (12). The population context concentrated in the cities has increased the complexity of the disasters in Iran, leading to the vulnerability to hazards (13) and consequently, large cities such as Shiraz are no exception of this rule. The present study was accomplished with the purpose to investigate the components of passive defense in urban park design.

Methods

Shiraz Jannat Garden is located in District 4 of the 10 districts of Shiraz. This garden is one of the three urban parks with the largest area among the city parks in District 4 with 280000 m^2. Figure 1 depicts the location of the study area in the country, province, and city. The garden is located near Amir Kabir Boulevard in District 4 and leads to Amir Kabir Boulevard from the north, Farazdoghi Street from the east, Meysam Boulevard from the west, and Farashbandi Street from the south.

This study was applied-developmental based on the objective, descriptive-analytical based on the nature, and cross-sectional in terms of time which was conducted during the 2017-2018 period in the area of Jannat Garden in Shiraz. The data collection process included two stages: the first stage tool was the library resources and documentary, as well as the opinions of the experts and activists in the field, and the second

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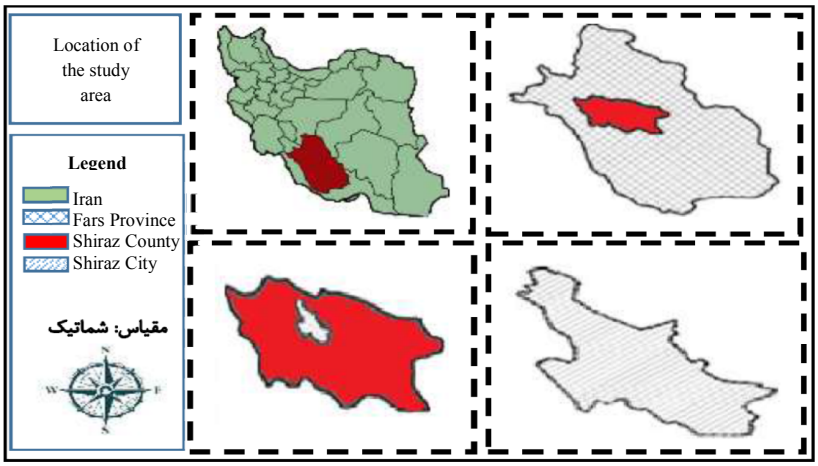

Figure 1. Location of the study area in the country, province, and city

stage included field survey and distribution and completing the questionnaire. In this study, the Cronbach's alpha method was employed to examine the validity of the questionnaire. According to the four dimensions of the questionnaire, the Cronbach's alpha was investigated in all four dimensions and the validity of the questionnaire was verified given the Cronbach's alpha value of above 0.7. The results of this test are presented in Table 1.

After collecting the data and questionnaires, descriptive statistics such as frequency, frequency percentage, mean, standard deviation (SD), etc. were used in the SPSS software to analyze the questionnaire data. Moreover, the binomial nonparametric test and one-sample t-test were utilized to test the study hypotheses. Given the use of the 5-point Likert scale in the questionnaires, the ordinal level of measurement was adopted for each item, and since the 5-point Likert scale receives a numerical equivalent of 3, the binomial test with specifications of (Cut Point = 3, Test Proportion = 0.50) was used to measure the impact of each item. When the items with the ordinal level of measurement are combined and the indexing is performed, the level of measurement of each index is upgraded to a relative scale and given the normal distribution of the data as well as the relative level of measurement of the indices, the single sample parametric tests with the 95% confidence level and the test value of 3 were used.

Findings

The descriptive variables examined in this study included gender, age, education, use of urban parks, and use of Jannat Garden Park. Out of the sample size of 384, 215 (53.4%) and 179 (46.6%) were males and female, respectively. The age range was divided into five groups as Figure 2, with the highest frequency in the 21-35 year-old age group.

In terms of education, the respondents were divided into four subgroups: under diploma, diploma and associate degree, bachelor, master, and higher degrees, which rates of 22.3%, 38.5%, 27.5%, and 11.4%, respectively. The highest and lowest frequencies associated with the education were diploma, associate, master's degree, and higher levels, respectively.

The respondents were divided into four groups of daily, at least once a week, at least once a month, and once in a few months based on the use of urban parks and Jannat Gardens Park, with a frequency of 11.4%, 22.6%, 48.6%, and 17.4%, respectively.

Table 1. Cronbach's alpha test results

Dimensions	Number of items	Cronbach's alpha coefficient	Evaluation
Life safety	12	0.841	Verified
Functional variability of the park elements	9	0.714	Verified
Functional variability of the park space	4	0.746	Verified
Stability of the natural elements	7	0.806	Verified

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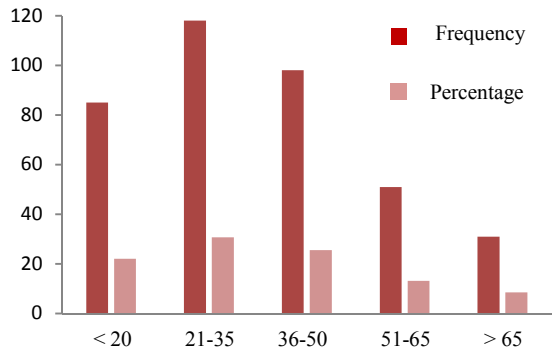

Figure 2. Distribution of respondents using Jannat Garden City Park of Shiraz, Iran, by age

The highest and lowest percentages respectively belonged to those who went to the park at least once a month and daily. In addition, the frequency percentages for use of Jannat Garden Park were 9.3, 21.6, 28.11, and 41, respectively, with the highest and lowest percentages associated with those who visited the park once in a few months and daily, respectively (Figure 3).

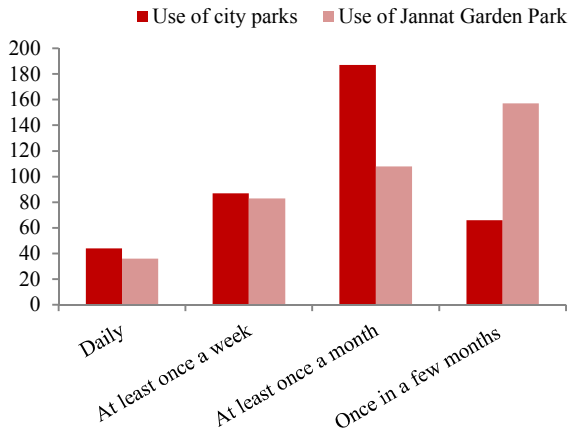

Figure 3. Distribution of respondents by the use of city parks and Jannat Garden City Park of Shiraz, Iran

Investigating the effect of passive defense principles in parks on citizens' life safety: 12 items were exploited in order to investigate the effect of the passive defense principles in the parks on citizens' safety. Given Figure 4, the results revealed that the highest effect of the passive defense principles of the parks on the citizens' safety was 84% in the component of designing the park areas and structure; and the least effect was on the design of the park fountains as 13%. A significance level of $P < 0.05$ was considered for all items. Statistical tests were employed to extend the sample results to the statistical population. Based on the t-test statistic as well as the positive lower and upper limits, the effect of observing the passive defense principles in the parks on the citizens' security was above the average level. This implied that the mean community interval in the 95% probability ranging from 3.94 to 4.09 was indicative of the fact that this effect in the community was higher than the average and at the desired level. This impact suggests that observing the passive defense principles in the urban park design can have a significant impact on enhancing the citizens' sense of safety.

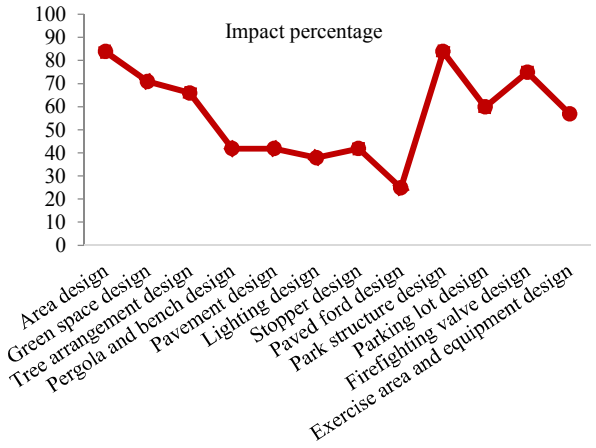

Figure 4. Percentage of impact of passive defense components on life safety

Investigating the effect of passive defense principles in parks on functional variability of its components: To investigate the effect of passive defense principles in the parks on the functional diversity of the park components, 9 items were used. Based on Figure 5, the results showed that the highest and lowest impacts of the passive defense principles of the parks on the functional diversity of the park components were 81% and 14% for the park structures and stoppers, respectively, and all items had a significance level of $P < 0.05$. Statistical tests were used to generalize the results of the sample to the statistical population. Based on the t-test statistic as well as the positive lower and upper limits, the effect of observing the passive defense principles in the parks on the functional diversity of the park components was above the average level. This implied that the mean community interval in the 95% probability ranging from 3.781 to 3.901 was

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indicative of the fact that this effect in the community was higher than the average and at the desired level. This impact suggests that observing the passive defense principles in the urban park design has a significant impact on enhancing the functional diversity of the park components.

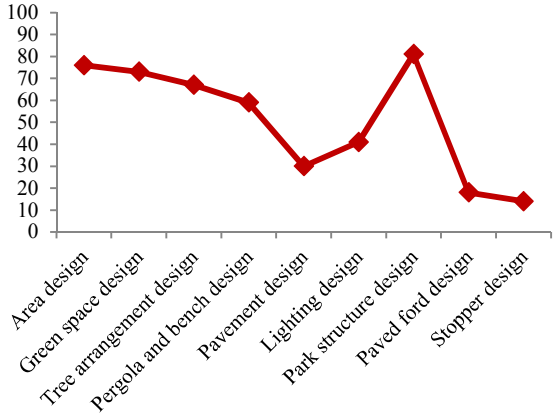

Figure 5. Impact of passive defense components on the functional variability of the park components

Investigating the effect of passive defense principles in parks on functional variability of park space: To investigate the effect of passive defense principles in the parks on the functional diversity of the park space, 4 items were used. Based on Figure 6, the results showed that the highest and lowest impacts of the passive defense principles of the parks on the functional diversity of the park space were 81% and 59% for the components of temporary accommodation site and shelter, respectively, and all items had a significance level of $P < 0.05$. Statistical tests were used to generalize the results of the sample to the statistical population. Based on the t-test statistic as well as the positive lower and upper limits, the effect of observing the passive defense principles in the parks on the functional diversity of the park space was above the average level. This implied that the mean community interval in the 95% probability ranging from 3.964 to 4.11 was indicative of the fact that this effect in the community was higher than the average and at the desired level. This impact suggests that observing the passive defense principles in the urban park design has a significant impact on enhancing the functional diversity of the park space.

Investigating the effect of passive defense principles in parks on the stability of the park natural elements: To investigate the effect of passive defense principles in the parks on the functional diversity of the park space, 7 items were used. Based on Figure 7, the results showed that the highest and lowest impacts of the passive defense principles of the parks on the natural elements of the park were 76% and 11% for the components of sustainability of the natural elements and the flowering sustainability, respectively, and all items had a significance level of $P < 0.05$.

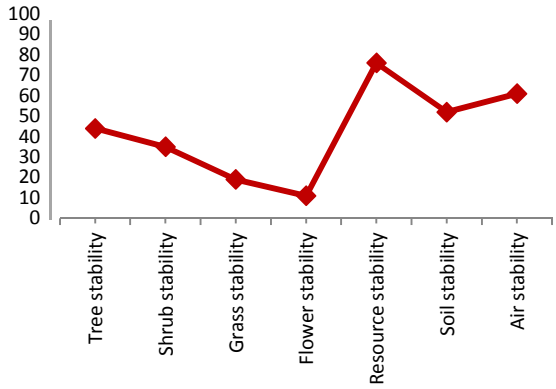

Figure 6. Impact of passive defense components on the functional variability of the park space

Statistical tests were used to generalize the results of the sample to the statistical population. Based on the t-test statistic as well as the positive lower and upper limits, the effect of observing the passive defense principles in the parks on the natural elements of the park was above the average level.

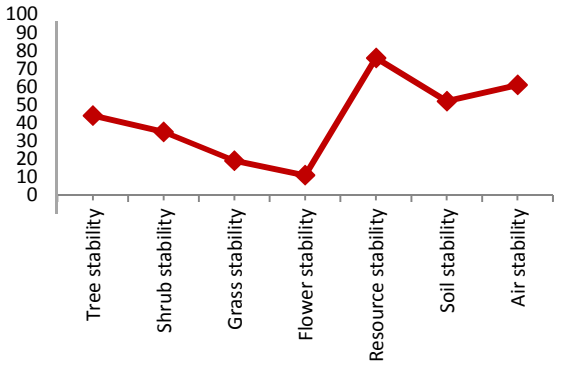

Figure 7. Impact of passive defense components on the stability of the park natural elements

This implied that the mean community interval in the 95% probability ranging from 3.541 to 3.835 was indicative of the fact that this effect in the community was higher than the average and at

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the desired level. This impact suggests that observing the passive defense principles also contributes to the sustainability of the natural elements of the park.

Conclusion

The findings of numerous studies on passive defense components in the design of urban spaces and areas showed that if the spaces are designed cleverly and in accordance with the principles of passive defense with a variety of urban components and spaces, not only one can provide the safety of citizens in natural and non-natural critical conditions, but they can greatly enhance its effectiveness in the best possible way by creating a beautiful atmosphere mixed with the unique architecture of Iranian culture (14,15). However, the present study showed that the highest and the lowest impacts on citizens' safety were respectively design of the park landscapes and design of the park fountains. Appropriate design considerations included the land slope (2-4%), lack of proximity to industrial and commercial centers (exposed to noise and air pollution), adequate space (3 to 4 hectares per 1,000 people), street width (10 m), proper trash can position (a trash can for 50 to 250 people with a volume 50 to 100 liters), installation of a double-side washing platform (3 m for 50 persons), etc. (20). These findings are in line with those of the study by Ahmadi et al. (16). In terms of the structure type and strength, the findings of this study on the functional diversity of the park elements are consistent with the application of the passive defense in the urban planning, showing that removing obstacles and excessive elements as well as reinforcing the structures were among the most important factors in reducing the human casualties (17). In terms of passive defense principles in the functional diversity of the park space, the present study showed that the temporary accommodation component and selection of shelters during the risks had respectively the highest and lowest impacts. In terms of function, the components of the accommodation site in the normal situation for the flat sports site, family picnic platforms, artificial lakes, toilets, and prayer rooms could be used as areas for landing the relief helicopters or temporary hospital sites, temporary accommodation platforms, water storage, and shelter in the times of crisis, respectively. A study carried out by Amini on the design and planning of urban parks for accommodation plan (from a passive defense approach) showed that by adding facilities, services, and functions to the parks, one could improve their efficiency (18).

As a Conclusion, if the passive defense principles are adhered to in the design of urban parks, it has a significant impact on maintaining and enhancing the citizens' safety, and the better the implementation and enforcement of the passive defense principles, the definitely better the defensive function of the park. Observing the passive defense principles also have a significant impact on the functional diversity of park components, leading to the defensive function of the park components in addition to their primary function, which will increase the functional diversity of the park components. As a matter of fact, citizens, apart from the core function of the components, will also have access to their defensive function and the functional diversity of the park components will increase for them. Furthermore, the diversity of the park space increases as a result of observance of the passive defense principles, and the park is no longer merely a social, recreational, or ecological environment for improving the city air, rather it can certainly play its defensive role and function in the event of a hazard and provide temporary accommodation for the people of District 4 in Shiraz and elsewhere. Along with the functional diversity of the park components as well as the functional diversity of the park space, we will also witness the sustainability of natural elements.

Acknowledgments

None

Conflict of Interests

Authors have no conflict of interests.

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