

CASE STUDY

Urban green spaces assessment approach to health, safety and environment

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ABSTRACT: The city is alive with dynamic systems, where parks and urban green spaces have high strategic importance which help to improve living conditions. Urban parks are used as visual landscape with so many benefits such as reducing stress, reducing air pollution and producing oxygen, creating opportunities for people to participate in physical activities, optimal environment for children and decreasing noise pollution. The importance of parks is such extent that are discussed as an indicator of urban development. Hereupon the design and maintenance of urban green spaces requires integrated management system based on international standards of health, safety and the environment. In this study, Nezami Ganjavi Park (District 6 of Tehran) with the approach to integrated management systems have been analyzed. In order to identify the status of the park in terms of the requirements of the management system based on previous studies and all Tehran Municipality's considerations, a check list has been prepared and completed by park survey and interview with green space experts. The results showed that the utility of health indicators were 92.33 % (the highest) and environmental and safety indicators were 72 %, 84 % respectively. According to SWOT analysis in Nezami Ganjavi Park some of strength points are fire extinguishers, first aid box, annual testing of drinking water and important weakness is using unseparated trash bins also as an opportunities, there are some interesting factors for children and parents to spend free times. Finally, the most important threat is unsuitable park facilities for disabled.

KEYWORDS: *Health, safety and environment (HSE), Park, SWOT Analysis, Urban Green Space*

INTRODUCTION

Urban parks and green spaces are one of urban public places with social functionality and many people with different ages spend their times in parks so it is important to provide citizens' health and safety. Most studies reported that green spaces have some beneficial effects such as: physical health, mental health, wellbeing and socioeconomic consequences. (Lee and Maheswaran, 2011) Parks and green spaces are also important to human

health for psychological and physiological reasons. (Villeneuve *et al.*, 2012) In addition, local governments have been expected to share their responsibility to public spaces maintenance. (Mutiarra and Isami, 2012). Urban green spaces are as an important resource to public mental health. (Grahn and Stigsdotter, 2010) Type of citizens effects on people's habits when they use parks and gardens (Sanesi and Chiarello, 2006).

Different plant species have various benefits for urban spaces. For examples, trees have ability to capture

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and filter multiple air pollutant, including level ozone, sulphur, nitrogen oxides and particular matters. Also trees can relief and decrease heat stress level especially during hot seasons. Generally, plant species have beneficial effects on drought, heat and pollution. (Zupancic, 2015). Some plants species are resistance against air pollution such as Acer sp., Chamaecyparis sp., Juniperus sp., Robinia pseudoacacia and some others lead to reducing noise pollution such as Acer negundo, Cotoneaster salicifolia, Robinia pseudoacacia var. umbraculifera, Cypress, Pine (Torabi Mirzaee et al., 2010; Nouri, 2006).

Increasing green space size can be mentioned as a managerial issue in order to balance temperature, raise partial humidity and absorb dust. (Liu and Shen, 2014; Bakhshi, 2014) Another outcome of implanting trees and other kind of plant species is their effects on carbon footprints analysis. Nowadays, construction and maintenance cause long-term environmental problems that designing urban spaces minimize their consequence (Strohbach et al., 2012).

Standard of green spaces per capita in Iran is defined as 30 m², however, the global standard is between 5 and 50 m². Because none of the large cities of Iran has possibility to develop green spaces. One of the major limitation in developing green spaces is shortage of water resources in Iran (Ruhollahi et al., 2008). Urban green spaces are natural parts of urban with some artificial arenas and covered by trees, flowers, grasses or other plants (Paseban Islam et al., 2013).

Based on studies about resources optimization, there are some strategies to reduce irrigation water such as: (1) Selection of appropriate plant species, (2) Lawn clipping height, (3) Removing thatch layer, (4) Using wastewater, (5) Using superabsorbent, (6) Regulated deficit irrigation, (7) Subsurface irrigation system, (8) Replacing grasses with groundcover plants, (9) Using surfactants, (10) Using other chemicals and (11) Using endophyte fungi (Rabbani et al., 2015). Moreover, using treated sewage for irrigation can be a good plant source. Nitrogen, phosphor and potassium are some of the essential nutrients to grow and plant reproduction. (Jahanifar et al., 2013) According to the researchers E-coli can transmit infection in digestion organs. Therefore, safety signs can prevent and protect children from E-coli in most public places (Soltan Dallal et al., 2011).

Green spaces are parts of the urban landscape and people are always in contact with problems relating to

green spaces, thus urban green spaces should be evaluated regularly as they are one of the urban development symptoms (Mohammadi et al., 2012) and sustainability indicators for urban development should include some parameters about green spaces. Results show that usage types of parks are significantly related to people's age. City planners and urban designers should consider this, by managing green spaces in a modern method and it leads to fulfill the needs and expectations of children, families, elderly people, etc. (Chiesura, 2004).

Some essential safety topics that should be evaluated in parks and green spaces are included (1) playgrounds safety, (2) general equipment safety, (3) paths and entries and exits, (4) Lighting equipment, (5) Signs, (6) sufficient relief facilities and (7) suitable flooring. Unsafe drinking water, food, poison and fertilizer are the most important issues that threaten human health in urban parks. Moreover, Plant species and trees maintenance, efficient use of natural resources are the major environmental indexes (Berahmand and Ghodoosi, 2013). Designing of an urban park based on safety issue is controversially because injuries that may result from play and sports equipment, can lead to unexpected and irrecoverable accidents. (National Program for Playground Safety, 2007; Vygotsky, 2009). Safety engineers focus on recognizing and controlling hazards, those conditions have potential causes that lead to injury (Roderick, 2004).

The important factors in safety designing of play spaces include hidden and unsecured places, separated playground for children and adults, playground equipment, lightening and playground flooring (Shite and Sharafi, 2014). Moreover, previous studies have been stated that the most dangerous situations for children in parks are because of playground equipment. The mentioned risk can decrease with sustain maintenance for both of equipment and playground surface. (Naeini et al., 2010) Furthermore, safety factors mostly in playgrounds, result from risk assessment in urban parks. So attention to this issue can eliminate some injuries such as fractures, falling, head injuries and scratches among children and some of this injuries can cause to serious problems. Therefore, unsafety playground equipment and improper playground flooring can lead to death (Oostakhan and Babaei, 2013; Allen et al., 2013).

There are some studies about disabled and their problems in urban places therefore urban management

have to do some action plans to improve park situation for the disabled as following: (1) Entries and ways should have proper slope and width. Slopes and stairs should be guard rails, (2) The fragrant flowers and the sound of the water should be used to the recognition continue by the blinds, (3) Flooring should not cause slipping or stuck wheelchair wheels, (4) Installing Signs and stands and sensors for the disabled and blinds, (5) Constructing suitable toilets for disabled and (5) Providing proper and sufficient welfare services for disabled such as: drinkers, bench, trash bin, buffet and etc. (Taghvaei *et al.*, 2010; Bahmanpour and Salajeghe, 2008).

According to some studies, the other issues that may cause problems in urban parks are crimes or addiction problems. In order to prevent and decrease consequence of these problems, police officers and park security should coordinate with municipality to make a safety public space (Groff and McCord, 2011; Ceccato and Hansson, 2013).

Therefore, in order to protect urban spaces, it is necessary to check the status of urban parks. Management of urban parks can promote environmental indicators and appropriate management leads to environmental protection of urban parks, moreover, appropriate management causes reduction of environmental waste in urban parks (Mehra and Lahijaninan, 2013). Moreover, focus on Health, safety and environment (HSE) in urban areas has become more imperative because of technology development, living standards improvement and environmental problems increment in cities. So HSE risks has become a major challenge in urban environments. Urban parks are the most important spaces in the collective life of citizens. Therefore, HSE rules are essential because of possibility of disease transfer (Berahmand and Ghodoosi, 2013).

In addition, implementing HSE management system leads to a healthy, pleasant and happy environment without accidents and injuries. Urban parks have different functionality in the cities with a high population and they are considered with different cultural, economic, social, health and traffic conditions (Dinarvandi *et al.*, 2012; 2013).

According to previous studies in Niyavaran Pak, some suggestions have been offered: (1) Legislation and sufficient standard rules toward HSE management in parks and attention to the revision of existing laws and regulations based on international achievements, (2) Allocating sufficient budget to achieve the objectives of the HSE in Parks and (3) Creating a center

to decide on the issue on HSE management issues and coordinating management structure (Hejazi and Sarabi, 2014).

Therefore, it is important to apply HSE issues in urban management, especially urban parks and green spaces management and it is needed to achieve urban spaces improvement. According to Maslow's hierarchy of needs, safety and security are the basic human needs (Takano, 2007) and parks are the interface between human and nature, so in this study, some HSE indexes have been considered to evaluate a specific park in District 6 of Tehran, Iran.

MATERIALS AND METHODS

District 6 of Tehran, Iran has 66 parks and some of them such as Saiee, Shafagh, Laleh, Nezami Ganjavi and Honarmandan parks are the specific ones. Nezami Ganjavi Park has been considered as a case study (Fig. 1 shows Nezami Ganjavi Park's location). It has beautiful green spaces and proper facilities to spend free times for children and families. In Table 1 characteristics of Nezami Ganjavi Park have been explained.

In this study, Nezami Ganjavi Park was investigated by researches studies, park survey and interviews with green space experts approach to HSE. Some studies, related to HSE issues in urban green spaces, have been reviewed to identifying HSE indexes.

After reviewing studies and identifying HSE indexes of park, HSE checklist has been designed based on HSE policy guidelines of Tehran Municipality. According to checklist results, park has been evaluated in terms of HSE management system requirements. In view of the standards such as ISO14001 and OHSAS18001 checklist has 3 scopes: safety (10 indexes), health (5 indexes) and environment (5 indexes). Each index includes some components and weight of each component is determined by experts.

RESULTS AND DISCUSSION

HSE checklist has been completed by park inspecting and interviewing with green space experts. Results of HSE checklist have been illustrated in Tables 2- 4. In these tables weight of each component is determined by green spaces experts of municipality and score of competent are given by park inspecting and interviewing with green space experts. Finally, score of indexes are calculated as weighted mean of index's component.

HSE indexes in urban Parks

Table 1: Characteristics of Nezami Ganjavi Park

Characteristics of Nezami Ganjavi Park						
Address	Iran-Tehran- Shahid Abbaspour Street-Tavanir-Nezami Ganjavi Street					
Location	District 6- Zone 5					
Construction Year	1996					
Park type	Local					
Area	14808 m ²					
Elements	Components	Properties				
Artificial Elements	Entries and paths of park	<ul style="list-style-type: none"> • East entry (Nezami Ganjavi Street) • West entry (end of 53th Alley, Seyyed Jamaledin Asadabadi Street) • Steep path • Too many stairs 				
		Buildings	-Workers residential	-Municipality Building	- Park office	
		Welfare Equipment	Bench	39 Items		
			Trash bin	34 Items		
	Restroom		7 Items			
	Drinking water		Urban Piping			
	Drinking fountain		2 devices			
	Chess and Ping Pong table		6 Items			
	Statue		1 Item			
	Sport accessories		21 Devices			
	Sound system		1 Device			
	Fountain		2 Items			
	Flower box		38 Items			
	Clock		1 Item			
	Sign		14 Items			
	Gate		1 Item			
	Path type		Pavement =8955 m ² Asphalt=420 m ²			
	Table football		1 Item			
	Solar water heater	4 Device				
	Lighting	100 Items				
Canopy	2 Items					
Natural Elements	Plants	333 Trees Area: 338 m ² Kind of Cypress, Noel Pine, Tehran P Weeping willow, Acacia, Elm, Magn Cotoneaster				
		Green spaces	Grassing	4258 m ²		
			Rose	484.89 m ²		
			Shrub	824.11 m ²		
			Season flowers	174.725 m ²		
			Permanent flowers	114.275 m ²		

According to the results, the average percentage of health indexes is equal to 92.33% (highest), the average percentage of safety indexes is equal to 84% and average percentage of environmental indexes is equal to 72% (lowest). As in Fig. 2.

According to Fig. 3, health indexes such as poison and fertilizer and health situation of staff have highest score (100%) and restroom situation index has the lowest score (80%) because there is no special restroom for the disabled in Nezami Ganjavi Park.

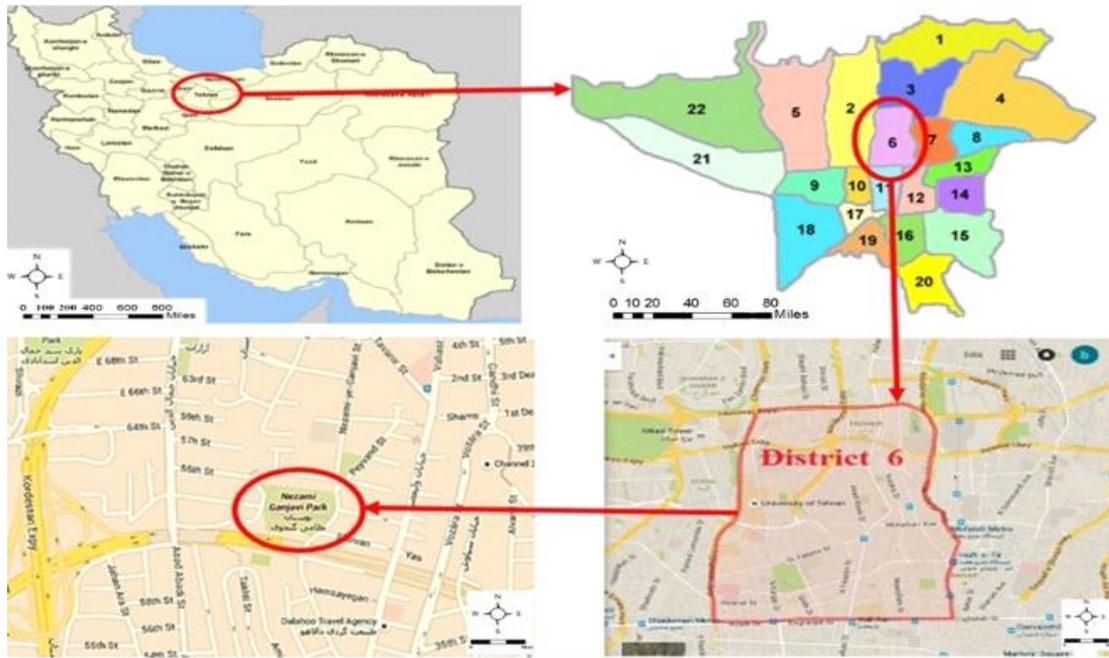


Fig. 1: Nezami Ganjavi Park's location

Table 2: Health Checklist

Scope	Index	Component	weight	Score of component	Score of Index
Health	Water	Separating irrigating from drinking water	3.5	10	8.95
		Sufficient drinking fountain	1.5	7	
		Easy access to drinking fountain for children and disabled people	1.5	6	
		Annual test of drinking water for microbial contamination	2	10	
		Contamination measure of pond water	1.5	10	
	Restroom	Proper restroom equipment	2	10	8
		Proper restroom location	2.5	10	
		Suitable restroom for disabled people	2	0	
	Trash bin	Cleaning restroom daily	3.5	10	9.2
		Sufficient trash bin	6	10	
Poisons and Fertilizer	Trash bin with door and plastic bag	4	8	10	
	Using personal protective equipment (PPE)	5.5	10		
Health situation of staff	Attending to personal health	4.5	10	10	
	Controlling staff health continuously	4	10		
	Appropriate staff room situation such as: lighting, good air-condition, humidity and healthy issues	6	10		

Table 3: Safety checklist

Scope	Index	Component	weight	Score of component	Score of Index
Safety	Park furniture safety	Manufacturing of park furniture based on international standards	2	8	9.25
		Absence of additional appendages and sharp edges	1.5	9	
		Suitable park furniture	2	9	
		Proper park furniture allocation	2.5	10	
	Entries and paths	Park furniture maintenance regularly	2	10	6.9
		Using Bullard to prevent motor vehicles entrance	1	10	
		Paths without holes	1.5	7	
		Appropriate ramp and stair	2	8	
		Possibility of passing emergency cars (separated entrance and minimum required width is 2 m)	2.5	7	
	Different spaces allocation	Installing shield around construction area	1.5	7	8.2
		Possibility of crossing wheelchair (minimum required width is 120 cm)	1.5	3	
		Not allocating playground near street	2.5	7	
		Not allocating public places under direct sunlight	1	7	
		Allocating suitable parents place in the vicinity of playground	1.5	5	
	Materials appropriateness with activities	Not allocating rest place near noisy places	1.5	10	6.6
		Separating different places	1.5	10	
		Separating children playground from adult	2	10	
	Lighting	Using suitable playground flooring	2	8	10
		Using plastic or fiberglass in manufacturing of play equipment	2	10	
		Using resistant materials for continued usage	3	5	
		Continuous maintenance	3	5	
	Signs	Proper light stand in paths and activity spaces including: entries, walking path, playground, signs and canopies	3	10	10
		Lightening maintenance regularly	2.5	10	
		Not use of dazzling lights specially in low height	1.5	10	
	Emergency facilities	Immunizing of electrical equipment and lighting (safety label and safety wire)	3	10	9
		Installing sufficient signs in required places	5	10	
		Standard size and readability of signs	3	10	
Security	Appropriate location and color of signs	2	10	10	
	Public phone near park	1	0		
Warning signs through poison spraying	Fire extinguishers	4	10	5	
	First aid box	3	10		
Playground immunization	Public training places	2	10	9.05	
	Continuous control of security	6	10		
	Police patrolling in high risk crime area	4	10		
	Warning to People before poison spraying	5	5		
	People awareness until 48 hours after poison spraying	5	5		
Playground immunization	Absence of dangerous roughness and additional objects in playground	2	8	9.05	
	Not allocating playground under direct sunlight	0.5	5		
	Not collision play equipment with people	2	10		
	Play equipment without sharp edges and extra appendages	2	10		
Playground immunization	Play equipment designing based on age, fitness, appropriate angles and distance between play equipment	1.5	8	9.05	
	Safety play equipment	2	10		

Table 4: Environment checklist

Scope	Index	Component	weight	Score of component	Score of Index
Environment	Proper plant species and environmental maintenance	Avoid of implanting allergenic, toxic and prickly plant species near playground and walking path	3.5	10	10
		Plant diversity to have a nice vision	2.5	10	
		Plant maintenance	4	10	
	Actions to reduce air and noise pollution	Implanting plant species that are resistant to air pollution	4	10	10
		Implanting plant species that reduce noise pollution	3	10	
		Use water sound for relaxation	3	10	
	Correct methods against pests and plant diseases	Use non-chemical methods(Agricultural, Mechanical, Biologically, Physical)	2	10	10
		Use low-risk poisons against pests and plant diseases	1.5	10	
		Optimum consumption of fertilizers	1	10	
		Poison spraying in favorable weather conditions	1.5	10	
		Storage and correct transportation of poisons and Chemical fertilizers	2	10	
		Safety disposal of empty cans	2	10	
	Disposal of surface water and sewage	Use standard criteria for sewage disposal through absorption wells or septic tank	6	10	6
		Surface water reusing	4	0	
	Waste management	Collecting rubbish and transferring to recycling areas	2	0	0
Using separated trash bins		1.5	0		

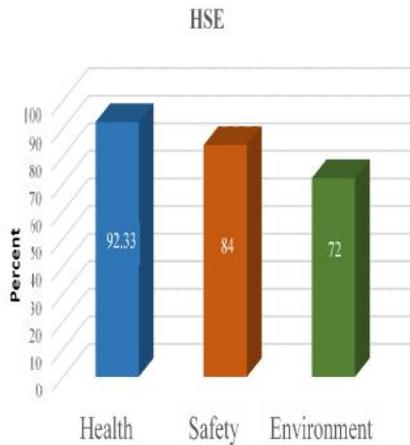


Fig. 2: Results of HSE assessment



Fig. 3: Average percentage of health indexes

As it is shown in Fig. 4, safety indexes such as lightening, signs and security have highest score (100%) and warning signs through poison spraying index has the lowest score (50%). These results determine that managers and experts investigate lightening and signs in Nezami Ganjavi Park, in addition,

park guide and police patrol in the park to have a secure place. The poison spraying index is the lowest level because of managers' unawareness of poison hazard.

According to Fig. 5, proper plant species and environmental maintenance, actions taken to reduce air and noise pollution and correct methods of fighting

against pests and plant diseases have highest score (100%) and waste management index has the lowest score because collecting rubbish and transferring to recycling areas and using separated trash bins have not been done in Nezami Ganjavi park.

Finally, a SWOT analysis has been conducted to planning HSE management system in Nezami Ganjavi Park. It leads to identify strength, weakness, opportunities, and threats in an analytical framework.

Fig. 6, illustrates Nezami Ganjavi SWOT analysis.

Therefore, urban managers should attend to:

- 1) Apply the best technology in park designing
- 2) Standardization all activities based on HSE policies
- 3) Continuous survey
- 4) Hazard identification, risk assessment and environmental aspects
- 5) Promote HSE culture in urban system

CONCLUSION

Urban parks are the important spaces and have many benefits as urban nature, recreation asset and



Fig. 4: Average percentage of safety indexes

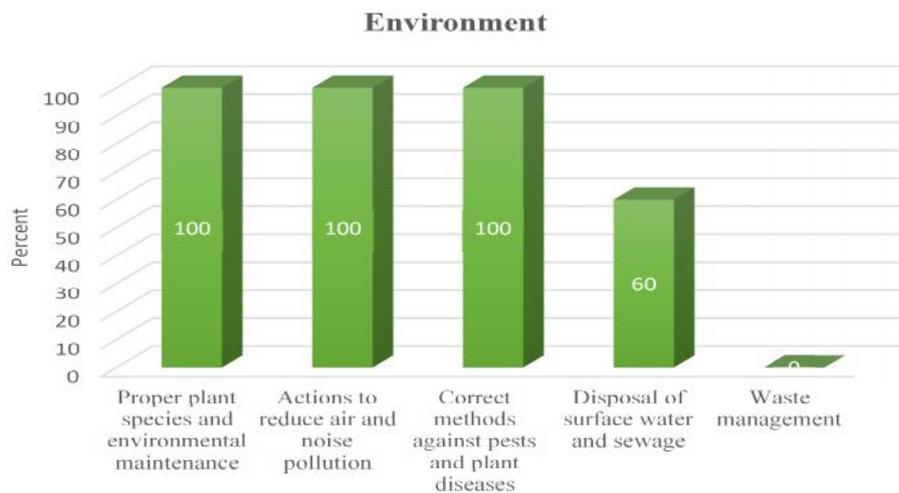


Fig. 5: Average percentage of environmental indexes

venue for community engagement. There are different elements such as urban furniture, welfare facilities, sport and play equipment, fountain, natural or artificial pond, restroom, drinking fountain, restaurant, stockroom and etc. in this public places and these elements have hazard potential.

Using improper playground flooring, unsafety lamp or electrical cable, absence of guard rails around dangerous places and etc., are some disastrous situations. As respects, parks management usually has been outsourced to contractors, so undoubtedly these places are critical spaces and they are faced with health or safety risks and environmental impacts. Therefore implementing HSE management system is necessary to prevent potential hazards in urban spaces. HSE has some policies that can be used to improve life quality in urban green spaces. Undoubtedly, HSE indexes in green spaces are the important requirements of urban management. So in this study, HSE indexes of Nezami Ganjavi Park have been evaluated and according to checklist that have been completed by interviewing green space experts and park survey, the result of HSE assessment are outlined below:

1) Health desirability 92.33% (highest), safety desirability 84% and environmental desirability 72% (lowest)

2) Health indexes such as poison and fertilizer and health situation of staff have highest score (100%) and restroom situation index has the lowest score (80%)

3) Safety indexes such as lightening, sings and security have highest score (100%) and warning signs through poison spraying index has the lowest score (50%)

4) Environment indexes such as proper plant species and environmental maintenance, actions taken to reduce air and noise pollution and correct methods against pests and plant diseases have highest score (100%) and waste management index has the lowest score (0%)

Strength, weakness, opportunities, and threats can be identified with considering the results of HSE assessment that have been mentioned above. Finally, a SWOT analysis has been conducted to offer some suggestions for urban management. Therefore, urban managers should apply recommended actions in order to eliminate weaknesses and threats.

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Fig. 6: Nezami Ganjavi SWOT analysis

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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