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Physical Design of Safe Urban Environment against Environmental Damages in case of Allameh Majlesi Street in Isfahan

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Abstract

Today, one of the main priorities of designers and urban planners is attention to the concept of citizens' security and methods for its enhancement. This is the most important issue to improve the street access network and traffic congestion. As a result, the physical design of Allameh Majlesi Street in Isfahan and its environmental security enhancement are considered crucial in urban space for the welfare of the citizens. This paper has implemented a descriptive-analytic research methodology. The statistical population in this study is all the citizens in the Allameh Majlesi Street of Isfahan. According to Morgan table, 196 people were selected as the study sample. The data collection was through a questionnaire, observations and on-site interviews; decision making was done using the SWOT technique. Three alternative designs were proposed which were evaluated through the AHP technique to select the best alternative. The physical design of safe urban environment against damages was based on criteria to improve the sense of security, utilizing natural elements, environmental quality, and redefining the physical elements. As a result, after evaluating the options, the third alternative was selected based on the index.

Keywords: Urban Space; Security; Environmental Damage; Allameh Majlesi Street; Isfahan

1. Introduction

In today's world, thousands of people get killed or injured by intentional and unintentional accidents every year. People may be at risk when they travel, go to work or go to school, leading to various injuries; they may never return home. These incidents represent the major problems of

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public health and development at international levels that affects people at all ages and social status, but most of the incidents occur to people from low and middle income countries. Nowadays, more attention has to be given to these issues to prevent accidents for which accurate planning is necessary. It is obvious that policy making and implementing urban management should fulfill the need for the safety of citizens as well to provide a suitable ground for growth and to promote safety and security at city levels (Ghalibaf, 2009).

Undoubtedly, the safety problems threaten the hygiene of urban communities in all age groups. Increase in population makes it more probable to increase accidents (Zyari, 2011). Gharee et al. (2010) have investigated and evaluated the sense of security in various urban areas and the results state that the qualitative and quantitative evaluation of physical and social security are necessary within urban spaces. Adibi and Azimi (2011) explain the security of the urban environment based on physical and design parameters. For contemporary issues of urban design, they gave attention to the necessity that human behavior in different places differs in the shape and geometry, and in many cases the space provokes certain human behaviors (e.g. criminal behavior). According to Rahmati and Heidarinezhad (2011), in a study entitled, 'Physical development of cities and necessity to determine safe urban space', safe area in cities will help to address the risks and vulnerabilities. Sadeghzadeh (2015) analyzed the design and improvement of the quality of the physical organization of the urban environment with regard to the community of the blind. He, with respect to the recognition of existing challenges, addressed to the lack of access to spaces due to the disorder of physical space at the Tajrish Square, resulting in lack of communication network at macro-scale as well passages for the blind people (Sadeghzadeh, 2015). Sami (2015) stated that criteria such as permeability and readability are security guaranteed in urban spaces of Dasteban in Mashhad. He also stated that public participation in the urban planning process can improve the current state of Dasheban area (Sami, 2014). Kalantari et al (2013) studied the planning of safe urban spaces based on gender separation with CPTED approach, in the framework of new urbanization theories, and concluded that it could lead to the reduction and prevention of urban crime rate. Daripour and Maleki (2015) showed that sense and identity of place, memorable moments, legibility of environment, general perception, visual pleasure, and the form and shape as urban landscape indicators all contribute to the sense of security of citizens in urban public space. Zanganeh (2015) evaluated pedestrian safety equipment on the streets of Koohdasht city and presented the necessary strategies to increase safety of urban streets and pedestrian crossings to eschew accidents. Kulawiak et al (2013), in a paper, considered security as one of the important factors affecting the quality of urban spaces and stated that high crime rate in open urban spaces around the United States and Europe made it obligatory for urban planners to present physical and cultural solutions for these cities.

Therefore, in light of the findings of previous research, if flourishing and prosperity is the aim, there is a need to get a better understanding of social structures and their impact on people's life and well-being. Improvement of safety is the result of environmental and social factors; hence, it is required to find appropriate solutions to improve the safety of people. In many cases, the type of physical space design, the role of a particular place and social dimensions of an area leads to safe and unsafe spaces (Adibi et al., 2011). As a result, qualitative and quantitative studies are essential for the security of urban space (Ghaeei, 2010). The vital importance of safety and security for any physical space of the city hence needs to be studied.

The accident prevention model for safe society in 1898 was first proposed by Prof. Swannrostrom from Swedish Carolyn University considered as an appropriate model to prevent accidents at county levels, which has been approved by the World Health Organization. Carolyn

University was known as the World Health Organization Collaboration center in disaster prevention and responsible for leading this global movement. The Allameh Majlesi Street is one of the old unique Streets of Isfahan. The importance of urban spaces, especially squares and roads, are due to the occurrence of social interactions. The reason to secure the Allameh Majlesi Street of Isfahan is its dynamism, its role in connecting the mobility of cars and motorcycle, as well as the presence of many pedestrians because of its vitality, lots of shops and presence of an Imamzadeh. Lack of enough attention to the pedestrian areas has culminated in more than 1000 accidents annually and the presence of criminals and homeless people causing psychological and social harms to the society.

2. Methodology

This is an applied research implemented with a descriptive-analytic method. The statistical population consists of all the citizens in Allameh Majlesi Street in Isfahan. Simple random sampling method was used to select 200 individuals among 3000 citizens. Strategies were formulated based on the SWOT technique. According to Morgan's table for statistical population of 3000 individuals, 196 people were selected as the sample population. The data collection was done through a questionnaire in the form of a survey to collect the required information for the analysis. To develop a theoretical base, Persian and English scientific articles related to the study were used. In order to better study the results of the questionnaire, field observations and interviews were conducted using EXCEL software. The SWOT technique was implemented for decision making and three alternative designs were proposed.

3. Findings

3.1. Analysis of the Design Scope (SWOT Technique)

The obtained information and the analyses by the SWOT are presented in table 1; the strengths, weaknesses, opportunities and threats of the area have been evaluated to figure out the strategies and relevant results for a suitable design.

Table 1 SWOT

	Allameh Majlesi Street – SWOT	S	W
		S1: Existence of land use index and population attraction at regional and city scale. S2: Presence of cultural, health, service centers. S3: Easy accessibility to public transport. S4: Presence of legible cognitive image along the street. S5: Presence of historical elements and organic texture of the street. S6: Existence of structure and places as historical and time indication of the	W1: Physical and activity worn-out in the Allameh Majlesi Street texture. W2: Existence of narrow passage in many parts of the area. W3: No area for spending leisure time and resting place. W4: The inappropriate width of the street and the absence of speed breakers along the route. W5: There is no proper parking lot that causes vehicular parking at the entrance of the street or double parking and this has caused disturbance in traffic. W6: Unplanned and inappropriate bridges.

		area. S7: Smooth path surface. S8: Skyline harmony.	W7: Unmanaged pedestrian and bicycle tracks. W8: Functional bans for the disabled. W9: Difference in surface and failure in the floor. W10: No proper use of facilities.
O	O1: Ability to use abandoned spaces for level parking. O2: Ability to create amenities and equipment on the streets for pedestrians. O3: Organizing how to navigate through the passageways and using appropriate physical design in the area can reduce the penetration of sound pollution in the area. O4: Presence of historical elements is an opportunity to create a hub for tourism. O5: Designing special tracks for bicycles and motorbikes can improve security.	- Use of appropriate facilities and lighting and upgrading the quality of the streets. - Surface design and walls in order to satisfy people. - To limit the traffic flow in certain areas.	- Creating motivation for people alongside the design of street. - Creating unity and empathy among people in the area to collaborate in street design. - Construction of parking lots around the streets.
T	T1: Destruction and reducing the visual quality of the worn-out area in case of failure to address the condition of the buildings. T2: Not paying attention to the needs of residents and pedestrian. T3: Risk of dumping waste in public and pedestrian areas. T4: Gradual degradation of valuable structures. T5: Destruction of the proper face of the historical texture. T6: Presence of barrier for the commuters. T7: Unsafe pedestrian for the disabled people.	- Due to lack of management and lack of accessibility to the physical form of the street one witness the decline of the street identity and security. - Strengthening the pedestrian network for the people.	- Training to raise people's awareness in relation to physical design of urban space against environmental damages.

3.2. Evaluating SWOT table and Extracting a General Strategy

Each of the norms present in strengths, weaknesses, opportunities and threats according to the design approach by ten experts (i.e., professors, municipal experts and urban design engineers), evaluated on a scale of 4 to 9 and the values were normalized. After multiplying the coefficients in the number of passages, the total sum of the values of each strength, weakness, opportunity and threat was obtained. Finally, according to the analysis of the norms in the study area, the result is an aggressive strategy which is shown in table 2.

Table 2 Valuation result

Internal environment			
Weaknesses 2.63	Strengths 4.26		
Adaptive strategy (minimum-maximum)	Aggressive strategy (Max-max)	Opportunities 3.97	External environment
Defensive strategy (Minimum-minimum)	Contingency strategy (Maximum-minimum)	threats 1.16	

3.3. Objectives, Strategy, Policy

Table 2 SWOT Analysis

Objective	Strategy	Policy
Enhance the sense of security within the area.	Enhance cognitive permeability for site users	• Improved lighting quality in the area • Surface design for all users of the site, including the disabled and the blind • Increased control and monitoring • Change in the texture at the same time with incident that happens within. • Creating signage, landmark and symptoms to encourage continued movement.
The use of natural elements in the area.	The use of natural elements along the street	• Restore vegetation texture. • The use of pots along the axis also adds to the beauty aspect, as well as to prevent the vehicle from entering the walkway.
Environmental quality	Upgrading the priority of pedestrian access than to the ride.	• Separation of the riding path from the pedestrian. • Change the materials used for flooring • Limit the vehicular travel time to the desired area • Avoiding the use of fixed facilities
Re-defining physical elements in the area.		• Creating harmony and increasing visual proportion of the street wall by using consonant colors, eliminating visual disturbances such as cooling channels, creating harmony in panels and canopies • Use suitable paving stones in terms of materials and colors, especially in areas where the route changes.

4. Analysis of the Questionnaire

The results of the analysis of the questionnaire shows that among 250 respondents, there was a need for 15 percent lighting, 55 percent of wall design, 55 percent surface design, 50 percent reduction of traffic, 65 percent separation of the pedestrian path from the bicycle and motorbikes and 10 percent increase of supervision.

4.1. Probable Scenario

In this scenario, because of public dis-satisfaction there is a probability that the Allameh Majlesi Street might be empty; buildings are destroyed causing damage to the appearance of the street. The

aesthetic aspects of the street are affected by the amenities of the shops placed on the pavement area. Another problem is double parking due to lack of parking lot, causing traffic congestion; this results in the inconvenience for pedestrian commuters as motorcycles pass through the footpath. In summary, the street beauty and dynamism are completely eliminated due to the high density and crowd along the pathway.

4.2. Preferred Scenario

The preferred scenario leads to the dynamic Allameh Majlesi Street where people walk on the pedestrian area and do window shopping. The stone pavements are designed and children are running along the sidewalk. Advertising places are allotted on the street walls, and all the information is electronically displayed. A number of buildings in the area are converted into parking lots resulting in traffic reduction. Even on certain days, private car entry to the area is prohibited, due to "a day without a car" regulation, and one could move around the street with means of public transportation. Motorcycle and bicycle tracks are made along the street, and inside the pedestrian areas there are flower boxes that prevent the vehicles' passing.

The uniformity in the shops' design and decoration give an aesthetical view along the route; there are benches along the sidewalk for short time rest. Presence of lots of trash bins causes the cleanliness of the route, and people move more willingly and enthusiastically on the street. Appropriate night street lightings make it a nice and appeasing place to walk and provide security for the pedestrians.

4.3. Framework

Table 4 Proposed framework for the formation of the Allameh Majlesi landscape statement based on Tehran model.

Landscape Statement Framework			The landscape of Alamah Majlesi neighborhood
Supporting tips	Meaning	Implied meaning	Allameh Majlesi Street is the heart of the physical and environmental security of the city of Isfahan
		Explicit meaning	Economic base: The city's historic religious axis
Details	Identity	Economic morphology	Use of the commercial center and economic tourism activities
		Socio-cultural morphology	Perfect place to spend leisure time, life and religious education
		Economic morphology	Inspired by the traditional texture of Isfahan and tourist sites
	Structure	Local status	Tourism destination on national-regional scale
		National status	
		Regional – international status	

4.4. Statement of Vision

Allameh Majlesi Street is the heart of the physical security and economic axis of Isfahan; in addition to its national grandeur, it has a brilliant niche at a regional level. Implementing well-established programs, boosting strong partnerships among people and authorities, the use of

business centers and economic-tourism activities as well as the historical-religious hubs, the elite organizations and tombs of Allameh Majlesi can all prove very effective in attracting domestic and foreign tourists; it can even attract residents to continue their lives there, and restore vitality and prosperity to the street. Such physical designs, the restoration of environmental safety, and the reduction of traffic all would solve the problems and improve the living conditions. This attempt might bring vitality to the street and accommodate many residents. Creating green space is also necessary to encourage people to spend their leisure time and social interactions there; this would enhance the dynamism and vitality of the area. Existence of precious historical arts and religious ceremonies in the region will make it possible to turn this area into a historic-touristic hub at a national-regional level.

5. Design

According to the studies carried out and the introduced indicators, the alternatives are presented; in order to achieve the best option, three alternatives have been proposed which are alternative zero, minimum and maximum.

5.1. Alternative 1 (zero)

In this alternative, the status quo is completely simulated and all the features are specified. In this, the street problems are studied in such a way that flooring, street walls and shops are examined.

According to the current design, the stone floorings of the pavement area are similarly un-organized and at places unsuitable for people. The security for the pedestrians is endangered as vehicles enter the sidewalks. The flowers are without safe railing protection.

Fig 1 Alternative zero

5.2. Alternative 2 (minimum)

In this alternative, changes have taken place to a minimum level. Amenities embedded such as benches, secure space such as resting places for elderly and disabled people, separate bicycle and motorbike lanes from the sidewalk and some lighting are provided.

Fig 2 Alternative 2 (minimum)

5.3. Alternative 3 (maximum)

In this alternative, a new design has been applied in accordance to the studied criteria. The design proposes equipment for people on the street, temporary resting space for elderly and disabled people, built-in benches, restoration of green texture and providing necessary street lighting.

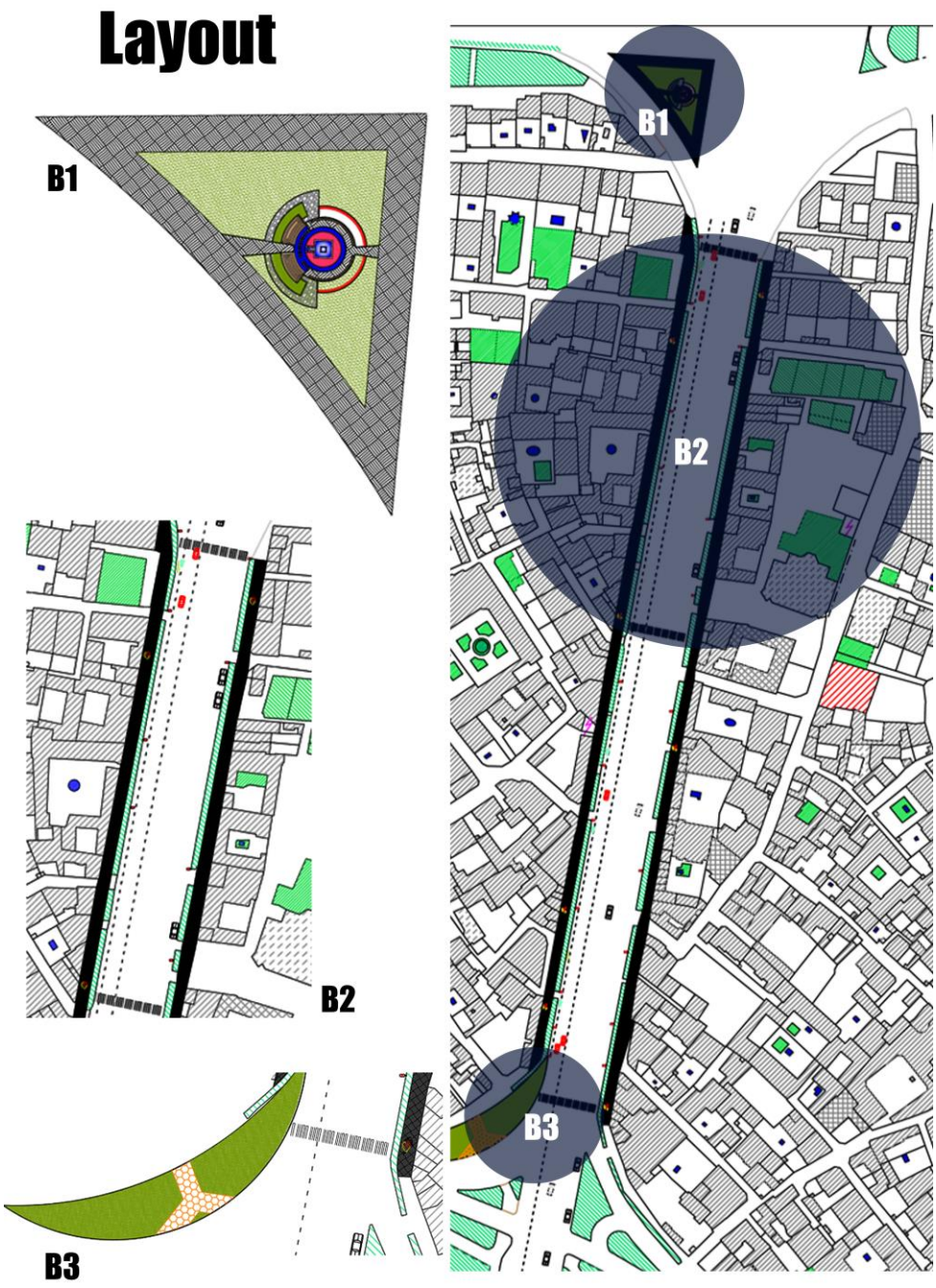


Fig 3 Alternative 3 (maximum)

6. Evaluation of Alternatives by AHP Technique

In evaluating the alternatives, the criteria that are considered are a) enhancing the sense of security, b) sustainable life, c) environmental quality, d) redefining the physical elements in the area.

- Four matrix assessment criteria
- First squaring each row, and then normalizing them.

Table 5 Valuation of criteria

	Enhancing the sense of security	Sustainable life	Environmental quality	Redefining the physical elements in the area
Enhance the sense of security	1	5	7	3
Sustainable life	1/5	1	3	7
Environmental quality	1/7	1/3	1	5
Redefining the physical elements in the area	1/3	1/7	1/5	1

Enhance the sense of security $\Rightarrow \sqrt[4]{1\ X\ 5\ X\ 7\ X\ 3} = 3.2 \rightarrow \frac{3.2}{16} = 0.2$

Sustainable life $\Rightarrow \sqrt[4]{\frac{1}{5} X\ 1\ X\ 3\ X\ 7} = 1.43 \rightarrow \frac{\frac{1}{43}}{\frac{11}{2}} = 0.12$

Environmental quality $\Rightarrow \sqrt[4]{\frac{1}{7} X\ \frac{1}{3} X\ 1\ X\ 5} = 0.69 \rightarrow \frac{\frac{0.0}{69}}{\frac{6}{47}} = 0.1$

Redefining physical elements in the area

$\rightarrow \sqrt[4]{1/3\ \text{X}\ 1/5\ \text{X}\ 1/7\ \text{X}\ 1} = 0.13 \rightarrow 0.13/1.67 = 0.18$

Evaluation of the sub-criteria within the criteria
1. Sub-criteria to enhance the sense of security
a) Quality of lighting, b) increasing supervision, c) reducing anomalies backgrounds
2. Sub-criteria of environmental quality
a) Separation of vehicular movement from pedestrian areas, b) width of the sidewalk, c) facilities and equipment of the city
3. Sub-criteria of redefining the physical elements of the area
a) Visual proportion, b) reduced disturbance, c) appropriate lighting
Evaluation of alternative of 1, 2 and 3 relative to the sub-criteria
1. Sub-criteria to promote security criteria
a) Quality of lighting, b) increasing supervision, c) reducing anomalies backgrounds
2. Sub-criteria for sustainable life criteria
a) Identity, b) dynamic, c) diversity
3. Sub-criteria for environmental quality criteria
a) Separation of vehicular movement from pedestrian area, b) width of the sidewalk, c) facilities and equipment of the city
4. Sub-criteria for redefining physical elements of the area
a) Visual proportion, b) reduced disturbance, c) appropriate lighting

Table 6 Sub-criteria evaluation of reduction of anomalies fields

Criterion	Enhance the sense of security			Sustainable life			Environmental quality			Redefining the physical elements of the area		
	Quality of Lighting	Increased monitoring	Reducing anomalies background	Identity	Dynamics	Variety	Facilities & equipment of the city	Width of the sidewalk	Supervision of the vehicular traffic	Appropriate lighting	Visual proportions	Reduce disturbances
Alternative 1	0.18	0.18	0.18	0.1	0.1	0.1	0.12	0.12	0.12	0.2	0.2	0.2
	0.18	0.26	0.25	0.26	0.18	0.25	0.26	0.23	0.27	0.22	0.15	0.27
	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
	0.0077	0.0112	0.0108	0.0062	0.0043	0.006	0.0074	0.0066	0.0077	0.0105	0.0129	0.0129
Alternative 2	0.18	0.18	0.18	0.1	0.1	0.1	0.12	0.12	0.12	0.2	0.2	0.2
	0.18	0.26	0.25	0.26	0.18	0.25	0.26	0.23	0.27	0.22	0.15	0.27
	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

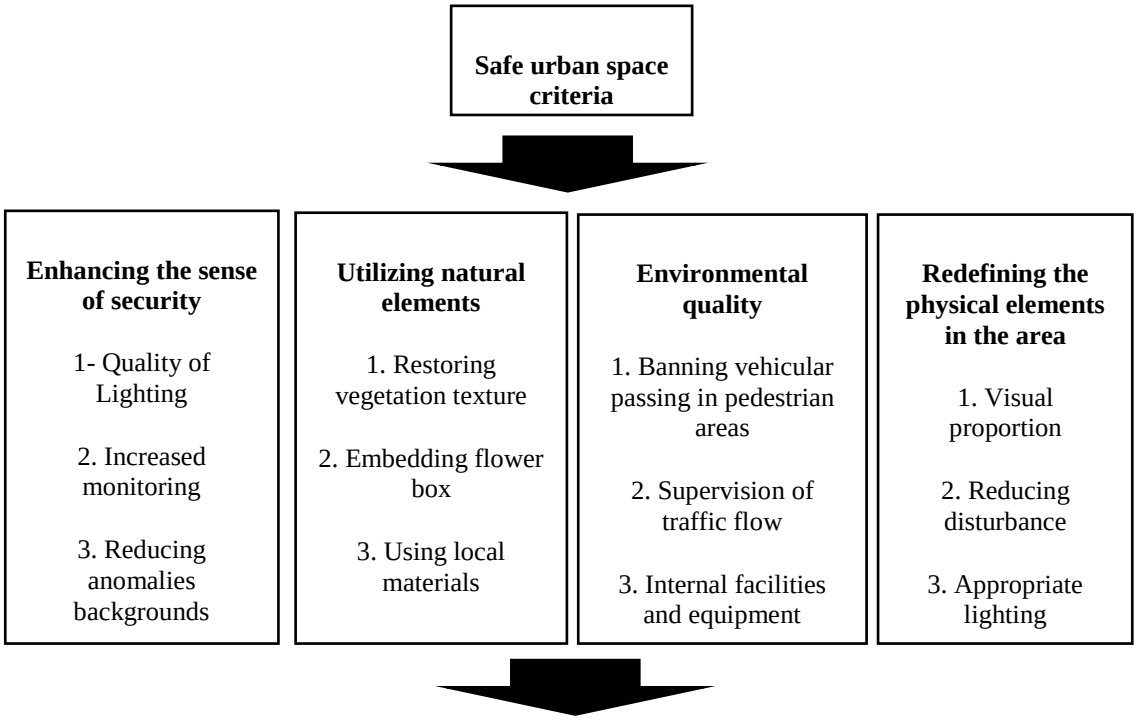
	0.0064	0.0093	0.009	0.0052	0.0036	0.005	0.0062	0.0055	0.0064	0.0088	0.006	0.0108
Alternative 3	0.18	0.18	0.18	0.1	0.1	0.1	0.12	0.12	0.12	0.2	0.2	0.2
	0.18	0.26	0.25	0.26	0.18	0.25	0.26	0.23	0.27	0.22	0.15	0.27
	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
	0.0081	0.0117	0.0112	0.0065	0.0045	0.0062	0.0078	0.0069	0.011	0.0088	0.0075	0.0135

Table 7 Scoring the alternatives

Scoring Alternatives	Alternative 1	Alternative 2	Alternative 3
	6.24×10^{-24}	7.38×10^{-23}	8.04×10^{-34}

After analyzing all the alternatives, scoring the criteria and evaluating each alternative with the sub-criteria, the third alternative was eventually selected as the best option.

7. Analysis and study of the final alternative in accordance to the safe urban space



The implementation of a safe physical design of urban space against environmental damages was made possible based on the mentioned criteria. By increasing the supervision and reducing the anomalies against damages, a design was proposed to construct standard bridges, facilities and equipment to prevent physical damages to the street users. Considering the subject of the study, it was an important issue to prevent the entry of vehicles into the pedestrian areas which was achieved via incorporating flower boxes and barriers and changing the pavement surface materials.

8. Conclusion

Nowadays, special attention has been given to security in cities. Therefore, to secure the city some areas were studied. According to SWOT table and the scenarios, to attract people and to create physical security, it is necessary to separate the motorcycle and bicycle lanes from the

pedestrian area and to design the flooring and street walls. Proper lighting at night and more monitoring and patrolling would restore security to the region.

After analyzing all the alternatives through the required techniques, valuing the criteria and evaluating alternatives with the sub-criteria, the third alternative was selected. Therefore, in order to improve the conditions and provide more security it is proposed to;

- Expand the street to add motorbike and bicycle lanes.
- Limit the vehicular movement to reduce traffic.
- Establish parking lots near the surrounding street to reduce traffic congestion.
- Change the stone flooring materials of the pedestrian area with regard to the user needs including disabled and blind people.
- Use flower boxes to increase the aesthetic aspects and to serve as an obstacle for the vehicles to enter the pedestrian area.
- Provide temporary short time resting space.
- Construct speed bumps and ramps.
- Improve the lighting quality especially in insecure and dangerous places.
- Create harmony and increase visual proportion of the street wall using consonant colors.
- Eliminate visual disturbances such as cooler channels and create harmony in panels and canopies.
- Design mechanized panels to provide information in the streets.
- Avoid the use of non-removable facilities.

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