Evaluation of Isfahan's "Mâdies" as Greenways, with Sustainable Development Approach (Case Study: Niasarm Mâdi)

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Received: Feb., 2014 Accepted: Aug., 2014

Expanded Abstract

Introduction

Using greenways could be helpful to promote the improvement of urban streets. Greenways, as they are known, improve the pedestrianism and related qualities like climatic comfort, visual complexity and desirable serial visions. The objective of this research is to evaluate the capacity of *Mâdies*[1] network in *Isfahan* to function as greenway. This research aims to assess in what extent they can play as main part of a vast green network. *Mâdies* are several streams divided directly from *Zayandeh-Rood* River. They constitute the main part of the historic-natural structure of *Isfahan*. There are about 250 km of these manmade streams which are perfectly planned, designed and constructed according to the topographic characteristics of the plain of Isfahan. Originally, *Mâdies* were created to irrigate the farmlands surrounding the river in the plain of *Isfahan* since the *Safavids* period. Today their role is completely changed in one hand due to the drought of *Zayandeh-Rood* River (source of water in *Mâdies*) and expansion of city and land use changes from agricultural into different urban land uses on the other hand. By the way, today *Mâdies* could play a vital role in improvement of environmental qualities despite their changing role. They are fundamental elements of urban structure in the city and reinforce the organic and natural aspects of urban planning and design as basic parts of greenway characteristics. Therefore, they could be considered as main structure of green network in the city of Isfahan. As it is known, greenways enhance quality of environment, aesthetic, recreation, education, relaxation, and preservation of habitation. Greenways can help the protection of ecological continuity. They are managed, planned and designed for several functions such as environmental, recreational, cultural, aesthetic and other purposes. Thus, we can extract greenway characteristics from existing definitions such as their linear form, organic design, social inclusiveness and their perfect adaption to the urban environment. *Mâdies* can play a central role as part of a structure which is greenway network. To do this, it is necessary to know in what extend they are appropriate to this function. This paper tried to identify the strengths and weaknesses of *Mâdies* to fulfill the task of being greenways.

Materials and Methods

The first step of the method consists of description and definition of *Mâdies* and greenways as the two principal parts of this study. The identification of the two above mentioned concepts was necessary to establish the categories of indicators which make it possible to compare them with one another. Describing and categorizing the main characteristics of greenways were the next step of the research. In this part, greenways are summarized across principal sources and expert in the field. The next step was definition of the criteria and indicators to evaluate in what extent the *Mâdies* could play the role of greenways in Isfahan. In order to determine the indicators, the main axis of precedent tables constitutes the categories in which the indicators are extracted from different sources. The data is gathered through observation, noting and measurement. Table 1 shows the criteria, sub-criteria and indicators.

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Table 1. Critera and indicators for assessment of Madies as greenways

Criteria	Indicators	Niasarm	Unit	Quantification and Measurement
A. Pedestrianism	A1. Interconnection of pedestrians and cars	96%	Length (m).	Length of common path (pedestrians and cars) transportation.
	A2. Pavement facilitating pedestrian	34%	m2	More convenient pavement covered percentage among 3 types identified.
	A3. Efficient width of pedestrian way	45%,	Width (m).	Width variation along Score *of Niasarm.*
	A4. Noise pollution rate	34%	dB	Average noise pollution recorded in one week with *Noise Dosimeter* and *Sound Label Meter*
B. Security	B1. Nightlife uses	5%	Number/ unit of length	Land uses having nightlife potentials
	B2. Social control	35%	Individual/ unit of surface	Number of individuals in space over 2 Hours (2 times a day), (+10→4 pts; 10-6→3 pts; 5-4→2 pts; 3-1→1pt; 0→0 point)
	B3. Night lighting	45%	Lux /unit of length	M2 of alighted spaces/total space along *Mâdi*
	B4. Sense of security and control	40%	Number of positive responses	Positive responses in questionnaires
	B5. Transparent fronts	25%	Unit/ length	Opening surfaces in m2/total surface
C. Safety	C1. Accident prone spots	90%	Number/ unit of length	Number of prone spots in length
	C2. Sense of security in pathways	100%	Number of positive responses	Positive responses in questionnaires
D. Sociability	D1. Equipment and facilities	5%	Number in unit of surface /total	Average areas of the equipment and facilities measured in unit of surface/ total surface
	D2. Programmed socio-petal spaces	5%	m2 of programmed spaces / m2 total	Average areas of the programmed socio-petal spaces measured in m2 /total
	D3. Public participation in maintenance	5%	Number of positive responses	Positive responses in questionnaires
	D4. Place attachment rate	70%	Number of positive responses	Positive responses in questionnaires
E. Viability	E1. Inclusivity of space	25%	Percent	Diversity of the different groups (sex, age) recorded in a week (2 times per day)
	E2. Climatic comfort of space	100%	Percent	Creating a list and determining score of *Mâdi*
	E3. Permeability of space	5%	Block length (m).	Length of blocks measured by GIS

F. Physical aspects	F1. Geometry	100%	Percent	Linear form (of green way)→Best point; semi-linear→0.5 point; non-linear→0 point
	F2. Structural elements	50%	Number in length	Elements of greenway (Corridors and pause points); *Mâdi* has no visible pause point
	F3. Network character	50%	Percent	Structure of *Mâdi* is branching, so is part of a network.
G. Place quality	G1. Adventure	5%	Number of positive responses	Positive responses in questionnaires
	G2. Fun of space	100%	Number of positive responses	Positive responses in questionnaires
	G3. Biodiversity	70%	Percent	Creating a list and determining score of *Mâdi* according to obtained information from the Park organization.

As it is shown in Table 3, the indicators are grouped in seven categories: pedestrianism, security, safety, sociability, viability, physical aspects and qualities of place. Then the *Mâdi* of *Niasarm* has been evaluated through the set of indicators. Quantification and measurement of each indicator is explained and several techniques like questionnaire, mapping, observation and survey are used.

Results and Discussion

The results of the research show that to become greenway, *Mâdi of Niasarm* needs to be improved. In seven established categories, the situation is satisfactory in just one category of Safety. In two other categories (pedestrianism and physical aspects), the results is above the average of 50%. Concerning the rest, the situation is not satisfactory. For example, the category of Security is below the total average. Figure 1 shows seven categories and their respected indicators.

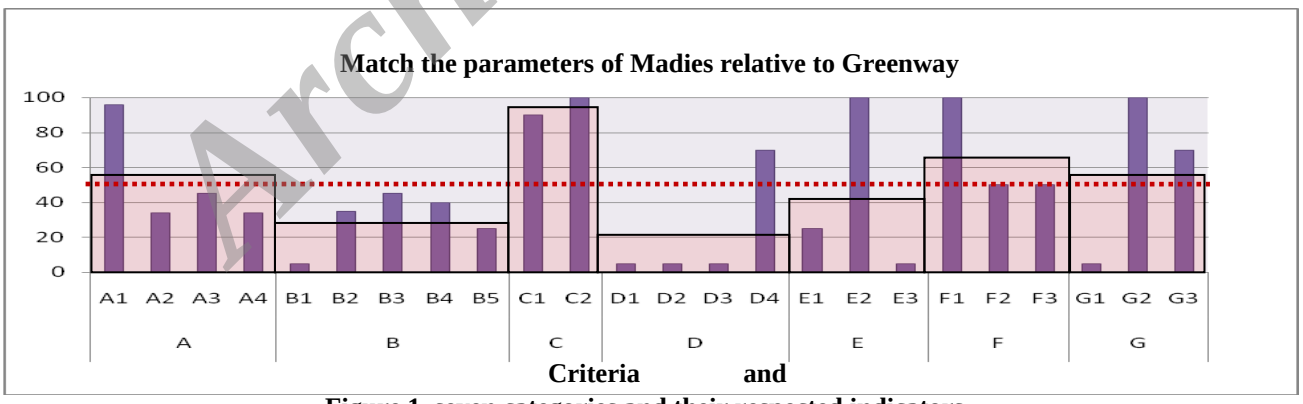

Figure 1. seven categories and their respected indicators

Conclusion

The physical, functional and spatial similarity of Madies in Isfahan and greenway are proved by the results of the research. However, according to this study, *Mâdies* do not function perfectly as a standard and greenway. The evaluation of *Mâdi of Niasarm* in this study in seven groups of criteria and 24 indicators shows that it involves many efforts to make the existent *Madies* good greenways even if they are suitable. In some criteria such as C (Safety), *Mâdi of Niasarm* has approximate condition for a standard greenway. In three groups of A (Pedestrianism), F (Physical aspects) and G (Place quality), the score is above 50% and it could be considered as acceptable.

Keywords: green infrastructures, greenway, Isfahan, Mâdi of Niasarm, Mâdies.