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The Role of Green Way in the Achievement of Urban Sustainable Development (District 3 of Tehran as a Case Study)

Fatemeh Shahani

Department of Urban Planning and Design,
Central Tehran Branch of Azad University, Tehran, Iran

Abstract: City developments cause to increase exploitation of natural resources more than environmental capacity and lead to create instability. Hence urban green spaces and elements are necessary consideration. Attitude of sustainable development emphasizes the role of green area and In order to achieve this goal, "green way" is considered as one of the most important tools for improving urban sustainable development. Green ways are the linear elements of networks; those are programmed, planned and managed for multi-dimensional purposes such as ecological, recreational, cultural, recognizable beauty and other reasons which are compatible with the concept of sustainable city. The purpose of paper will demonstrate "increasing bio-environmental quality in cities and considering sustainable development items can be achieved by green ways". In this regard, city's green space compounds are recognized as a major structural component in the process of green paths influence. To achieve the main goal, required index is determined in the study area (district 3 of Tehran) and evaluated existing green corridors potential. Research findings have obtained from questionnaires and then analysis is done by the statistical (Chi-square) method based on responses. Finally, in urban sustainable development, multi-functional roles of green ways are attained by suitable communications, access and income in mentioned roads.

Key words: Sustainable Development · Urban Greenway · District 3 of Tehran · Access ability · Social relationships

INTRODUCTION

Increasing recognition of the worlds' expanding population and current global rural to urban migration necessitates a better understanding and integration of urban ecological process into the framework for urban design. All the technological developments and human accommodation have led a lot of extra unused things in regions. During years this subjects disturb natural life cycles and chain of life in urban areas. Reinforcing the ecological networks in cities is a proposed solution for answering these problems, either for developing natural species or increasing mutual relations between human being and green spaces. Green ways can mix with urban networks for developing ecological activities and acting like natural city lungs.

According to definition of sustainable development, a sustainable city should contain essential characteristics of sustainability. Quality of life is in the central part of various descriptions of sustained city. Urban nature like green paths and ways establish all the required sequence for life qualities, also this progression is the key part for sustainable development. Turner believes that green path is one of the most important planning tools for increasing natural environment quality of city's inhabitants [1]. Based on Little approach, green spaces connected with organized and associated networks make the ecological movement easy and lead to accomplish the sustainability [2]. In Fabos definition green corridors are: "Tunnels with various widths join to each other like the highways or railways" [3], or as Ahern opinion "They are similar to a linear open space that, firstly, they are green in terms of environmental issue and secondly, they can use as a path"[4].

Regarding the green paths are designed and planned for two decades in all around the world and most of the countries reach to estimate these kinds of roads, the organization of these paths and networks seems

Corresponding Author: Fatemeh Shahani, Department of Urban Planning and Design, Central Tehran Branch of Azad University, Tehran, Iran. Tel: +98-919-004-0397.

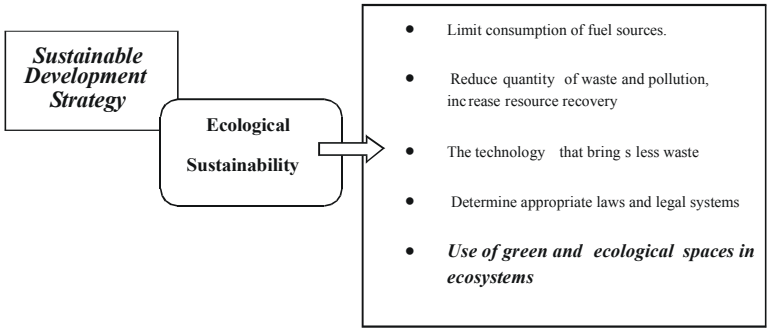

Fig. 1: Ecological sustainable development strategy

inevitable in Iran's cities. District 3 of Tehran will be as a case study to enhance the green networks. This area will be evaluated based on theoretical concepts of paths and green corridors. Because of appropriate herbal covers and suitable relations between green path parts, district 3 is considered and identification, combining and developing urban green spaces in it, are along the purpose of paper. In this study, the ideas and goals of sustainable development are described and emphasized the environmental elements of urban green area for achieving sustainable city. Respectively, roles of urban green paths in sustainability and types of them are considered and the index is come from mentioned green roads. In conclusion, evaluation criteria in the district 3 answers the main question of the paper "how can move along to create the urban green ways, by using the potential of green spaces in district 3 of Tehran municipality?" and then results and provided solutions are expressed based on hypothesis testing. This paper is shown, by greenway evaluations in mentioned district, can be achieved the significant roles of greenways in urban sustainable development. This presentation will focus on the development and management of main greenways corridors in Tehran as backbones for sustainable development.

Theoretical Study

Sustainable Development: Sustainability is a vision and it is born by changing people's view in the world. The environmental issues are mentioned in the Brantland Report of World Development Commission. In a specific definition as Shearman's view "sustainable development is the progress of life quality for protecting environment" [5] and in this expression, the concepts of "development" and "environment" are parallel each other and describe one goal. In the environment, roles of human being are so considerable and sustainable development emphasizes human's rights for healthy and innovative life with nature harmony. All the recent numerous and complex environmental problems in sustainable development planning, lead to publish different agendas and strategies for designing the framework of sustainable development, Fig. 1.

Based on Chiesura theory, the balance between various parts of city development and between city and green spaces are considered by the most effective and relevant components of sustainable development [6], those are described in Table 1.

Green Way: Today with growth of urbanization, dramatic development of green spaces is more apparent than before. Therefore, city managers use all kinds of appliances (natural or artificial) to profit from them in different aspects. On the other hand, approach of human knowledge progresses and their effects have become more comprehensive in different aspects. Landscapes and green ways will increase the environment qualities and they are the best place for spending leisure times. Nowadays, although about 1/3 up to 2/3 of perspectives in the world contain green spaces and paths, there are still several places that should be identified and considered by

Table 1: Effective components of sustainable development

	Components
1	*Create a favorable city image with human proportions, urban identity and urban*
2	*Prepare flexible programs in land use*
3	*Provide green and active spaces in the urban environment*

Table 2: The importance of green ways establishment

Cases	Importance
Landscape Ecology	Create readability and clarity in the landscape and strengthen the sense of place
Agriculture	Prevent soil erosion, enhance nutrient cycling, decrease wind speed and soil erosion, increase humidity in the air, etc.
Economic	Increase value added and tourism development, create job opportunities and business
Social	Enhance recreation opportunities, create field of health promotion, prepare community education in relation to nature, find transport systems which do not consume energy (like walking, cycling, skating, etc.)
Management	As Green Belts: limit development , decrease energy consumption, enhance scenic beauty and comfort

people who have responsibility in these fields. Viles *et al*. are expressed the importance of green ways establishment [7] in Table 2.

Greenways are multifunctional trails for non-motorized users, connecting communities, local initiatives, natural and cultural heritage sites, promoting a healthy environment and lifestyles.

Hence, Greenways:

- Are initiated, developed and managed by communities;
- Encourage sustainable development and provide a positive contribution to the economy
- Promote and enable low environmental impact lifestyles;
- Provide a framework for community-based initiatives;
- Promote nature conservation, cultural heritage preservation, sustainable tourism and mobility;
- Integrate sustainable transport solutions and improve safety for users
- Address needs of locals and visitors, [8].

Greenway planning and design corroborate the principles of landscape planning and design, focusing on valuable areas and resources [9], fostering better metropolitan landscapes [10].

While green infrastructure can have a significant effect on the ecology of the urban environment, its specific use for urban ecological networks to strengthen sustainable development has yet to be truly recognized [11].

Green infrastructure emphasizes the quality and quantity of urban green and the multifunctional role of these spaces [12], as well as the connections of these habitats [13].

Furthermore, green infrastructure has the ability to maintain habitat integrity and provide the physical basis for the development of urban ecological networks [14]. Urban green infrastructure can also increase the overall natural and semi-natural vegetation cover. The implementation of green infrastructure into an integrated functioning system to support urban requires attention to the spatial configuration and composition of green infrastructure as well as its functional and structural elements [15].

Research Case Study: Location of Tehran in the southern slopes of Alborz Mountain gives special benefits to it. Most of green ways in Tehran are gathered in the north part of it and they are near rivers or valleys. They work as recreation or health area for people who live in Tehran. The shape of city's relationship with nature in north part is different in various sections, district 3 is one of the northern sections in Tehran and due to its green masses with beautiful scenery, it is selected to evaluate exiting green liner patterns, however other districts have these parameters partly, Fig. 2.

The composition and distribution of urban green space in district 3 of Tehran, has been more related with the specified purposes than other districts. This area has linked elements in the environment and liner structure and has specific spatial and functional feature for multi-functional purposes.

District 3 is considered based on theoretical frameworks, assumptions, goals for answering questions and expected results. It is shown that if these kind of green forms in the three main roads of district

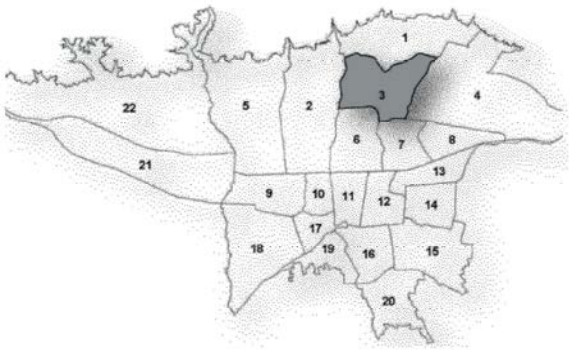

Fig. 2: Location of district 3 in Tehran

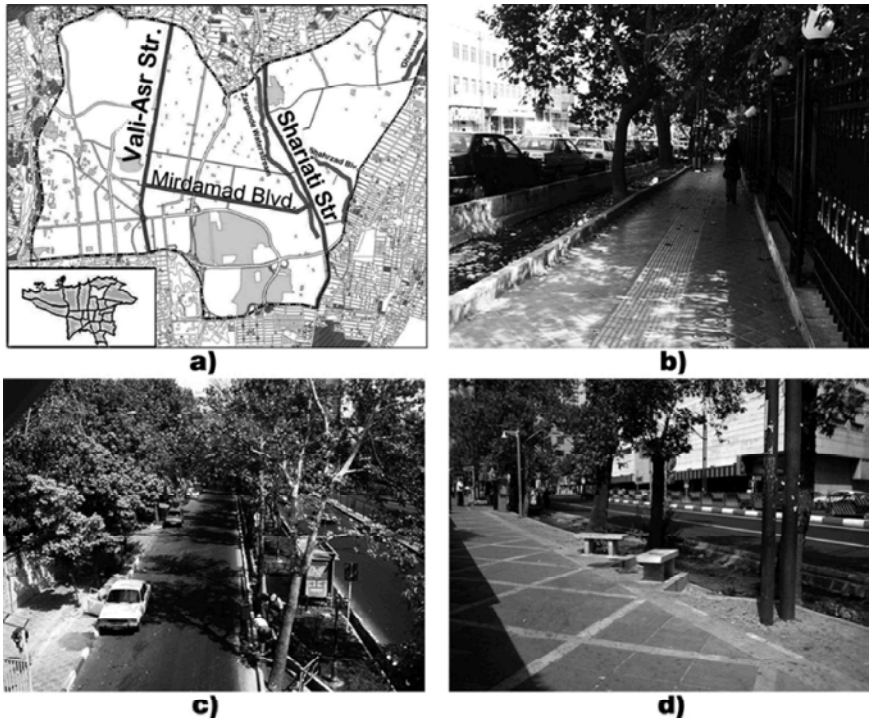

Fig. 3: a) Map of district 3. b) Shariati St. c)Mirdamad Blv. d)Vali-Asr St.

3(Vali-Asr St- Shariati St- Mirdamad Blv, Fig. 3) have potential to be urban greenways or not, along maintaining sustainable development indexes. Also surveys about social behaviours, functional structures and interactions around greenways are discussed with indicators.

Indeed, these ways are existed in district 3 of Tehran and studies about hypothesis are done by research indicators.

The paper purpose is to demonstrate greenway significance towards the improvement of sustainable development in urban area. The case of district 3 of Tehran showed the achievements on urban planning, funds capturing and landscape improvement.

Research Indicators and Hypothesis: The indicators have been chosen by studying related references which are mentioned in research theoretical section. Thus, indicators of green paths are "Providing green spaces, Pollutions and pollutants, Connectivity and continuity, Visions and Perspectives, Multi-functional structures, Tourism and income, Access ability and transportation, Social relationships". Those are used as factors to promote sustainable development in case study's areas. Regarding defined indicators for answering the question, just the last three indexes will be used in district 3. Though other criteria can be effective for reaching goals, just these three indicators are tested because of their related characteristics.

This hypothesis is expressing for answering the research question: "we can establish urban green ways in district 3, by creating appropriate social relations and accessibility with preparing income in general green spaces of case study". This hypothesis is just for about areas that are either green or use as a path. For surveying hypothesis, three mentioned indicators in Table 3, are used and each of them is divided in to sub-indicators.

Table 3: Indicators and sub-indicators in research hypothesis

Row	Indicator	Sub-indicator
1	*Tourism and income*	Tourism growth with job and business opportunities for increase revenue
2	*Access ability and transportation*	Access for residents
		Travel and transfer away from roads traffic
3	*Social relationships*	Creation active community based on environmental factors (bicycles and pedestrians)
		Creation social spaces in public areas

Table 4: Survey of urban green way creation

Establish of urban greenway	*Extremely unfavorable*	*Unfavorable*	*Acceptable*	*Favorable*	*Extremely favorable*
Markets and businesses along the route	15	73	169	137	0
Combined commercial and recreational facilities along the route	5	112	176	63	28
Access route for residents to go to work, shopping center, public transportation	25	67	228	53	11
Access route for other people to go to work, shopping center, public transportation	25	204	95	54	6
Allow to cross pedestrians without interfering with traffic	9	142	193	30	10
Places for resting short time along the route	15	218	126	25	0
Pedestrian route along the axis	5	132	183	64	0
Cycling route along the axis	140	214	10	15	15

Table 5: Statically analysis of urban green way creation

Survey of urban green way creation	Actual frequency	Expected frequency	Frequent difference
Extremely unfavorable	30	76.8	-46.8
Unfavorable	145	76.8	68.2
Acceptable	147	76.8	70.2
Favorable	55	76.8	-21.8
extremely favorable	7	76.8	-69.8
Sum total	384	-	-
Chi-square			147.06
Degrees of freedom			2
Meaningful level(Sig)			0.00

Research Methodology: The main research methodology is based on questionnaires with Chi- square test. This test is used for variable relationships which one of them are measured at least in Non- parametric level. Variables are independent of each other and in this paper relations between indicators and district's potential are examined by Chi- square test. This mentioned test only determined relations, but it does not explain manners and degree of strengths.

One-sample Chi-square test (which is a Non-parametric test) is used by the statistic SPSS software and it will compare the real data distribution and expected frequency. For better assessment hypothesis, indicators divided in to sub- indicators. Then questionnaires are used to convert qualitative indexes to quantitative ones. Therefore these quantitative parameters can be evaluated by chi- square test in SPSS software. Indeed, questionnaires help to survey potential of district for preparing sustainable greenways. Although other methods like AHP or Fuzzy-logic and Lisrel or R software can be suggested, based on type of indicators and questionnaires, chi- square test is used.

In this research, questionnaires are applied also for analysing and they refilled by samples of studied area- for instance Shaffer *et al*. researching greenways of Texas [16] -and sample masses will be based on Krejcie-Morgan Table [17] and Cochran Formula [18]. In Krejcie-Morgan's table, the volume of sample for 1000000 people is 384, so for populations of district 3 (293181 people), 384 is used. In Cochran Formula of sampling, 74865 households are available in district 3and based on this formula number of samples should be382. Afterconsidering society characters, results derive from the conditions of case study. Then, in the step of surveying, available information with indicators is studied. All indexes identify and analyse for answering the research question.

Test Hypothesis and Findings

Test Hypothesis: For each sub-indicator in the questionnaire, a question has been made and has been measured based on potential of the district for establishing green ways in green axes. In Table 4, the answers have valued in 5 levels and in Table 5, its frequency has compared with expected ones.

Non- professional and inexpert people (ordinary ones) answer questionnaires and based on their respondent, indicators are discussed. However, these evaluations are not somewhat comprehensive, in most cases-such as Shafer, *et al* research in greenways of Texas- environmental assessments and surveys are done by ordinary people and local residents. So these comments are used as main factors for planning in people's future.

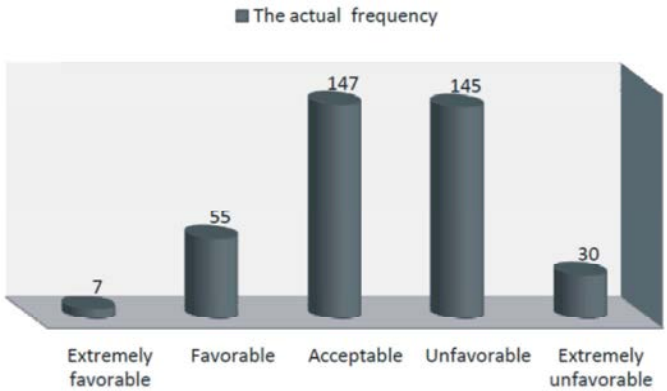

Fig. 4: Survey of urban green way creation

Table 6: Hypothesis test

Case	Type of test	Meaningful level(Sig)	Result of assumption H_1, H_0
Urban green way creation	One-sample of Chi-square	0.00	$H_1$was confirmed

In the hypothesis test, existence and loss of relations will be described by following model [19]:

Existence of relation (A real effect): H_1: P<0.05

Loss of relation (No real effect): H_0: P 0.05

Chi-square test ($\chi 2 = 147.06$) is meaningful in level of 0.000 and show the difference between the expected and gained frequency. The measurement of meaningful level (0.000) is less than an error measure (0.05), So H0 is failed and H1 hypothesis is accepted. Hence by 95 % confidence level can be said, there are meaningful differences between gained and expected frequency. Our expected frequency for each level with equal distribution between categories is 76.8, but conclusions show that frequencies of statistic society are different for cases.

Table 6 is the summary of the hypothesis test's conclusion. By confirmation of assumption H1; it can be proved that "there is a real effect between urban green way creation and related indicators of sustainable development". So with considering these indicators "Tourism and income, Access ability and transportation, Social relationships" It is expressed, by creation of pedestrian and cycling access, appropriate relations and developing trade and fun activities in general green spaces of district 3, can be moved to establish urban green ways.

Regarding to the test has been done, substantiation fields of a hypothesis for establishing urban green ways have been accepted and thus the assumption has been confirmed.

The Research Finding: The works done and in progress revealed a clear greenway strategy, starting a positive dynamic towards a qualified network of public spaces. The projects reflect the potentialities and identities of each place, improving landscape and placing as a better space to live, work and rest, the applied strategies and actions became more visible and faster to implement from plan to works.

The summary findings of indicators are explained in case study:

Indicator: Tourism and Income: Malls and trade activities along routes are characteristics of green way axes that have been evaluated acceptable and favourable. The applications of these activities are mostly used in regional aspect. Suitable access between these activities and green ways can be reasonable for both drivers and pedestrians. In some green axes of district 3, mixture of fun centres and trade activities are seen, which are so ideal for everyone, but in some cases quality of recreational activities and suitability for different ages may be inappropriate. In fact, these centres can be very significant for growth and development of tourism; because of providing areas for entering tourists, which is the basic goal of green ways. These places will attract tourists as an optimal path, either for using environmental conditions or identifying the mentioned district.

Indicator: Access Ability and Transportation: Access along routes which are connected or branched from them are acceptable for residents, but for people who refer to these ways for working or shopping are undesirable.

High traffic, not enough width for driving and weak transportation is the most important reasons for refusing to pass these ways. There are lots of traffic conjunctions in district's green ways and when these spaces interfere with pedestrian's path can lead to reduce abilities for walking along the routes. Discontinuities and intersections of ways can affect pedestrian's safety, so these paths should have been revised. Also, these conjunctions should shrink for providing pedestrian's relaxation in walkways.

Indicator: Social Relationships: Along paths, for developing relations and social interactions, some places are needed for the short time to stop. These places should prepare pedestrians and cyclists relaxation. Inappropriate replacement and small size of district 3's green ways are made them unfavourable. Since when people want to use them as the short rest or dialogue, they face problems and at last ignore them. These relations in green ways will lead to freshness and life in all parts of route. The most important characteristics of green path are pedestrian and cyclist axes, which must consider in green ways of district 3. Pedestrian's axes in these paths are somehow acceptable, but equipment and materials are not well enough. In Some sites, these ways are separated, which lead to dissatisfaction and unused areas as walkways. The cycling axes ignore along routs because of narrow walkways, wide streets and weak functional potential and consequently, it is inappropriate in green paths. There are capacities for these activities in the ways; however they need to review in physical borders. Thus, drive and walk routes in urban green ways of district 3 should consider all the physical, environmental and accessible situations to show its perfect performances as the main indicator of green ways.

The aim is to learn and work on Greenways support and different sustainable development opportunities such as:

- Improving nature areas and tourism site management learn about Tehran nature and do practical work on nature routes.
- Participating in cleaning the environment
- Natural and cultural heritage conservation and landscape protection by using local resources – accommodation, tourist services
- Promote non-motorized transport and environmentally-friendly tourism, recreation and sport.

DISCUSSION AND CONCLUSION

The natural environment and quality of spatial and visual pleasant of district 3 is noticed, as the area with capacity of urban green way's development. Located between mountains and plains, cause to contain different visions and perspectives; prepare conditions for pedestrians and use of clean air and climate. For achieving urban green way in district 3, the combination of urban spaces and assess are identified as an important structural. Establishing urban green path situation is evaluated by definite sub-indicators, which have been accepted because of relations or effects between these cases and urban green ways. As a result "The environmental potential and green spaces in axes are effective and acceptable to attain urban green ways."

In this research, the users are interested in these paths due to their beauty and application, Their Perception of green ways influence on the environment. These situations prepare circumstances for future policies, improve problems, make supplements and plan strategies for achieving goals. The study's conclusions have illustrated the weakness and basic challenges in urban green spaces and have identified green area's potential, in support of increase and develop these paths. When green ways can be sustained, that are contained all the suitable characteristics, managed by administrators and established situations for basic and accurate uses. Since regarding to urban green way's definition, these places should not be considered only in environmental aspects; even they should be used as useable and active linear green spaces.

A Successful Greenway becomes a backbone along which various sustainable development projects can be implemented including social enterprises, CO2 reduction and climate change projects, certification and eco-tourism as well as public awareness raising activities.

According to conclusion, the main point is that before any action in district 3, we should prepare essential backgrounds in environmental, functional and social fields; otherwise any actions for promoting greenways will not be achieved any success. Results are based on research finding, theoretical concept and along with principles of sustainable development. Therefore via them, we can prepare necessary fields in direction of future policy, move to improve exited shortcomings and create new facilities.

I hope that the planning process of district 3 Greenway can be a good example also for the public contribution. And, it can be a good opportunity for the protection of landscape values. I think the greenway program can be a good tool for the protection of the landscape heritage and also for strengthening the attachment to the landscape of the inhabitants of Tehran.

In conclusion, the expected outcome of the study is that the potential of green infrastructure use for strengthening sustainable development in urban environments is high but will vary greatly depending on the details of configuration and composition of existing green infrastructure, the ability to introduce new elements of green infrastructure. In addition, the use of urban ecological networks as a tool for promotes the development of sustainable urban landscapes.

Strategies and Solutions: Expressing the strategies which green ways can be progressed sustained development is so extended indifferent study fields. Thus, the effective and applied solutions are explained and In order to reach and improve mentioned indicators, these strategies and solutions are suggested:

Strategies: Emphasizing economic and tourism benefits due to site's multi-application roles as a green path (based on tourism and income indicator)

Solutions:

- Identifying and increasing the role of district 3 in Tehran Tourism Master Plan.
- Attracts new activities and Creation job opportunities based on capacities.
- Making value added in the neighbouring areas (Green way as an economic value)

Strategies: Emphasizing the integration of pedestrian and driving networks (based on access ability and transportation indicator)

Solutions:

- Reorganization of existing corridors in the district and adaptation to surrounding land uses.
- Considering greenways in urban transportation systems as main or secondary ways or roads in categories.

Strategies: Increasing social efficiency (based on Social relationships indicator)

Solutions:

- Providing necessary infrastructures for entering people as pedestrians and cyclists.
- Strengthening social stability in greenways by encouraging recreational and community activities.

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