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Research Note

Sustainable urban design; past, present, and future Case study: Darabad River Valley

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Abstract. The rapid and uncontrolled haphazard urbanization is a serious threat to the manmade and natural environment and the socio-economic balance of our time. There is a global concern that urbanization must be oriented in responsible, sustainable, and livable urban forms. High quality of sustainable urban design plays a key role in creating these sustainable living environments. In this regard, learning from culture and history and searching together are vital for new ways of designing. In this paper, the evolution of the settlements with respect to sustainable urban design in past, present, and future is analyzed. The study indicates that we had sustainable urban design in pre-industrial period in an organic way; however, we altered the existing ecosystems by welcoming incompatible technological elements; elements that cause a kind of ill growth similar to cancer. In this relation, a case study of urban environmental design for Darabad River Valley in Tehran as a sustainable urban design project is presented briefly. Finally, it is concluded that we should know that designing is a kind of altering the systems. A comprehensive wise and conscious approach similar to what we have used in Darabad River Valley project is suggested for similar situations.

1. Introduction

Human being's instinct to live in an urban area, dependence on others for the basic needs, and the urge to share all bear testimony to the fact that human is a social animal. History reveals that the metamorphosis of man from hunter to cultivator compelled him to lead a settled life in a social community form. Community life has been reflected by different lights during the past eras, subject to environmental, physical, economic and social norms of the time. The automobile free traffic resulted in the growth of small self-sufficient communities, with good social interaction and special respect for natural surroundings [1]. In the pre-industrial societies, men, methods, and materials determined the size and morphology of the settlements. The method and materials were very simple. Thus, the urban form reflected human scale. With the advent of the Industrial Revolution, the machine brought about a total change in the living and settlement pattern. As the industry pulled a lot of people from the rural areas, the urban areas acquired a new identity; thus, their social, economic, political, and physical characteristics altered. They generated slums. In fact, many urban slums with all kinds of pollution were created. This urban decay was the breeding ground for new patterns, many of which were not compatible with the basic requirements and ecological potential of the inhabitants and their site (Figure 1 and Table 1). In this paper, the case study of Darabad River Valley in Tehran with

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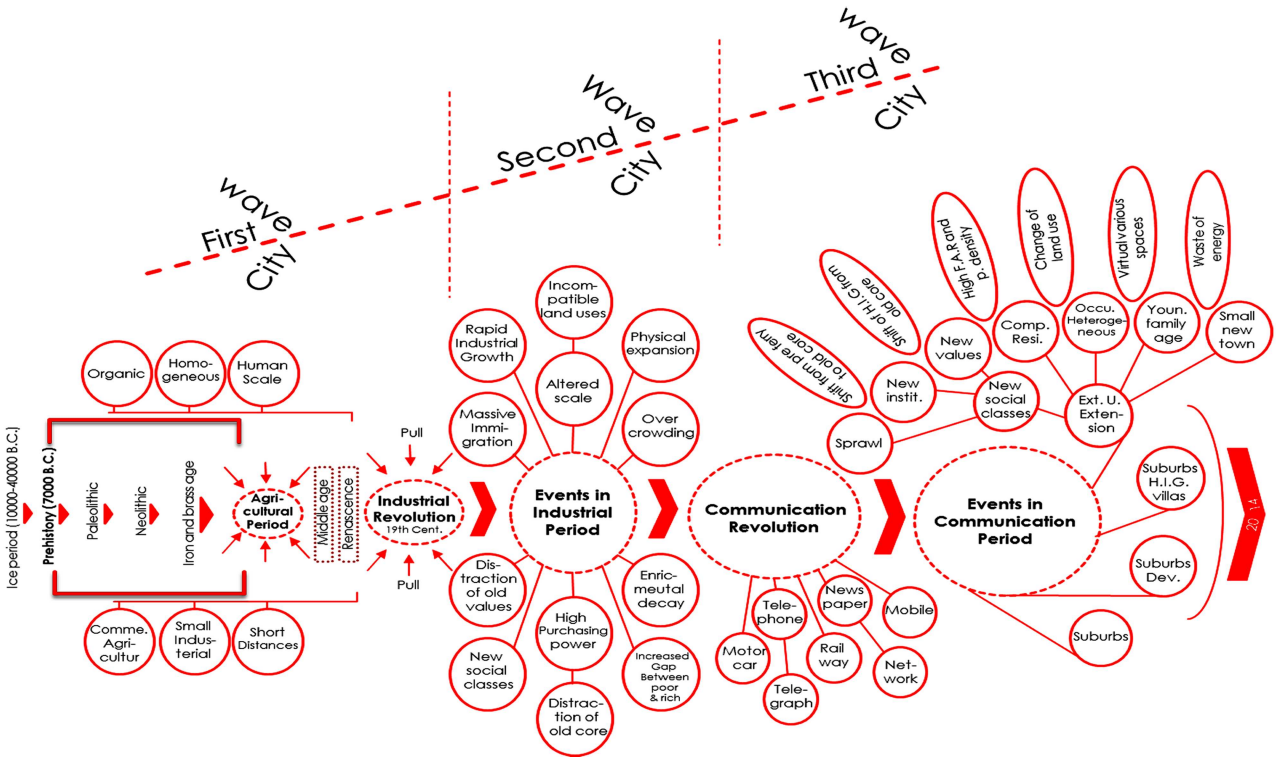

Figure 1. Evolution of human settlement (please refer to Table 1).

high environmental quality, which was about to convert into a huge polluted urban drain, is presented.

2. Material and methods

Here, a case study entitled Sustainable Urban Environmental Design for Darabad River Valley located in north-east of Tehran is presented in brief.

To study the river valley of Darabad, three stages of study, analysis, and proposals were followed. The main headings of the research are listed below:

1. Defining the scope of various zones for studying existing situation;
2. History of the place;
3. Study of similar cases;
4. Geology and geophysics of the area, morphology, topography, and physiology;
5. Hydrology, flood pattern, and climatology study;
6. Environmental studies and various pollutions;
7. Green spaces, open spaces, and urban spaces;
8. Animals and birds;
9. Population and socio-economic aspects;
10. Land ownership;
11. Tourism, recreation, and their requirements;
12. Urban planning and urban design studies;
13. Landscape studies and features;
14. Traffic and circulation system;
15. Various proposed plans at higher level and the influence zone (Such as Tehran Master Plan, etc.);
16. Infrastructures;
17. Site analysis (action area);
18. Various analyses of the abovementioned aspects and preparation of 17 SOWT table for each and every subject;
19. Synthesis of the study;
20. Aim, objective, and ideas;
21. Strategy, policies proposals;
22. Design criteria for each zone;
23. Typical design solution.

3. Results

The result of the above discussion indicates that we had sustainable urban design in pre-industrial period in an organic way. However, we altered the existing ecosystems by welcoming incompatible technological elements; now and then, we should realize our previous mistakes and do not alter any organic and surviving fabric without comprehensive deep study. We should know that designing is a kind of altering the systems. The design of our towns and cities must concentrate on not only making them visually attractive, but also

Table 1. Comparative analysis of various features of settlements in pre-industrial, industrial, and post-industrial periods (with reference to Figure 1).

No.	The first city Pre-industrial properties	The second city Industrial period properties	The third city Post-industrial period properties
1	Organic & normal growth (according to physical and ecological potential)	Imposed development by master plan and start of acceleration urbanization	Rigid zoning (completely residential, commercial etc.), suburb occupation & urbanization of rural areas
2	Normal gap between rich and poor	Increasing gap between rich and poor	Highly increased gap between rich and poor (99%-1%)
3	Harmony between manmade and natural environment; fine grain uniform texture of built form	Lose of harmony between manmade and natural environment; coarse grain & uniform texture of built form	Contrast between manmade and natural environment; coarse grain & uneven texture of built form
4	Low media of communication	Average media of communication	Fast-forward media of communication
5	No traffic problem	Traffic jam and hazard	High traffic jam and hazard
6	Long time taking communication	Average time taking communication	High and fast media of soft and hard wire communication
7	No video ecological damage	Low video ecological damage	High video ecological damage
8	Carbon free settlements	Micro level carbon problem	Macro level carbon problem (damage of ozone layer)
9	Physical human public spaces	Physical human and automobile public spaces	Virtual spaces
10	Spiritual settlements with strong elements and landmarks of cultural values	Weak spiritual aspect and weak cultural values	Lost spiritual aspect and cultural values
11	Low damage to the environment	Micro level damage to the environment	Macro level damage to the environment
12	Human scale corridors, pathways & and nodes	Bolvards, high ways and freeways & expanding old pathways	Elevated high ways, underground corridors and nodes
13	Pallet of monochrome and harmonic colors	Pallet of contrast colors	Pallet of high level of contrast colors
14	Local traditional production	Standardization, mechanization, prefabrication, industrialization and modern mass production for regional consumption	Mass production for global consumption
15	Homogeneous limited society (feudal)	Heterogeneous and new social classes	New social classes (network holder)
16	Unipolar powers	Bipolar powers (capitalist & socialist)	Multipolar powers
17	Soft areas dominating landscape	Soft areas and environmental decay and decreasing soft green areas	Hard areas dominating landscape

Table 1. Comparative analysis of various features of settlements in pre-industrial, industrial, and post-industrial periods (with reference to Figure 1) (continued).

No.	The first city Pre-industrial properties	The second city Industrial period properties	The third city Post-industrial period properties
17	Recyclable garbage and waist; -no plastic materials	Production of non-recyclable material	Environmental decay due to high amount of non-recyclable materials
18	Low purchasing power	Average purchasing power	High purchasing power
19	Religious wisdom as a value	Capital as a value	Knowledge of inventing instruments (Hard & soft wires) for powers benefits
20	No air, water and sound pollution (monoxide & dioxide)	Starting of air, sound, water and land pollution	Contamination of water, land and polluted air and sound in big cities
21	Joint families	Breaking of joint family	Single, small and broken families and change of family age
22	Similar language and accent	Similar language different accent	Imposed language and accent of political powers
23	Inward organic limited expansion within the city walls	Expansion beyond the city walls	Outward expansion of cities
24	High face to face real social interaction	Average social interaction	Face away false and mendacious social interaction
25	Short distance of place of work and living	Increased distance of place of work and living	High distance of place of work and living
26	High cooperative society	Medium cooperative society	Low cooperative society
27	Low-rise apartment housing	Medium-rise apartment housing	High-rise apartment housing (high F.A.R in green areas)
28	Agriculture economy	Large scale industrial economy	Knowledge base economy
29	Thought oriented society (not instrumental); short gap between taught and action	Thought and instrumental oriented society; beneficial taught and actions	Instrumental oriented society; more of new theories and less action for cities.
30	Mix land use without major problem	Mix land use with major problem of zoning	Dictated zoning & non-practical mixed land uses.
31	Sense of orientation	Weak sense of orientation	Loss of sense of orientation
32	Sense of belonging	Weak sense of belonging	Loss of sense of belonging
33	Sense of place	Weak sense of place	Loss of sense of place

Table 1. Comparative analysis of various features of settlements in pre-industrial, industrial, and post-industrial periods (with reference to Figure 1) (continued).

No.	The first city Pre-industrial properties	The second city Industrial period properties	The third city Post-industrial period properties
34	Planning and designing for man as a part of nature	Man interfering in nature and planning and designing for automobile	Planning and designing for automobile and fast mood of transportation irrespective of natural environment
35	Settlements with defined edges	Destruction of edges	Not determined and proper urban edges

addressing issues, such as economic viability; encouragement for regeneration; attention to environmental and socio-cultural aspects; and creation of cohesive, safe, clean, and green communities and urban forms.

4. Discussion

In the contemporary period, many new theories have been developed by various specialists in different fields all over the world to solve the created problems in industrial and post-industrial periods. Unfortunately, many of the piecemeal sorts of solution that we have adopted so far could not help to solve the problems to the scale required. Sustainable design (also called environmental design, environmentally sustainable design, environmentally conscious design, etc.) is the philosophy of designing the built environment and services to comply with the principles of social, economic, and ecological sustainability in the most accepted way to deal with our settlement design and urban fabrics.

4.1. Unsustainability causes

Various theorists in planning and designing, like Krier (1992) [2], Alexander Jencks (1986) [3], Norberg Schulz (1987) [4], Jakobs (1961) [5], MecHarg (1969) [6], Robert Owen (quoted from Pakzad [7]), John Ruskin & Viliam Moris (quoted from Mosavi Hejazi & Pourjafar) [8], and Ardalan and Bakhtiar (2014) [9], are against some of the modernist ideas. They have interesting ideas against modernism and claim that it has caused unsustainability. Some of them believe that the modernist rationalism has failed.

The following are the major global problems that have mostly appeared after Industrial Revolution:

- Increase in earth temperature;
- Destruction of vegetation cover;
- Soil erosion;
- Extinction of various kinds of animals and species;
- Injustice in economy and unequal division of resources;
- Consumption of recourses beyond requirements;
- Rapid urban population growth;
- Dependence on unrecyclable materials;
- Appearance of various types of pollution;
- Design and development without respecting nature;
- Limited people participation;
- Over-loading of the land by high-rise development and high F.A.R (Floor Area Ratio);
- Chang of green land to brown;
- Scio-economic problem and incompatible land uses of traditional core areas;
- Zoning, which is a kind of dictation and none-practical mixed land use in big cities;
- The gap between the passive aim of modernism and what the modernists claim openly;
- The main aim of many of modernists, which is maximum benefit in the shortest time;
- Unsustainable socio-economic, political, and management conditions;
- Planed and designed cities for automobile and not human being;
- Failed mathematical and quantitative planning;
- Hopeless and useless modern life;
- Destruction of human scale and disrespect for tradition.

5. Case study: Sustainable urban environmental design for Darabad River Valley

5.1. Darabad River Valley

River Valley of Darabad is located on the foot of Alborz Mountain and east of District 1 of Tehran (Figure 2). River Valley of Darabad is a God given gift to the inhabitants of Tehran and many of those who enjoy their weekend over there. Darabad River Valley has a village where it reaches plain areas with less slope. The village had a population of 367 people in 1920 [11]. Mozafaroddin-shah built a small palace in this region

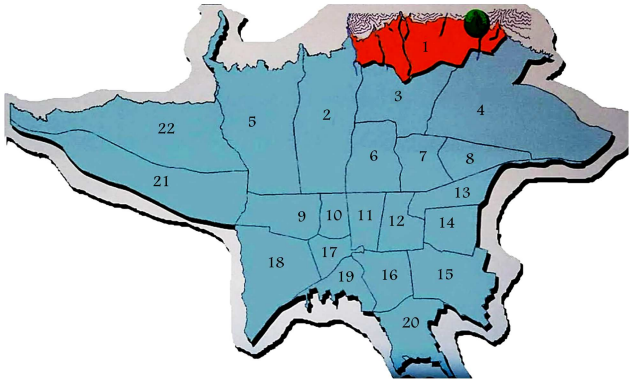

Figure 2. Location of the Darabad River Valley in Tehran [10].

in 1918 [12]. From the date, this place became popular and was populated beyond its capacity. Available land was used for agriculture and most of the area was covered with gardens and green farms at that time. Darabad river valley is one of the greatest 7 river valleys in the north of Tehran, which with the associated rivers can have a sustainable environment due to the characteristics of high quality of potable water, good subsoil, and rich green areas. This makes it an important issue to maintain and conserve this sustainable rich quality of environmental heritage.

This project aims to make the river valley (with high quality water, vegetation cover, and beautiful rocks, fountains, and falls), which was converting into a huge polluted urban drain, a leisure valley for the north-east of Tehran. A comprehensive wise and conscious approach is applied in this project. Issues such as economic viability; encouragement for regeneration; attention to environmental and socio-cultural aspects; and creation of cohesive, safe, clean, and green communities and urban forms were considered in this project.

5.2. Darabad River Valley

To study the existing situation, the entire site was divided into three zones after an overall observation. They were named zones A, B, and C (Figure 3). Zone A has a quite natural environment. Zone B is partly built and has semi-natural environment. Zone C is mostly manmade environment that is Darabad urban village.

Accordingly, by study of the existing situation to define the problems and prospects related to the headings mentioned above (in methodology of research), 3 volumes of report were prepared. However, in this paper, problems and prospects are given in brief: unfortunately, due to irrelevant encroachments, unplanned growth of the settlement, and many unauthorized buildings, the main function of the river valley of Darabad, which is providing the areas of natural and visual significance and green spaces with flow of clean and cool air plus water for drinking and agriculture, has been forgotten. Most of the riverfront built forms are not faced the river. Unfortunately Darabad river sides have become a place for garbage and drainage disposal.

Urban Village of Darabad, which is located beside Drabad River (Zone C) and within the valley, had an organic pattern of built form with fine grain and uniform texture. Previously, gardens dominated the built

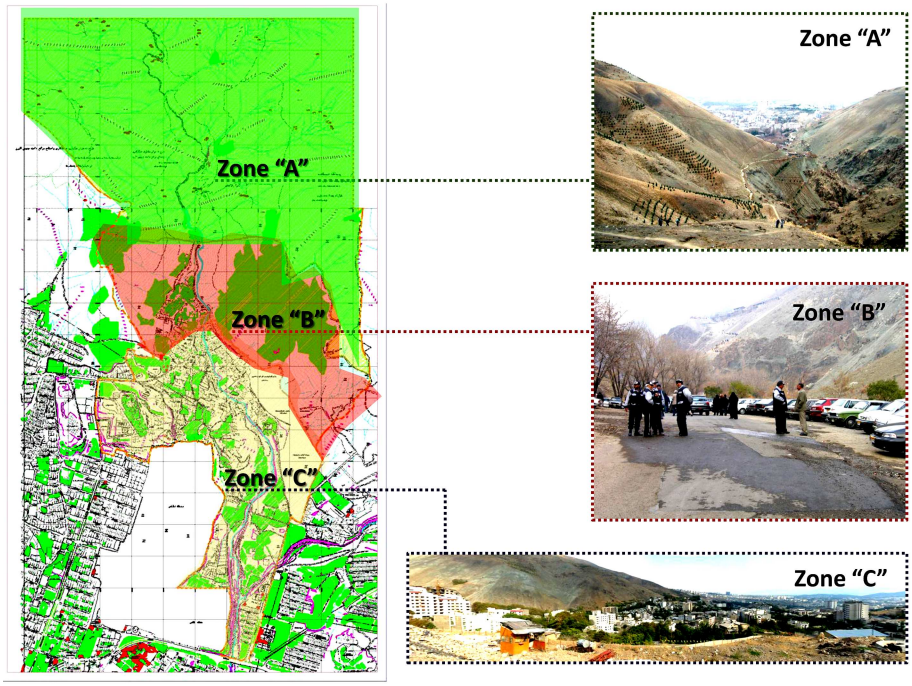

Figure 3. Zoning of Darabad River Valley [11].

form of the village. But, at present, it is encroached by high-rise development (buildings), which not only closes the interesting visual cone to the mountain and other natural views, but also is incompatible with the present narrow alleys. It also causes a sudden change in the beautiful skyline. Municipality, other organizations, and some of the inhabitants engaged in land and building speculation have closed their eyes and ears and forgotten the mad flow of 1986 in these areas, which killed many people and destroyed many houses. As it is already mentioned, one should be aware that designing is altering an existing system [13]. Some of the housing projects in Darabad have not been designed compatible with nature. Therefore, planning and design with respect to ecological requirements of the environment for conservation and revitalization of Darabad River Valley should be the main aim of the Municipality of Tehran. To achieve this goal, "Tehran River Valley Conservation Authority" (TRVCA) shall be formed. This organization will be responsible for achieving the aim and objectives of the river valleys conservation reported in this project. All the river valleys shall be linked to each other at the foothill of Alborz Mountain to form a green pedestrian corridor for recreation (Figure 4).

Famous architects like Corbusier tried to have Shivalik Hills as background for Chandigarh City in India. Tehran has a chance to have beautiful skyline of Alborz Mountain at its background through these river valleys. Therefore, building height in the purposed Zone C (Figure 4) shall be controlled to have good view and relation to open and green spaces and Mountain of

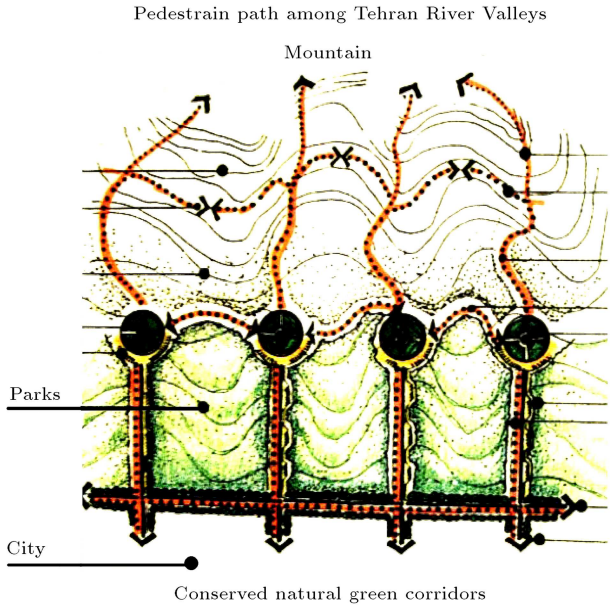

Figure 4. Purposed conceptual diagram for the river valleys of Tehran to be linked to each other, providing a recreational pedestrian pathway along the Alborz's foothills [14].

Alborz. A meandering undulating landscape stretching across the length of Chandigarh, which Aditya Parkash calls it: "The place of leisure and pleasure of strolling and picnicking of gossiping and frolicking. People should move leisurely from one end to another. Here shall be birds' paradise, a garden of flowers, perhaps a garden of Sculptures set in a landscape of fountains, falls, and sprinkling and hills and trees" [15]. We can have similar ideas for river valleys of Tehran, especially for one like Darabad that has yet some potential to be revitalized. In the process of an ecological approach, respecting natural values and climatic consideration of land form and local architecture shall be kept in view. Restricted roll and regulation to consider foothill urban design and architectural criteria is vital in these areas. Putting the river into a concrete channel without considering the rich landscape features of the site shall be inhibited (Figure 5).

Safety and security from flood, earthquake, and landslide shall be considered in any purposed plan. Educating and encouraging people to respect environment regarding disposing rubbish, cutting trees, and polluting clean and potable water of natural fountains in the valley shall be started. Connecting various open and green spaces to the main green corridor of the river valley is necessary. In this way, not only the major view to the mountain will be conserved, but also a continuous pedestrian path and cycle truck can be provided along the river passing through green spaces and gardens. This makes the valley of Darabad a leisure valley. Both sides of the riverfront shall develop as a green corridor (Figure 6) with a minimum width of 30 meters as the proposed "Zone A", and all the existing green spaces and dilapidated building areas shall be green in future. This is the proposed "Zone A" (Figure 5). Proposed leisure valley should have open public green spaces after every 10 minutes

Figure 5. Concrete chancel for Darabad River Valley which is unaccepted approach and has been stopped as it was suggested in this project [16].

Figure 6. Various significant areas along the river [11].

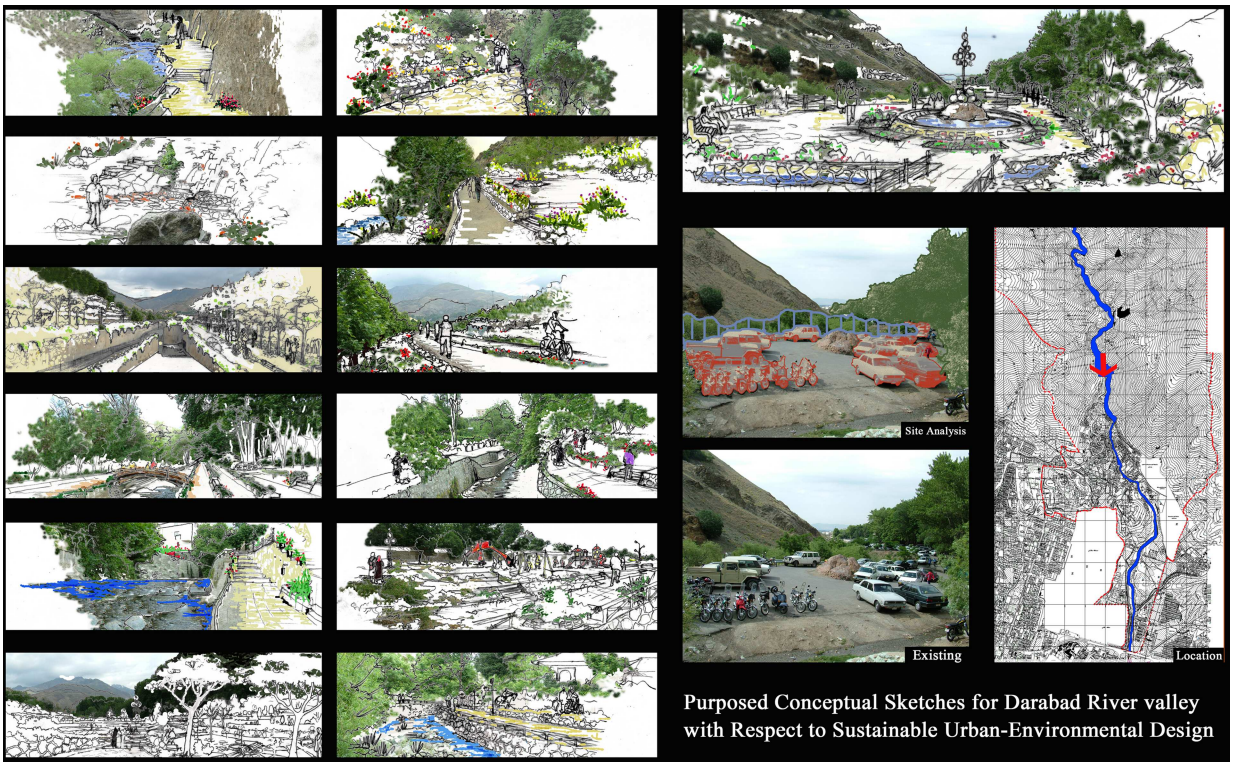

Figure 7. Sketches presenting urban environmental design ideas for various section of Darabad River Valley [17].

of walk so that people can have a chance for rest (Figure 6).

Building laws to control building height in such a way that important views and vistas remain open is necessary. Sustainable plantation and green spaces with local plants with some infrastructure to house people during earthquake hazards are required. Health care facilities, toilets, dustbins, fire distinguish, and other facilities such as restaurants shall be provided at various spots for the tourists and inhabitants that come to the valley in the weekend.

6. Conclusion

Limited resources such as air, water, and land would not allow over-populating, over-loading, and misbehaving the natural environment. The accelerated urbanization has brought several major problems that threaten future of the cities and lead to unsustainability. A sustainable city must take care of its valuable resources, especially those which are helpful in creation of green and clean spaces and cohesive built form. Many big cities of third world, like Tehran, have similar problems in their existing situation and development plans. Iranian history reveals that they have a brilliant past in respecting nature. They have always designed with nature. Places like Tehran's river alleys and especially Darabad shall be fully conserved, not only as a vital part of the present city, but also as a natural heritage for the future generation (Figure 7). River valleys of Tehran in District 1 can be the best recreational zone, where water and good soil for plantation and green spaces are available. These corridors would survive and join Tehran's proposed green belt.

This will obviously help to improve microclimate of Tehran.

It is purposed to create a kind of convivial access from Darabad village to the hilly areas. The foot hill with its existing natural features (such as waterfalls, fountains, color full rocks bushes, flowers and trees) can be developed as a natural eco-park with attractive pedestrian cycle and horse truck. All the mentioned features can make the River Valley of Darabad an interesting leisure valley as a natural recreational area in Tehran. Finally, a comprehensive, wise, and conscious approach, similar to what we have used in Darabad River Valley Project, is suggested for all similar projects.

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Biographies

Mohammadreza Pourjafar was born in 1956. He gained good experiments in painting and sketching during his high school studies in Mathematics. His research interests are art, arch., urban design, and planning. He received the Gold Medal of CCA (Candigarh, India, 1983), Punjab University Medal, and Indian Institution of Engineers Medal in 1984. He did MUD at SPA in 1986 and PhD at IIT Roorkee, India, in 1992. Prof. Pourjafar has published more than three hundred scientific papers. He has published 10 books in architecture and urban design. He has also been awarded for one of his books, named "Urban Environmental Design of Water Front". He was head of Faculty of Art & Arch. (T.M.U) until 2008 and HOD of Urban Planning and Urban Design till May 2015.

He has also worked on the following projects: design of private houses, development plan of Bandar-e-Lengeh and Kong, and comprehensive plan of settlement along the northern side of the Persian Gulf. Also, he has the experience of corporation in planning and side selection of Millad Communication Tower, landscape design of Tarbiat Modares University, planning of Modares Science and Technology Park, environmental planning and urban design criteria identification for Darabad River Valley, and preparation of a comprehensive plan for Sahand New City (Until 2008). He was selected and awarded by president of IR Iran as a distinguished professor at national level in the field of research in Art & Arch. in Iran in 2010 and also in 2014.

Ali Pourjafar was born in 1989 in India. After his Mathematic & Physic Diploma, he did BArch at PNU in 2011 and MUD at Tarbiat Modares University in 2015. He is the co-author of two books named "Architecture and Urban Design of Islamic Period

in India" and "Manifestation of the Iranian-Islamic Subculture in Designing Urban Spaces". He has published about 30 scientific articles about architecture and urban design. He has also cooperated in a few research projects such as rediscovery of Persian Islamic vocabulary of urban design with reference to the Shiraz School of Urban Design, and study and development of urban planning and design criteria of Iranian-Islamic city. Ali Pourjafar was nominated as a distinguished student at the national level in Iran in 2012.