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## Interconnection of Traditional Water Substructures and Neighborhood System in Iranian Cities: Urban Structure and Water Substructure in Semnan City

Ayda Alehashemi\*

Ph.D. in Landscape Architecture, Imam Khomeini International University, Qazvin, Iran.

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### Abstract

Water substructure of Semnan city is considered to be one of the unique examples of the interconnectedness of water network and urban structure in Iran and provides a valuable opportunity for reading different aspects of the relationship between water substructures and urban structures in Iran. Knowledge of hidden and manifest aspects of this multidimensional interconnection are considered in the redefinition of the role of water substructures in urban substructures in contemporary Iranian cities. The current essay seeks to answer the question concerning the quality of formation and development of traditional water substructures in harmony with neighborhood structures that form Iranian cities through the study of Semnan City as its case specifically focusing on the role of physical and trans-physical connections resulted from the neighborhood relations in the formation of water substructures of Semnan. To this end, by referring to historical documents and contemporary studies of the structure of Semnan City and traditional system of water division in this city, the author historically identifies different aspects of the interconnection between the structure of historical city of Semnan and this city's traditional water substructure. The results of our studies show that the bilateral interconnection between the city and water substructure in Semnan in a specific way follows the neighborhood system that has formed the city. This system has gone beyond the down-top management of physical structures and in a multidimensional form is related to the social, economic and cultural structures of the city. This interconnection in a specific form in the scale of urban neighborhoods and individual and collective life of the residents of urban neighborhoods has also made the neighborhood system governing the city the basis of water substructure and in this way provided the ground for survival and preservation of this traditional substructure.

**Keywords:** *Semnan, Neighborhood Structure, Water Substructure, City Morphology, Urban Structure.*

## Introduction

For several centuries, the cities of Iranian plateau have taken form and been developed in a bilateral interconnection with water substructures. The central part of Iranian plateau has been particularly the cradle of formation and development of complicated and unique water substructures that have made urban life possible in this part of Iran. Along with many influential factors involved in the partial formation of urban systems in the cities of Central Plateau, water substructures have had a vital role in regulation and continuity of urban physical and trans-physical structures. The multidimensional relationship of structures of city and neighborhood as well as the urban micro and macro systems with these networks of water distribution in Iranian cities is considerable. This interconnection has conducted the structure of Iranian cities in Islamic period and the studies in the domain of Iranian-Islamic cities without paying attention to the role and place of these networks of water distribution in Iranian cities will remain fruitless. On the other hand, analysis of different aspects of this relationship provides the ground for redefinition of the interconnection of the water substructures and returning their substructural role in the formation of urban structures in Iran.

Semnan City is considered to be one of the considerable examples of formation and development of city connected with water substructure in Iran. This technical-social substructure reveals significant aspects of the interconnection between the water substructures and neighborhood structures that have given form to Iranian cities.

The present essay by emphasis on historical part of Semnan city and the neighborhood system governing it addresses various physical and trans-physical aspects of traditional water substructure with urban structures. It is particularly focused on the question of different aspects of the interconnection between the water substructure and neighborhood systems that have formed the urban structure of Semnan in order to

recognize the mutual influence of the neighborhood system forming Semnan city and traditional water substructure in this city. We specifically seek to demonstrate the hypothesis that the structure and interconnection of water substructures with urban structures follow the neighborhood system governing the city.

To find the answers of questions and demonstration of the hypothesis, this essay in two parts conducts a study of the structure of Semnan city composed of semi-independent neighborhoods and provides a reading of the interconnection between city and water substructures based on this neighborhood structures in different scales of land, city and neighborhood and struggles to assay various aspects of the connection between water substructure and urban structures.

## Research Background

This essay discusses the bilateral interconnection between the water substructure and urban structure based on neighborhood microsystems and focuses on Semnan as a case. The background of the present research is also divided into two parts of the background of studies concerning the relationship between the water substructures and urban structures in Iran, on the one hand, and studies in the domain of knowledge and analysis of the governing system in Iranian cities focusing on neighborhood microsystems, on the other hand.

As to the relationship of water substructures and the structure of Iranian cities, some scattered studies have been conducted the majority of which are centered upon the role of water distribution networks in the general morphology of city including orientation of urban paths and passages and division of urban blocs in harmony with the trajectory of flows of water distribution. This group of studies are based on the researches of Michael Bonine who believed that the morphology of Iranian cities to be under the influence of the trajectory and quality of distribution of water through the streams and flows. He also considered the

geometry of land division and direction of streets to be compatible with the network of water distribution (Bonine, 1979; Bonine, 1982; Bonine, 1989; English, 1998). In recent years, Iranian researchers have emphasized this morphologic relationship in Iranian cities but they have not taken a new step beyond the writings of Bonine or English (Estaji & Raith, 2016). As to the recognition of structures they have formed in Iranian cities, certain studies have been conducted focusing on the role of semi-independent role of neighborhoods in the formation of the structure of city (Kiani, 1989; Raymond, 2007; Mansouri, 2014; Piran, 2005; Gaube, 2008; Qasemi, 2018; Tavassoli, 2016). Partial independence of neighborhoods has been underlined in the spatial organization, on the one hand, and in social system of the city, on the other hand.

In the studies of the structural role of water substructures in the structures of Iranian cities, this reading of Iranian city based on small and semi-independent wholes of urban neighborhoods has not focused on the interconnection between water substructures and the neighborhood system governing Iranian cities. While previous studies have concentrated on the role of water substructure in the orientation of trajectories and morphology of city and distribution of social classes in different urban areas in harmony with the water division network. The present essay struggles to explore the compatibility between the structure based on the neighborhoods as semi-independent microsystems in the structure of Iranian cities and water substructures, physical and trans-physical aspects of the interconnection between water substructures and Iranian cities in Semnan as a case of study.

### Research method

The present essay is a qualitative study. Relying on the method of case study and in a historical form, we have sought to know the structure and spatial organization of the historical city of Semnan

and also the structure and features of traditional water substructure of this city. By comparison of traditional water substructure and semi-independent neighborhoods in the historical city of Semnan, we investigate the interconnection between this water substructure and urban structures based on neighborhood systems in different scales from land to city, neighborhood and even the individual in Semnan city. To know the historical structure of Semnan city and understand the relationship between the water system and neighborhoods of Semnan city, we have taken advantage of the pictorial documents (particularly aerial photo of Semnan 1956) and urban maps of the historical situation of the city and its constitutive elements and recent efforts for restoration of historical areas of the city (comprehensive urban projects of innovation) and also contemporary studies concerning the historical knowledge of traditional irrigation systems and the traditional cultural and social relations related to Semnan (Safinezhad, 1980; Ahmad Panahai Semnani, 1995; Ahmad Panahi Semnani, 2002; Farhadi, 1997).

### Structure of Semnan City and Neighborhood System Governing It:

“Sharestan” as the main part of Iranian-Islamic cities in Middle Ages were composed of two public areas (city center and main streets) and private areas (residential neighborhoods): public part is consisted of the main square, Jameh Mosque and other public services like Bazaar, school, traditional water reservoir, public bath, sometimes Emamzadeh or Tekyeh. City center is connected to the city gates through main passages that are generally direct and without twists. Bazaar is formed by setting a roof on one of these passages between the city center and one or two of the gates. The structure of the historical city of Semnan and the neighborhood system governing it follow this classic structure of Iranian cities (Fig. 1). The private part of the city is divided into residential neighborhoods. Each neighborhood has one or several

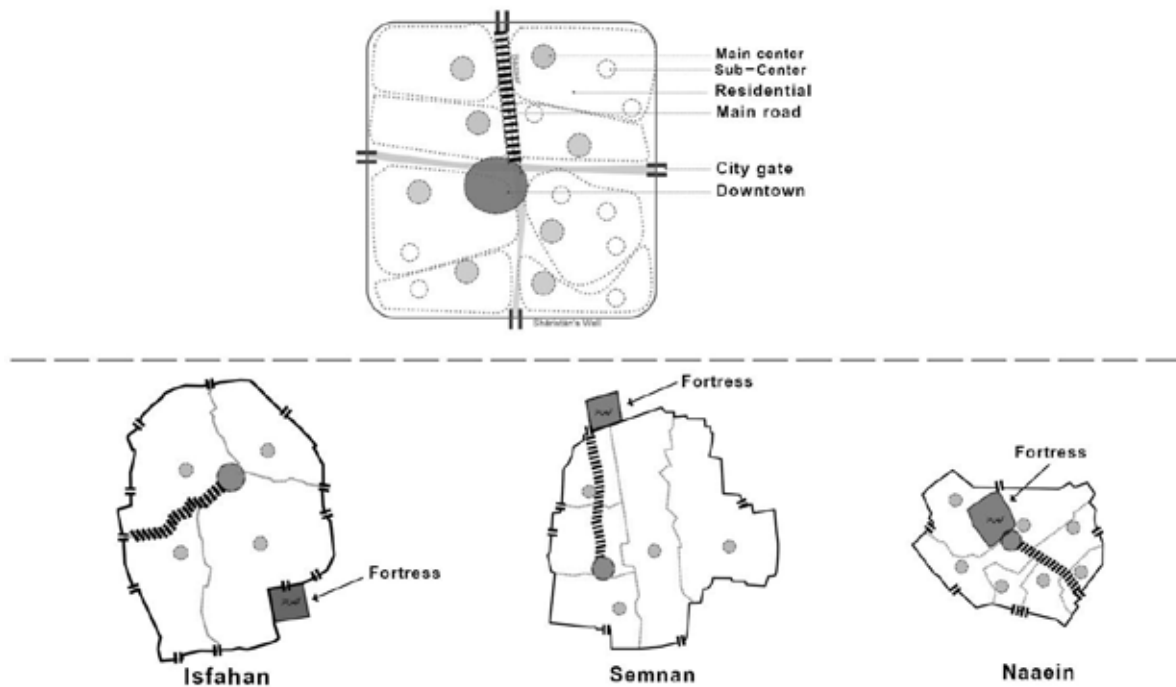


Fig. 1. Schematic structure of Sharestan, including city center, Bazaar, city gates and residential neighborhoods connected with this general structure of city and Semnan's Sharestan. Source: author based on the aerial photos of 1956 and Baghe Andishe Consulting Engineers co. 2009.

neighborhood centers that provide the daily needs of the residents. Generally speaking, neighborhoods take form based on tribal, family, religious or professional commonalities. Contrary to the main passages in public area, the passages and access points in residential neighborhoods are usually formed through twisted allies and even deadends. Nevertheless, wider trajectories are in charge of connecting the neighborhood centers and main passages of public areas and finally of connecting the neighborhood with the city center, Bazaar and city gates. Sometimes one of the neighborhood centers turns to the city center following the increase of its importance and area and the main passages inside the neighborhood play the role of the main trajectories of the city. Although no determinate line separates the neighborhoods from each other, these semi-independent parts that act in the form of microsystems inside the public system of the city, have a vital role in the spatial organization of Iranian cities. In fact, social relations inside these

microsystems and the relationship and situation of these neighborhoods as compared to each other and with main trajectories and public parts of the city form the urban structure (Gaubé, 2008; Tavassoli, 2016; Kiani, 1989; Mansoori, 2014; Sultanzadeh, 1988). The importance of neighborhoods in Iranian cities is so much that even by reliance on the scale of independence and separation of neighborhoods, Boninie's thesis of Iranian cities is challenged (Piran, 2006).

In Semnan, three neighborhoods of Shahjuq, Latibar and Nasar (that were later divided into three separate neighborhoods of Nasar, Efsanjan and Choobmasjed) formed the residential neighborhoods inside the wall of Sharestan (City Center) and three villages of Kadivar, Kooshmuqan and Zavaghan around the city later turned to the residential neighborhoods outside the Sharestan. Each neighborhood has a center of main neighborhood that enjoys extensive proper facilities including such services as Tekyeh [gathering house

for Shia rituals], mosques, bath, water reservoir, fountain and in some cases, school and shopping centers. Tekyeh Pahneh served as the center of Esfanajn neighborhood, Tekyeh Latibar as the center of Latibar neighborhood and Tekyeh Choobmasjed as the center of Choobmasjed neighborhood<sup>1</sup>. Along with this, each neighborhood had a number of secondary neighborhood centers that in fact were mini squares in the main allies of the neighborhood where the services were provided for the residents. For example, in Nasar neighborhood the secondary centers consisted of Tekyeh Kohandezh Bala, Tekyeh Kohandezh Paain, Tekyeh Molla Qazvini, Tekyeh Abbasiyyeh, Tekyeh Chahrrah, Tekyeh Abrishamgaran and Tekyeh Jaghi, and Tekyeh Nasar as the center of Nasar neighborhood.

The center of Esfanjan neighborhood (Tekyeh Pahneh) that is located along with Jameh mosque and Emanzadeh and serve as the center of the city center and the city Bazaar extends from Tekyeh to Pahneh. The main passages of city are relatively direct and connect the city center to city gates and the centers of the adjacent neighborhoods.

### **Semnan's Water Substructure**

The water needed by Semnan was provided only by a seasonal river with short water supply called "Gol Rudbar" and one of the most accurate systems of water division has been designed based on seasonal rivers in this city. Accurate division and sharing of water in Semnan is considered to be one of the innovations of Sheikh Ala Al Dawlah Semnani (659-736 AH) (Rafei, 1962, 26; Ahmad Panahi Semnani, 2002, 35).

Semnan's water system is respectively composed of the following factors: 1- water disseminator; the river's water in three kilometers north of the city at a region called "Para" is divided into 5 areas by the water disseminator (Rafei, 1962, 21); 2- main channels; first 5 and later 6 channels are in charge of transferring water to the neighborhood (the water

of Junbadan channel after passing through several mills in a place called 40 Qiblah is divided into two halves one half of which moves towards the pool of Latibar neighborhood while the other half heads towards the pool of Shahju neighborhood)<sup>2</sup>. Transfer of water to neighborhoods is conducted through these three channels towards the city center and there are also three independent channels that handle the transfer of water to the city environs; 3- Mill, on the trajectory of main channels there are 17 mills (Safinezhad, 1980, 117); 4- Main pools of water reservoir, water is transferred into the pools of water reservoir in northern parts of the neighborhoods (Rafei, 1962, 22); 5- secondary streams, water from the aqueducts of the pool (pool head) enters into determinate streams; 6- secondary tributaries handle the work of division of the water in streams; 7- flows, the water in the streams enters narrower flows alongside the trajectory; in summer this water is conducted towards farming lands and in winter this water is managed to be reserved at reservoirs; 8- secondary dividers divide the water of flows into two or three parts; 9- water reservoirs in two public and private groups are in charge of reserving water for the daily use of the people in city; 10- public wetland where the surplus water from the system is gathered there and its harvest covers the costs of the preservation and management of the system.

### **• Semnan's Water Substructure and Neighborhood System**

The interconnection of Semnan's water substructure and the neighborhood system governing the city and the spatial organization of Semnan city can be studied in various ways.

In land scale: water substructure in line with the topographic features of land transfer water to sextuple neighborhoods and up to the far north of the suburbs and neighborhoods of the city. In this place, water is reserved in a pool in proportion to the area of every neighborhood.

In fact, from its strating point, water system has taken

form in line with the neighborhood relations: water disseminator (divides the river's water in proportion to the needs of the neighborhood into five parts), main channels of water conduct water to the neighborhoods, watermills on the trajectory of main streams are used in every neighborhood to grind the wheat (on the trajectory of main streams of water transfer there are 17 watermills) (Safinezhad, 1980, 117); main water reserve pools (6 main pools on the upper part of the six neighborhoods and farms related to them at suburbs) the volume of which is proportionate to the needs of neighborhoods and farming lands (the largest pool is that of Nasar (the largest neighborhood at the city that includes city center, Bazaar, and public services in urban scale) that provides the water of Nasar neighborhood). Secondary streams and flows that divide the water (that handle the work of transfer and division of water into/among the farming lands and also carry the water to the public and private water reservoirs inside the residential neighborhoods); secondary tributaries handle the division of water in secondary streams; secondary dividers on the trajectory of secondary flows divides the water in every flow into two or three parts; public and private water reservoirs inside the neighborhoods (are in charge of reserving drinking and using water of the residents throughout the year specifically in summer); public wetland (that is in charge of collecting and using the surplus water of Sharestan for covering the costs of management of water system); (Fig. 2).

In city scale: location and direction of main trajectories, Bazaar and also city center in line with the trajectory of transfer of water into main streams. In neighborhood scale: the site selection of main trajectories of neighborhoods, main and secondary centers of neighborhoods and also significant and key applications of neighborhoods and houses of residential neighborhoods have been done in view of the trajectory of flows and location of water reservoirs (Fig. 3). Basically, every neighborhood has had a large

or small public water reservoir as well as a public bath which were usually constructed by the efforts of the philanthropists of the neighborhoods or by the funds raised through endowment and their required water was provided relying on the endowed shares of surplus water (Ahmad Panahi Semnani, 2002, 101). The streams flowing through the allies carried water into the neighborhood centers and into public water reservoirs and baths and also into house-gardens and private water reservoirs of some neighborhood and city elders<sup>3</sup>. Finally the surplus water is conducted towards the public and endowed farms outside the city and in the southern part of the city (that covered the costs of preservation and management of the division of water and water substructures). (Neighborhood centers at Semnan city center: Nasar neighborhood, Efsanjan neighborhood and

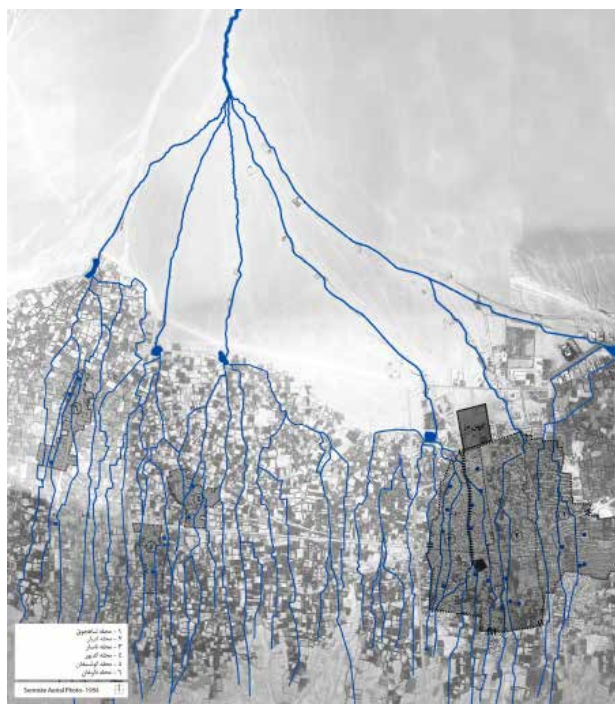


Fig. 2. Interconnection of water substructure and structure of city, neighborhoods, city center and suburbs in land scale. Source: author based on aerial photos taken in 1956 and Baghe Andishe Consulting Engineers, 2009.

1- Shahjuq neighborhood; 2- Latibar neighborhood; 3- Nasar neighborhood; 4- Kadivar neighborhood; 5- Kooshmoghhan neighborhood; 6- Zavaghan neighborhood

Choobmasjed neighborhood; 1-Tekyeh Najafi, 2-Tekyeh Kohandezh Bala; 3-Tekyeh Kohandezh Paein; 4- Tekyeh Molla Qazvini; 5-Tekyeh Abrishamgaran; 6-Tekyeh Abbasyah; 7-Tekyeh Chahrarah; 8-Tekyeh Nasar; 9-Tekyeh Pahneh; 10-Tekyeh Hematabad; 11-Tekyeh Hosseinieh; 12-Tekyeh Siah; 13-Tekyeh Saeed; 14-Tekyeh Pachenar; 15-Tekyeh Choobmasjed; (gray: mosque; blue: water reservoir)

In neighborhood centers the water substructure is

connected with significant and religious applications, on the one hand, and with people's daily life, on the other hand. The center of Tekyeh Pahneh neighborhood with such facilities as Jameh Mosque, Emamzadeh, Bazaar gate and carvansaras plays the role of the city center. The city Bazaar has taken form over the main passage that connects the northern gate of the city to the city center. The Bazaar stream in line with the same trajectory has passed through

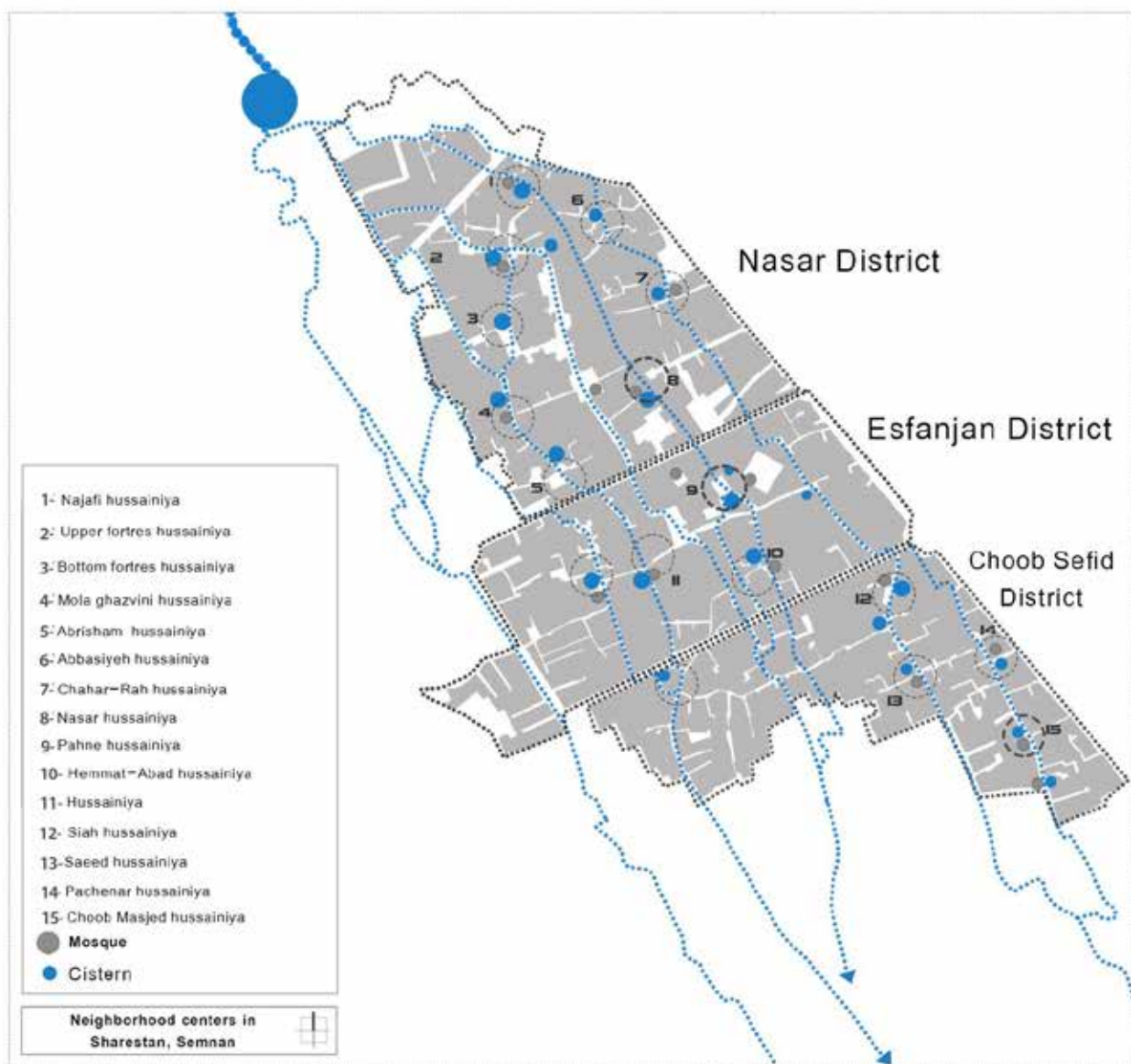


Fig. 3. Relationship of trajectory of water division channels and spatial structure of Nasar Neighborhood in Semnan city. Source: author based on the aerial photo of 1956 and Baghe Andishe Consulting Engineers, 2009.

the Bazaar (today this stream is flowing in a covered form under Semnan's Bazaar) and provides the water required by the schools and carvansaras connected to Bazaar and centers of neighborhoods in its course and also the public facilities of the city center.

Although like other cities, the border of neighborhoods in Semnan city is not clear in physical form, the pool water is used as an index to draw the lines between the city neighborhoods. Thus, the area covered by Nasar pool defines Nasar neighborhood while the rest is Efanjan neighborhood that is fed by the water of Efanjan pool. Then, people know that which house or property is part of which neighborhood (Fig. 4).

Bazaar; trajectory of water flow; scope of center of Pahneh neighborhood (mosque; bath; carvansar; Emamzadeh Yahya; mosque; water reservoir)

### Water Substructure and Nonphysical Structures Governing Neighborhoods Nonphysical

connections (social-cultural-aesthetic and mental) between water substructure and urban structures are established based on the system and relations inside neighborhoods and with each other in Semnan.

Water substructure is of a colorful presence in



Fig. 4. Semnan city center (center of Pahneh neighborhood) and the role of water substructure in site selection and providing of the water of public services that are located in it. Source: author based on aerial photo 1956 and Baghe Andishe Consulting Engineers, 2009.

the general landscape of neighborhoods and open streams and flows in neighborhoods of city center along with the trees that exist now and then alongside the flows have formed people's general understanding of neighborhoods and city.

In neighborhoods these flows were not only a means for transfer of water into the public and private water reservoirs rather they were also a core around which the social life took form inside the residential neighborhoods: washing dishes and clothes took place alongside the stream, small gatherings took form under the shade of trees and were considered among the daily activities of the residents and moreover the streams had been a place for children's bathing and playing (Fig. 5). Furthermore, according to traditions, the margins of the main pools of the neighborhoods were used as a place for the people's recreation (Tarh va Pazhuhesh Consulting Engineers, 1974).

Water substructure and its constitutive elements also played a key role in readability of city and neighborhoods. In Semnan contrary to many other Iranian cities, where the constituents of water system with their special architectural and aesthetic ornaments and forms change into readability signs (Bokhara pools, Lar ponds, Naeen water reservoirs and etc.), the constituents forming the water system neither pools nor the water reservoirs, flows, dividers are subjects of aesthetic presentations. In Semnan, however, names used for different flows, streams and dividers ("Barjam" in ethnic tongue) provided the ground for the increase of the role of signs and readability for them. In the dialect of Semnan's people, these constituents with special names provide a place for people's appointments. Every flow and streams has its own particular name and Barjams also have their specific names and in every neighborhood there are certain places in relation to water substructures as a location for social occasions.

The interconnection between mental, cultural





Fig. 5. General landscape and social life of neighborhoods in relation to water substructure. Source: Tarh va Pazhuhash Consulting Engineers, 1974.

and social structures of the city neighborhoods and water substructure has become crystalized in the management of this water network in every neighborhood and also in city. In Semnan, the management of system was in harmony with the neighborhood system of the cit. Every pool has an independent irrigation council that includes the share holders from the neighborhood and the specific staff of the same pool. For regulation and coordination of the shareholders of water division in every irrigation time, all these coordinating people are gathering in a public place like Tekyeh or Mosque (Safinezhad, 1980, 105). Management, division and preservation of the constituents of water network were distributed among the residents of the neighborhoods in a hierarchical form and all shareholders participated in this affair. All people from the neighborhood, tribes and families played a role in the field of the preservation and amangement of water and constituents of water substructure. This public participation provided the ground for collective activities in relation to water and in this way, mental continuity of all citizens was preserved as regards water and water substructure. Deep interconnection between the management of water system and people's culture and religion in Semnan is considerable and has numerous examples among which one can refer to giving importance to microstreams of water and different times. By allocation of specific names for them in different times and places, a special strategy is adopted that

prevents from the water wastage. Water ownership in Semnan like other movable and immovable objects and its ownership documents could have been transferred like those of house, garden, and land in the form of inheritance and the marriage portion of many brids in Semnan had been water ownership. The water ownership in Semnan was divided into three general categories: personal, endowmen (mosque, Tekyeh, Hosseinieh, baths, public water reservoirs and etc.) and governmental (uses of organizations, governmental offices, gardens); (Ahmad Panahi Semnani, 2002, 76-78). Moreover, management of division and distribution of water had been closely related to social, religious, and cultural beliefs and rituals of people inside the neighborhoods. The water required in public places like mosques, Tekyeh, Hosseinieh, public baths and public water reservoirs of neighborhoods was provided through endowment. Water endowment for religious affairs, recitation of Holy Quran, Moharram mourning for Imam Hossein was carried out in Semnan just like the other Iranian cities. This interconnection between the system and management of water distribution in urban area and also in suburbs and religious rituals and ethnic traditions of endowed waters through adding extra water circuits in special times has numerous examples. Here one can refer to the governmental water and surplus water which are considered to be of public utility and have been provided for the residents of neighborhoods on religious occasions.

There were also collective water and specially allocated water shares that reminded particular religious and traditional occasions for the residents of neighborhoods (Ahmad Panahi Semnani, 1995 & Ahmad Panahi Semnani, 2002).

This colorful and multidimensional presence of water and the constituents of water system in collective and individual life of people of neighborhoods in the course of past centuries has provided the ground for active presence of water, water substructure and its constituents in public culture of Semnan's people and in this way it has formed the multilayered interconnection between the intangible culture of Semnan and water substructure. Life and social relations in neighborhoods are closely intertwined with the management and division of water and water substructure.

### Summary and Discussion

The neighborhood system governing Semnan city in different layers has had a decisive role in the interconnection of water substructures and urban structure of Semnan. This interconnection based on neighborhood relations has provided the ground for formation of multidimensional interconnection between water substructure and tangible (physical) structures and intangible (trans-physical) structures. Table 1 shows that this interconnection in different physical and transphysical aspects and in land, city, neighborhood and individual scales is based on the neighborhood system governing Semnan city composed of three neighborhoods inside the wall of city center and three neighborhoods inside the suburbs (Table 1).

### Conclusion

The compatibility between the neighborhood structure and the relations governing it in Semnan city with traditional water substructure shows that there is a bilateral relationship between the urban structure based on the semi-independent neighborhoods in

Semnan city and the traditional water substructure of this city. Thus, a multidimensional interconnection has taken form between the water substructure and urban structures. This interconnection is not merely limited to the physical structure of neighborhoods, aspects, domain, direction, location of passages and neighborhood centers rather it is something beyond it. This substructure is interconnected with social and cultural relations of the neighborhoods of Semnan city as well as different social, religious, cultural and individual streams of collective and personal life of the residents of the neighborhoods in Semnan city.

In fact, a multidimensional and mutual interconnection has taken form between the water substructure and urban structure of Semnan city based on then neighborhood system and down-top management of it in this substructural network. The mental (intangible and nonphysical) interconnection based on the neighborhood and family relations have provided the ground for stability of traditional water substructure in Semnan city. It has formed a system that all people given their neighborhood and tribal difference in city and social and economic status in neighborhood have a strong relationship with it. This water substructure based on the neighborhood structure and the family and social relations governing the neighborhoods in city has endured despite the modern water substructure management based on central top-down managerial system and even in spite of numerous damages it continues its traditional life.

The study of the interconnection of water substructures and neighborhood systems and explanation of the indices and measures governing these down-top substructures is of paramount importance today particularly in view of the numerous difficulties with which the modern water substructures are grappled in relation to the city and citizens. Then, it needs a special literature and method to be defined for it.

Table 1. Aspects of interconnection of water substructure and urban structures of Semnan based on neighborhood system; Physical Interconnection Transphysical Interconnection. Source: Author, 2019.

	Physical Connection	Trans-Physical Connection
<b>Land Scale</b>	Interconnection between coordinate water substructure and natural and topographic features of earth and sextuple divisions based on existing neighborhoods	Interconnection of water substructure and folklore and intangible culture
<b>City Scale</b>	Interconnection of water substructure and direction of main passages of city, city gates, Bazaar, and city center	Interconnection of water substructure and its management with local religious and social rituals and ceremonies of people in neighborhoods
	Interconnection of water substructure with significant sacred applications in city scale	Interconnection between water substructure and social relations among neighborhoods in city scale (participatory management of water in city scale) – endowment in city scale
<b>Neighborhood Scale</b>	Interconnection of water substructure and direction and trajectory of public and semi-public passages of neighborhoods and neighborhood centers	Interconnection of water substructure with daily activities and social life of the people in neighborhood
	Interconnection between water substructure and area and border of neighborhoods	Interconnection of water substructure with private and semi-private scale of family relations in neighborhoods
	Interconnection of water substructure with significant public applications in neighborhood scale and also the houses of great men in neighborhoods	Interconnection of water substructure with social and cultural relations governing the neighborhoods (participatory management of water among residents of neighborhoods and families) endowment in neighborhood scale

## Endnote

1. The main core of the centers of neighborhoods in Semnan city had been composed of the open or roofed religious gathering houses of Qajar Era and the name of the centers of the neighborhoods was chosen according to the name of the Tekyeh that served as the center of the neighborhood.
2. The water reservoirs in urban houses are called Khut that were usually built under one of the living rooms of the house. Sometimes people designed their water reservoir in a form that it would have a hatch (50\*70 cms) towards the public street in order to provide access to water for the people. Every year in winter these water reservoirs are filled by people in a collective way (Ahmad Panahi Semnani, 2002, 99).
3. One can refer to the following cases: 1- daily water, 2- seasonal water including summer, winter and the surplus water that was for triple neighborhoods outside the city wall and irrigated a major part of the city gardens and gathered in three pools of Kadivar, Kooshmoghhan and Vazaghan, 3- specific waters and finally the endowed waters. Among other examples, one can refer to “Bajan water” that represented a scarce amount of water that remained behind tributaries and streams and was gathered and

used by the pool guards; “Bari Dar water” that was flowing in the flows of Semnan before the closing of the water flow and the amount of which is usually calculated on the next day’s water share. This water belongs to the “water shares” and was sometimes given to “Engamevis” [man who was in charge of recording the water shares] as a token of appreciation (Ahmad Panahi Semnani, 2002, 79-85).

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