

NAEEN
Aspects of Environmental Response

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Abstract

There are numerous studies dealing with Iranian history and culture, but only a few of them have discussed the architectural forms found in cities and towns. Consequently, there is a need for more analytical studies that can explain the processes by which these architectural forms and cities have developed throughout Iranian history.

The main objective of this study is to use a multimedia format to study different types of information. A second objective is to show the role of water in the formation of one Iranian city, Naeen. I have used my own field experience in Iran as well as the works of others to explain the path of water as it influenced the formation of one of the oldest extant cities of Iran's dry arid region, Naeen.

Multimedia presentations on this compact disc use slides, video sequences and 3D models combined with text, all of which have been programmed into an interactive environment.

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All drawings are original unless noted otherwise. The aerial photographs are from the archive of Organization of Survey and Topography in Iran and all the other photographs were taken by the author. The video sequences about the old town of Naeen are clipped from the original video filming by Iranian National Television and the video sequences about the new town were filmed by the author.

At the end of this report I provide a glossary of common local terms used in this report; they are indicated by Italics in the text.

Introduction

The process of city formation and development in Iran has consistently been based on the interrelation of the physical and cultural environments. The founding of cities has resulted from various factors, such as religion, economics, and physical components of topography and geography. The major cultural factors have been religion and history. The significant physical factors have been climate, water supply, and local materials. All have contributed to the construction of cities in Iran.

Considering water the most important factor in the survival of the city, Naeen has been selected as a case study of the pre-modern Iranian city. It has been chosen because of its location on the border of the Iranian plateau, which demanded ingenuity in the securing of water and its unique preservation after the emergence of Modernism changed the form of most Iranian cities.

The first part of this project sets out general information about the time and place within which this city was formed. It includes Text, pictures, and video sequences that provide a general view of the town and inform the viewer of what Naeen looks like and why. As the viewer will discover, this town is no longer occupied. It was abandoned, as residents, seeking change and modern life, were attracted to areas of development and mechanized activities in the vicinity. People moved to another part of the region and built a new town, which would be more relevant to new machines: wide street for fast moving cars, piped water, sanitary washrooms and baths within the dwelling, electric fans and heat, and a myriad of other amenities; yet something important left

behind.

The second part of this project is a review of the different scales of environmental response found in Naeen: urban, neighborhood, neighborhood centers, and house.

The third and final part offers a brief introduction of the new town of Naeen followed by a comparison of the modern with the older town.

The overall objective of the project is to demonstrate that the old town, which had formed through decades, reveals layers of knowledge, which can still be of great value for contemporary urban developments.

General Information

LOCATION

In the province of Esfahan, Naeen is the mid point along a trade road between these two major cities, Esfahan and Yazd. It is situated on the edge of the central plateau, provided the first available rest point for caravans and voyagers on their east-west journeys. It is located on a bow like area surrounded by low mountains to the west and south. Because of these mountains underground water could be channeled to the town made agriculture their first source of life.

Apart from coastal area of the Caspian Sea the Iran suffers from a shortage of water. Water has always been a treasure. Depending on the locality water is drawn either from rivers, springs and wells or from the typically Iranian irrigation system "Ghanat". *Ghanat* was and is to this day a masterpiece of engineering for the daily water supply in Iran.

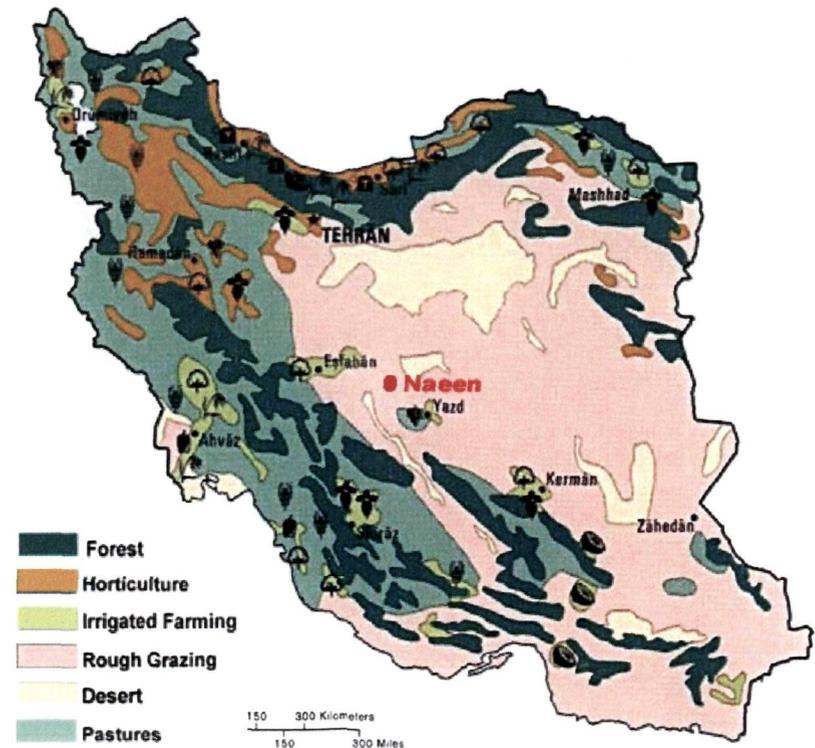
According to the report of Iranian Statistics Office in the first decade of the 20th century about 50,000 systems were in operation at this time. Only a few and highly respected experts could and can set up such a system. In this system the underground water, which collects after rain or snow is channeled in slightly sloping, long underground ducts to the villages and towns.

At a short distance from the town the water is brought to the surfaces where it is stored in reservoirs for convenient distribution.

At distances of 50 – 100 m vertical shafts leading to these underground ducts are drilled which serve as air vents for

the laborers and for bringing up the excavated soil. Without technical aids and without consumption of energy and raw materials, by the power of thought, physical work and the utilization of natural conditions significant achievements were attained.

Figure 1- Iran Natural Map



HISTORY

Province of Fars is one of the oldest regions of Iran, It was also the official center of Achaemenian dynasty (pre-Islamic period). The city of Naeen was the official center of an area named Yazd in the region of Fars. After Islam this province was divided into five areas, but Naeen still had the same role in controlling the area. It was at this time that Naeen was a thriving city. The earliest recorded document *hodood ol'alam* that mentions Naeen, briefly, belongs to second half of 4th Islamic century (10th century).

The 13th century was a flourishing time for Naeen. Some of the best architectural examples of this period were built in Naeen, like *Masjed Baba Abdolah*; *Emamzadeh Said Ali*; *Masjed Jah-meh's* minaret. During the Mongolian Invasion (14th century) most of the cities in central and northern Iran were destroyed and *Naeen* was not an exception. The inhabitants used the city's old castle named *Narenj Ghaleh* and built a large ditch around it to protect themselves.

Safavid dynasty (16th century) made some serious differences in the economic and cultural conditions of the people. Naeen became part of the province of Esfahan. The capital city of this province has the same name, Esfahan which was also the capital of the country and the Safavid dynasty. In Naeen religious beliefs determined the borders between the settlement areas, and because of some religious ceremonies each neighborhood had and still has its own place called *Hosseinieh*.

Until the first decade of the 20th century Naeen was a city economically dependent on its agriculture and handcrafts,

and there were all types of orchards and prairies around the city. Its hand woven rugs had a very good impact on the rug market in Iran and later outside of the country. This was the pre-industrial condition although some of the elderly inhabitants still try to make a living from these professions. Emerging new ideas from abroad have made some differences in the inhabitants' lives. The city had a closed shape and it needed to be opened up to get and give the new services. Therefore a new street suitable for fast transportation was built (fourth decade of 20th century) right in the middle of the old city fabric. This plan did not work and through the years inhabitants left their old houses and started to build new ones on the other side of the main connecting road between the two major cities of the region, Yazd and Esfahan.

Figure 2 - Naeen Aerial View, 1960s



To Esfahan

New cutting street

To Yazd

ECONOMY

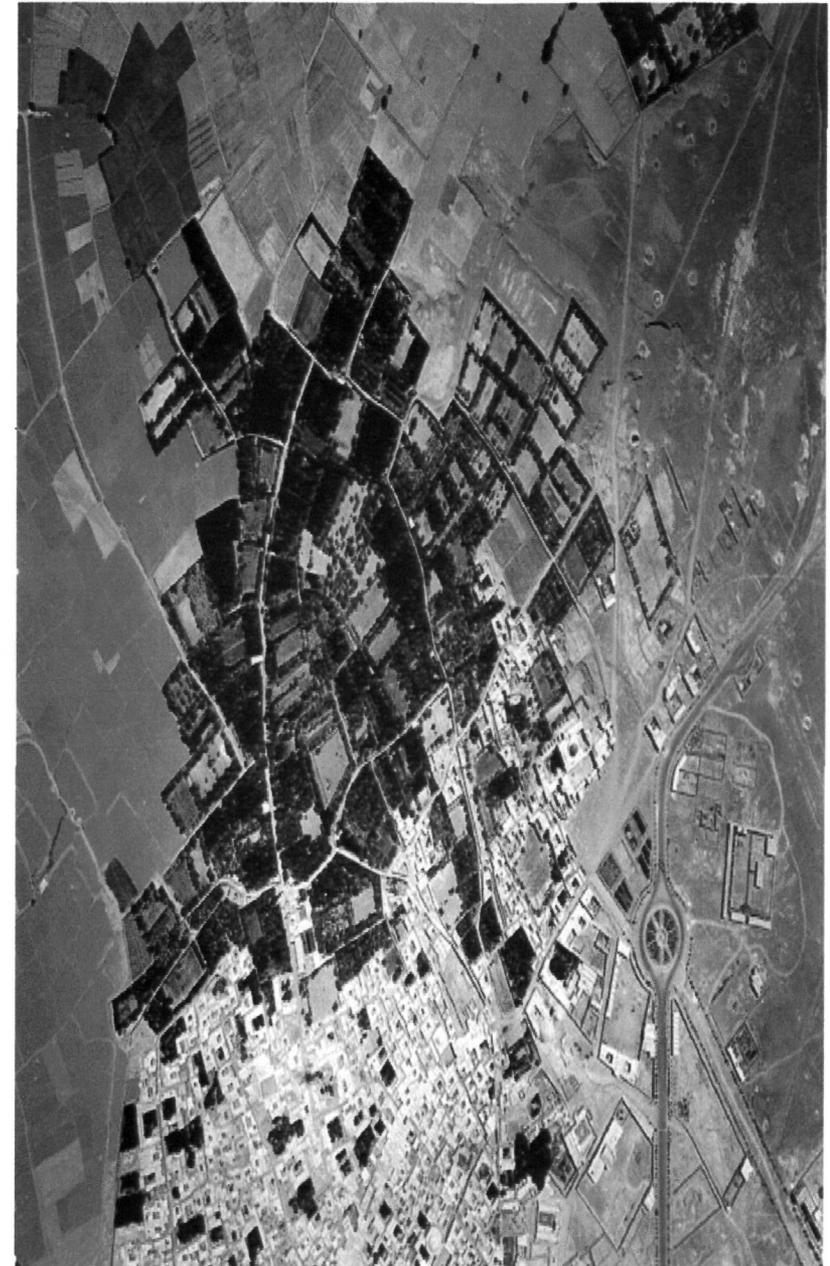
Naeen has an official role in the province of Esfahan and some of the governmental offices, which are located on the new town of Naeen, provide the main job market for the youth of this city. On the other hand Naeen's economy depends on agriculture and the trading of some handicraft products like carpets and rugs. Recently the problem of irrigation and the lack of water have grown. One of the reasons is the increasing usage of deep wells. During World War II deep wells were introduced in Iran by the armies. Deep well has cheaper construction costs comparing to those of the *ghanat* but the *ghanat* is more reliable than deep well because it gathers water from different water tables therefore the rate of water flow remains steady.

For the past few decades insufficient supply provided by the *Ghanats* or underground rivers gradually decreased the areas of orchards and grasslands. Farms also suffered and were not in a good condition.

Naeen's water is salty and because of that the land was most fertile for fruits like pistachio, pomegranate, and cotton, which do not need much water to grow.

About hundred years ago there were twenty tile and pottery workshops in Naeen. The products were traded with many other cities in the province. Hand woven carpet and rug were and still are part of the home-based economy for most families, although if it was not for the city's official situation in the province, most of its youth would have left the city for better job.

Figure 3 - Naeen Areal View - Gardens and Orchards- 1950s



CULTURE

The old city of Naeen has seven *Mahallehs* or neighborhoods, which were formed because of the different religious beliefs and social status of inhabitants. The family consisted of man, woman and children plus their grandparents and their grandchildren. Thus it was a large extended family that occupied each house within which invisible borders marked the territory of each subfamily.

The relationship between neighbors formed the immediate neighborhood. Two, three, or four neighbors could be connected through an octagon-shaped entrance space, which served to both separate and join the different entrances at the same time.

Sensibility and affection for nature together with the diversity of the local conditions in this area have led to widely differing building forms. Water and climate, light, air and the cardinal points were of predominant importance, so that water and vegetation were taken into even to the smallest courtyards of the houses, villages and towns, and a tree was always planted in such a position that it could be seen from all rooms.

An old Iranian proverb states that: "Others have planted so that we can

an old man built a house he always endeavor to preserve the existing old trees so that he could live in their shades. Whoever felled a tree always had to plant a replacement and ensure its growth. position to always find and utilize suitable materials and their most efficient and ingenious manner of treatment was passed from generation to generation.



Figure 4 - Seven Neighborhoods of Naeen

Overview

Figure 5 - Persian Carpet, Naeen Product

AERIAL VIEW

When standing on one of the roofs of an old, typical Iranian town located in dry arid zone, like Naeen, the whole town is like a huge carpet. Its surface is only slightly undulated with the domes of houses; here and there green trees can be seen, there are usually the slim needles of minarets and the abstract shape of the smooth brickwork of the mosque dome. It gives an impression of lightness, even of floating, without any claim to monumentality or to a dominating effect. The green cultivations of walled gardens and orchards form the edge of this large earthly carpet.

Above these exceedingly soothing horizontal lines is the spaciousness of the scenery, with the rough contours of the mountains in the distance presenting and imposing picture.

One cannot imagine human settlements being placed more harmoniously into a landscape than these old Iranian towns and villages with their houses of similar type, made from the same materials, of the same color and with their similar flat, barrel or domed roofs. Houses which are built so closely to each other that they have effect of being one huge, flat one-story building, a building that perforated by innumerable courtyards and the thin veins of narrow crooked lanes. Even where the silhouette is determined by special elements like ventilation towers, *Bahd geer*, this same effect is maintained because of the complete similarity of these elements, it remains serene, concerted and convincing.



Source: <http://www.medallionrug.com/>

Figure 6 - Naeen Aerial View, 1950s



PANORAMA VIEW

Bazaar

Emam zadeh Said Ali

Gardens & Orchards

Narenj Ghaleh

Masjed Baba Abdolah

Figure 7 - Naeen's view to the Southwest

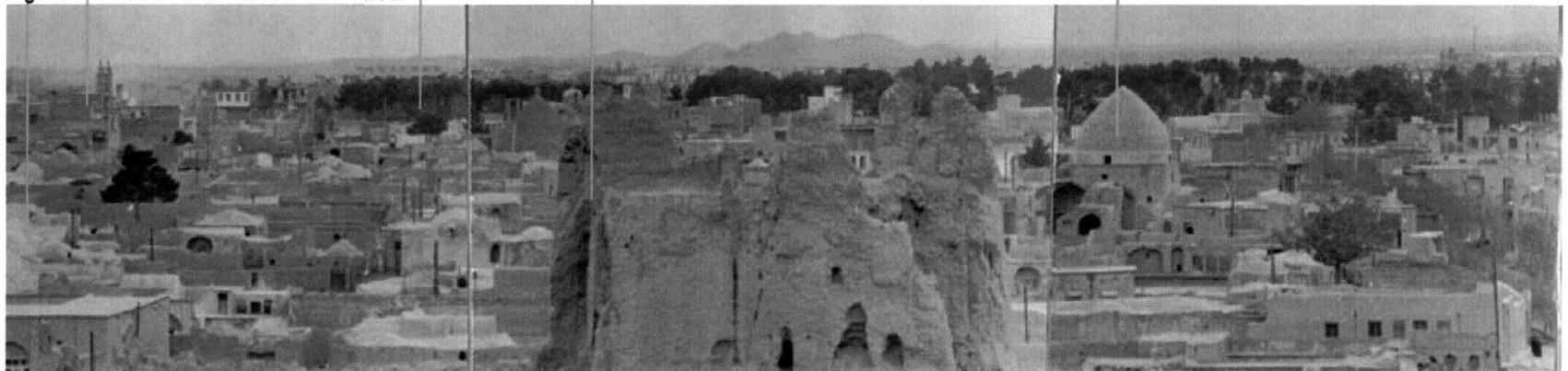




Figure 8 - Naeen's View to the Northeast

Gardens & Orchards

Ventilation tower

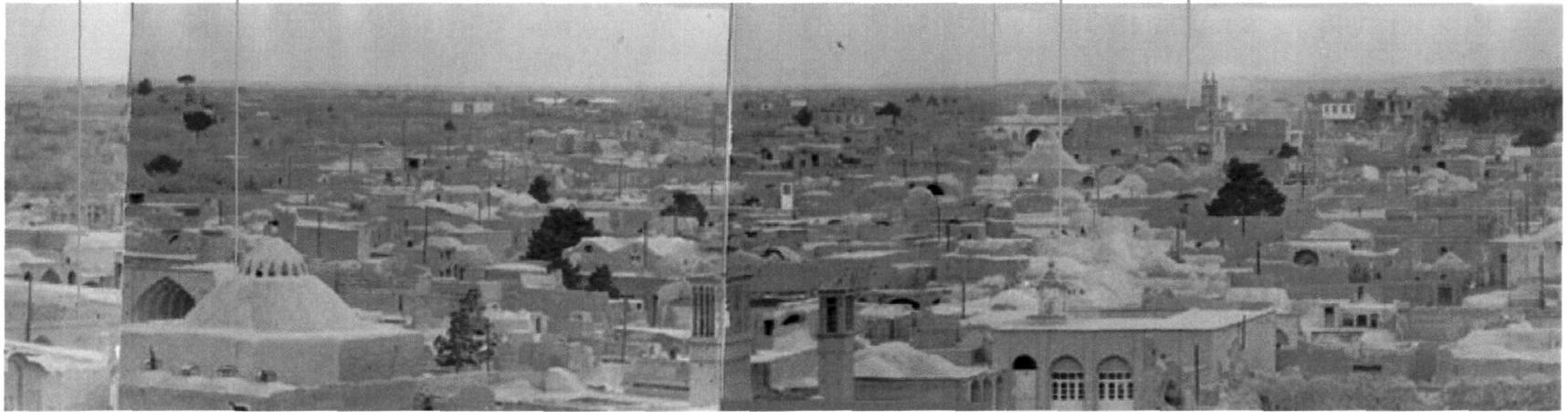
Hosseinieh (a city courtyard and a place for religious ceremonies)

Tekyeh (covered sacre place for religious ceremonies)

Bazaar

Emam zadeh Said Ali

Figure 9 - Naeen's View to the Southeast



Environmental Response at Urban Scale

THE LAND OF NAEEN

Naeen, one of the oldest Iranian cities, is located on the border of the plateau; at latitude of 32.52 north and longitude 53.05 east. It is surrounded by two mountains; on the southwest is *Kala Kooh* and to the north *Chah Zangool*. These mountains range in height from 900 to 1500 meters. There is no permanent or seasonal river in this region, so the main source of water is groundwater, which is accessible through *ghanats* and wells.

The old fabric of Naeen has an area of 38 hectares and is located on a plain zone with an average height of 1200m. Mountains on the north and southwest catch life-generating snow. The area in which Naeen is located is an arid zone with hot days and cold nights. In summer the maximum temperature is 43 C and in winter the minimum is -9 C. In normal conditions the relative humidity is less than 50%.

Figure 10 - Iran Topography Map



THE ROLE OF WATER

As a result of widespread aridness, water has always been a leading feature in settlement distribution throughout Iran. To recognize this, a review of the major characteristics of Iran's topography is required.

Iran is a country of deserts and high mountains. It extends between latitudes 25 and 40 degrees north and longitudes 44 and 63 degrees east, with an area of some 628000 square miles. Iran is located between two major depressions: the Caspian Sea to the north and the Persian Gulf to the south. Two mountain chains rise sharply from these two depressions, the Alburz Mountains to the north and the Zagros Mountains to the southwest. These mountain walls surround the central depression of Iran, the Iranian Plateau. This irregular, bowl-shaped geography has resulted in general dryness. Excluding two strips in the northern and western sections, Iran consists mainly of dry lands and barren mountains. The Zagros Mountains, extending from the northwest to the southeast, block rain-bearing westerly winds. Similarly, the Alburz Mountains, stretching from the northwest to the northeast along the Caspian coast, hinder the moist winds deriving from the Caspian Sea, resulting in uneven distribution of precipitation over the plateau. Thus, while the bases of the mountains experience a considerable amount of humidity, the central basin of the plateau remains comparatively untouched by any kind of precipitation.

Distribution of rainfall throughout the country is directly influenced by the presence of mountains and, largely related to this, the density of human settlements; most of them occur on the sides of the mountains where access to water is

possible.

Iranian cities for the most part have been built in areas with an available source of water and relatively arable land nearby. In most regions of the plateau, cities obtain their water through *ghanats* and are located at the foothills of mountain chains on alluvial fans or in inter-mountain basins.

A *ghanat* is a subterranean aqueduct that collects groundwater at the foot of the mountain and carries it, following the descent of terrain, to settlements and fields.

THE GHANAT

In the extensive dry regions near the desert in Iran, water is brought from mountains to the plains in long subterranean ducts. It is then captured in covered reservoirs in or near the village or town. Rows of vertical shafts are used for building and servicing these ducts. On an aerial photograph these holes each surrounded by excavated soil, look like an orderly perforation of the landscape. It is in part because of these holes however, that water is made available for many uses, and flows, in covered streams or gutters along the passage-ways of the town.

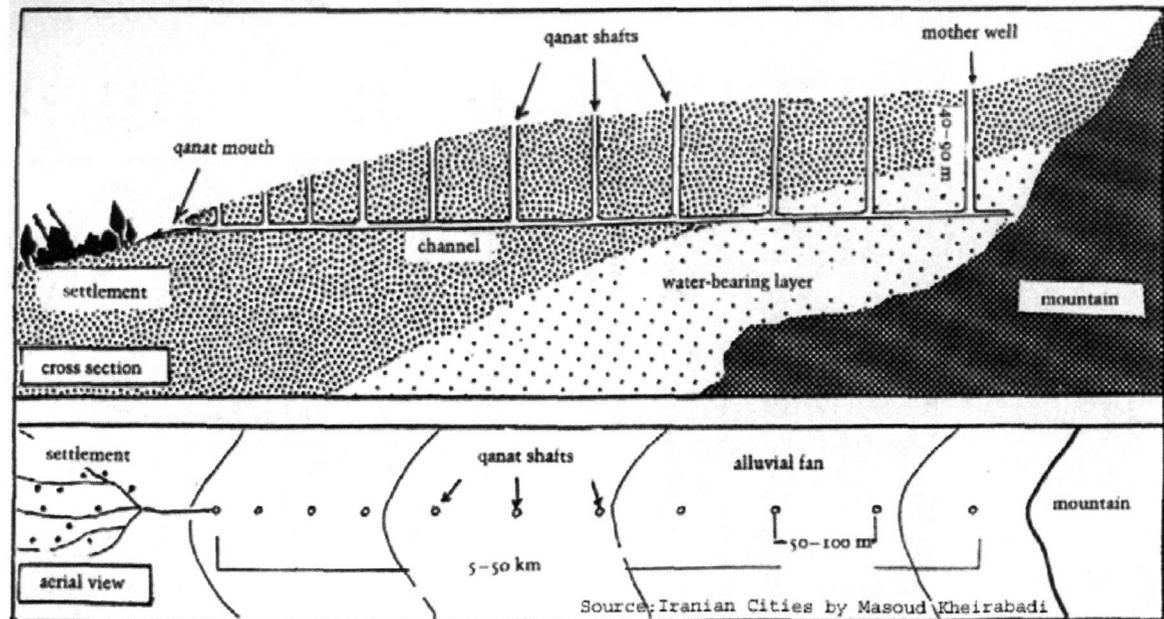
According to Masoud Kheirabadi in his research *Iranian Cities* usually, a group of expert men, called *Moghanni*, build *ghanats* and they often transfer their skills to their heirs. Their tools were hatchet, shovel, a lamp, and the exterior winch located at the top of the shaft.

In the *ghanat's* construction the most important step is finding the location of the first shaft or main well (*Chah Madar*). The *Moghanni* usually follows the path of the natural stream coming down from the hills and looks for proof of water such as a spring, and or summer plants that help him to calculate approximately the location of the main well. This main well is dug until it reaches the groundwater of a resistant layer.

The well is about one meter in diameter and as deep as the water table of the area. The depth of the main well also depends on the length of the *ghanat*, the size and gradient of the alluvial fan, and the amount of the owner's investment. Because of the expense of construction, *ghanats* are kept as shallow as possible; they are seldom dug below 100 meters.

To realize where the water will come to the surface, the depth of the main well and the depth of the *ghanat* are calculated. To reduce the wearing away of the tunnel by running water, the slope should be between 1:1000 and 1:1500 or close to level. It is not always possible to have the opening of a the

Figure 11 - Ghanat Shafts (Source: *Iranian Cities* by Masoud Kheirabadi)



ghanat inside the town and the ghanat must flow on the surface for many kilometers before reaching the settlement, which adds to the pollution and evaporation of water during hot seasons.

But most of the time the builders try to build the water system as fast as possible, so they start the construction from two end points and dig toward each other. At a distance of 50 to 100 meters, a series of vertical shafts (*chah*) are dug along the *ghanats* to connect the tunnel to the surface.

The length of the *ghanat* is the distance from the main well to the opening. Like the depth, it depends on the slope of the ground and the slope of the water table. When the builders decide on the location of the main well, the direction and the slope of the *ghanat*, and the *ghanat*'s outlet, they begin to construct the tunnel. It often begins from the outlet (the opening of the *ghanat* near the town) and continues in the direction of the main well.

Usually, the distance between these shafts is short at the foot of the mountains and becomes longer as the shafts approach the flatter surfaces toward the desert. The function of these shafts is to ventilate, remove the excavated soil, and to provide access to the tunnel to facilitate repairs. The excess soil is collected around the openings of the shafts and is used to protect the shafts from shifting sands and flooding.

The tunnel has an egg shape and it is about 1 meter wide and 1 to 1.5 meters high. When the tunnel passes through sandy soils, loops of baked clay are used to prevent roof and

wall collapse. The tunnel continues to be dug in an upslope direction until the water from the water table pours in. During the construction of a *ghanat* there are always dangers of drowning under rushing water, being buried by collapsing roofs, suffocation, sliding while climbing up or down the shafts, snakebites, and so forth. Therefore, this job is usually rewarded and valued among the habitants.

In the end, after its construction, the value of a *ghanat* is affected by the rate of the water flow. Flow depends on the capacity and the length of the water-bearing layer, which is related to the amount of precipitation. The rate of the flow in a *ghanat* differs during the year with variation of the water table height. The maximum rate of flow occurs in winter and early spring and the minimum in late summer and fall.

Figure 12 - The Opening of Gahnat Shaft



GHANAT SYSTEMS IN NAEEN

As a result of their expense and importance, *ghanats* have played a major role in the social structure and settlement patterns of Iranian towns. They often pass under the owners' summer rooms and surface somewhere on their properties. After passing through the town or village and satisfying internal needs, *ghanats* are used for agricultural purposes. The more affluent people live around the outlet or upstream where the water is fresh and clean, and the poor live downstream where the water is already warmed and polluted. However, the householders usually get their drinking water early in the morning.

In Naeen, more clearly than in any other city in this region, we can obtain a clear idea of a traditional, small Iranian city. The old city of Naeen is no longer inhabited, but it is preserved to such an extent that we can understand the original functions and features of the extant buildings. This is unlike the other cities, such as Yazd and Esfahan, where the cycle of construction, abandonment, or demolition, and reconstruction has never been interrupted. Here in Naeen, the conditions are preserved as they were hundred years ago.

There were two major *ghanats* providing the water for people in Naeen, Varzi-Jan and Mehry-Jan. The lack of water caused the latter to be abandoned, but the former is still in service and continues to be the main source of drinking and irrigation water. The Varzi-Jan *ghanat* brings the water from the southwest mountain, Kala Kooch, which is one of the Zagros mountains. The length of this *ghanat* is about five kilometers. There is another *ghanat* on the north side of the town, with water flow that is seasonal, coming from a moun-

tain called *Chah Zangool*. The main *ghanat* route, Varzi-Jan, which comes from Kala Kooch near the town branches into several routes, each going to a different part of the town through covered gutters when inside residential areas and along open streams when in agricultural areas. As we can see in the map of *ghanats* most of the time the routes for these water channels are along the passageways, which shows that the formation of the neighborhoods are related to water routes. Gutter routes mostly pass through one side of the houses along the related passageway and remain underground to keep it unpolluted. The water is accessible through the basements where the summer rooms are located.

Figure 13 - example of Covered Gutter Routes

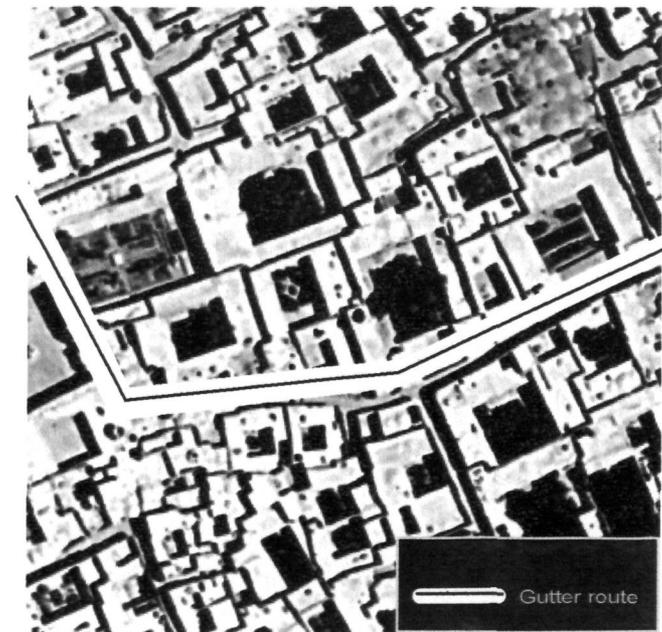
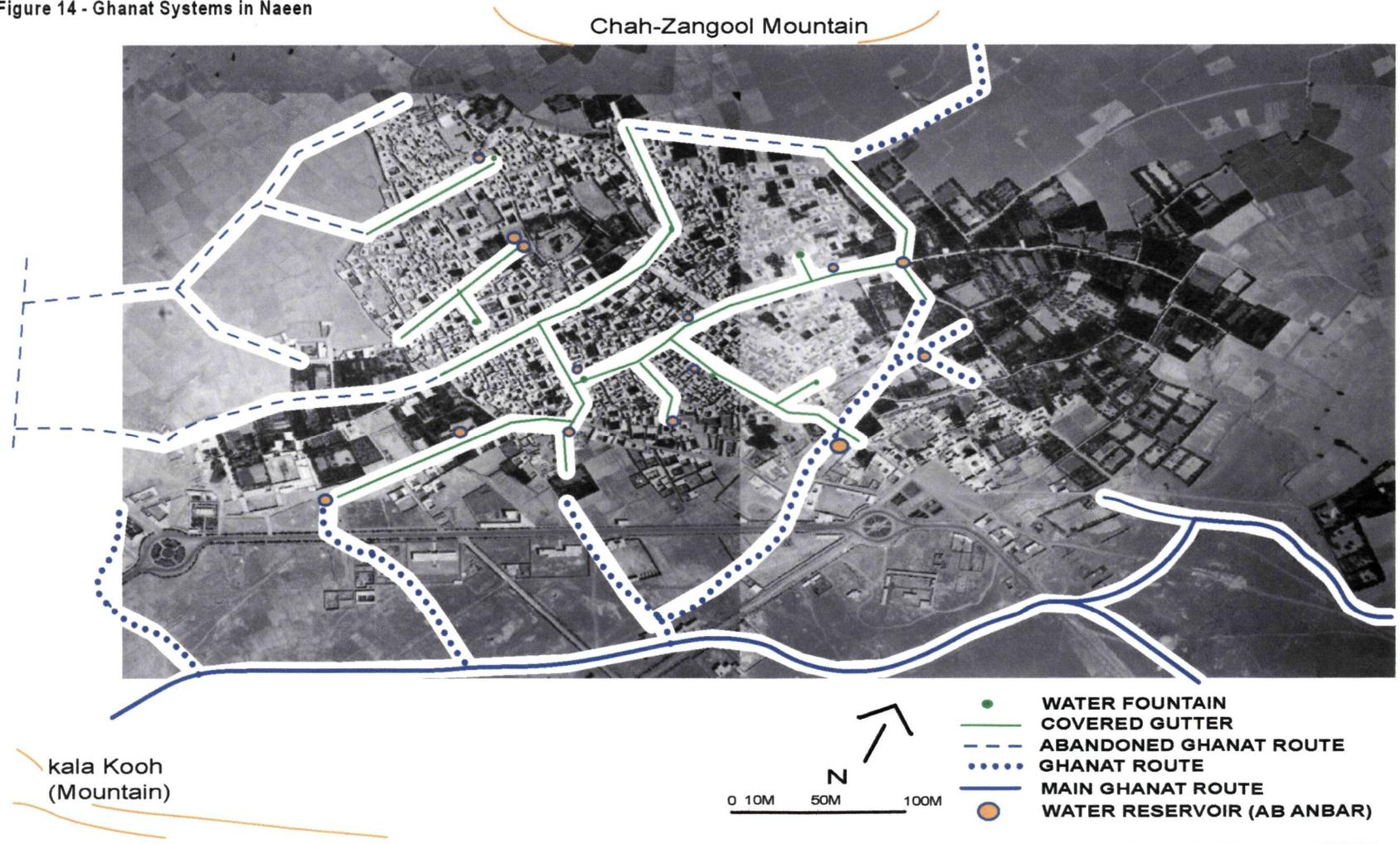


Figure 14 - Ghanat Systems in Naeen



Water comes to town and is conserved in water reservoirs or *Ab Anbars*, which are found both outside and inside the town. Usually each neighborhood has one or more water reservoirs. These reservoirs are housed in Dome shaped buildings which have one or more ventilation towers, making them a recognizable feature in the fabric of the town. For ease of public use, the entrances of the *Ab Anbars* are usually located on the main passages and intersections of the town. Naeen has seven neighborhoods, each with a center, a town courtyard, or as the inhabitants of Naeen call it, *Hosseinieh*. Every *Hosseinieh* has a drinking water fountain or *Sagha Khaneh*, a word which has a cultural and traditional history.

Hossein is the name of the grandchild of Mohammad, the prophet of Islam, and the third religious leader (*Emam*) in Shi-eh Islam. Hossein died of thirst in the desert because his enemy, Yazeed, cut off the water supply and thus destroyed the Islamic army. In Iran, the Shi-eh people have the belief that if you provide free water for everyone you will have a special place in Heaven. *Hossienieh* is the name given to a place for religious ceremonies and usually there is a drinking water fountain or *Sagha Khaneh*, which means the home of the one who brings water. There is often a small niche inside the *Sagha Khaneh* where one can light a candle and say a prayer.

Ab Anbar or water reservoir has a cubic or cylindrical underground tank, which is accessible through a staircase attached to the internal wall for cleaning purposes. The tank is always built underground for three reasons. One is because

Figure 15 - Sagha Khaneh - Bobol Masjed Courtyard's Entrance



Sagha Khaneh

Figure 16 - Gutter Routes in Naeen



the construction process is much easier than building it on the surface and the surrounding excavated earth helps to reinforce the walls. The second reason is that the water inside remains cool and the outside temperature has less affect. The third reason is that transferring water from the *ghanat* is simple. Ventilation towers or *Bahdgeers* are another important part of the construction because they provide air circulation inside and ease of access.

For using the water of the water reservoir, there is a stairway attached to it. with an entrance on main passageways or intersections. Ease of access to the water is ensured by the convenient sitting of the entrance of the water reservoir along main passageways or intersections.

Figure 19 - Plan and Section of Ab Anbar or Water Reservoir

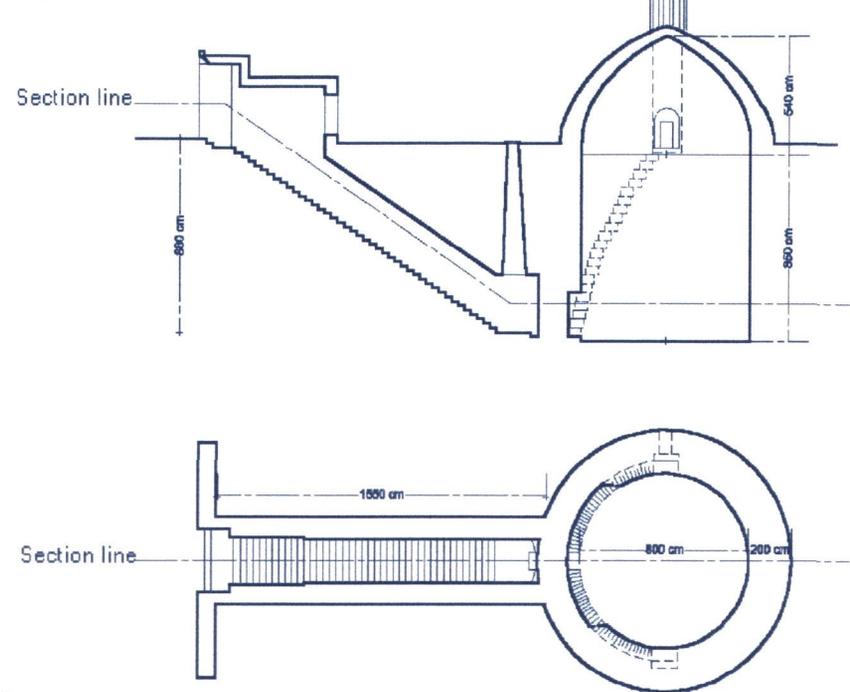
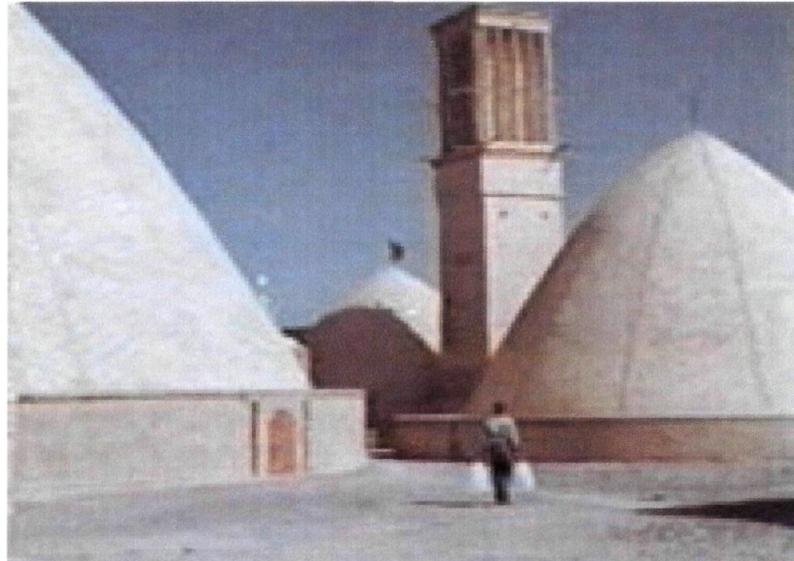


Figure 17 & 18 - Ab Anbar or Water Reservoir and its Bahdgeers or Ventilation Towers

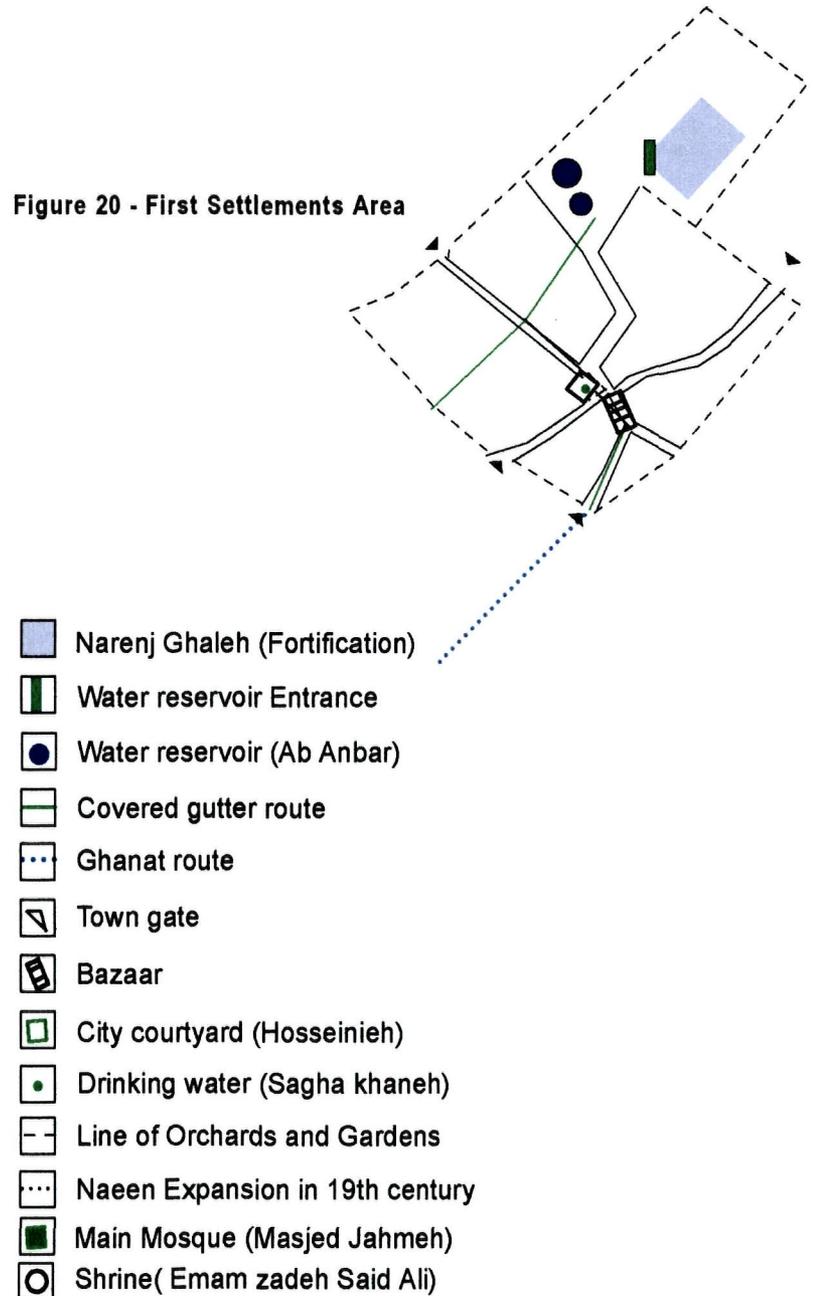


CITY EXPANSION

The most important factor in the survival of the city and then its subsequent expansion was access to water. As a result of climatic conditions in the Iranian plateau, the main source of water had always been *ghanats* and conserving more land for agricultural uses was the major concern for inhabitants. In Naeen the first settlement area was formed around the main water reservoirs near *Narenj Ghaleh* or the fortified village. The entrances of the water reservoirs were inside the *Ghaleh* walls, so that they would be protected.

The *Varzi Jan Ghanat* brought water to the town from the Kala Mountain located to the southwest of Naeen; it developed many branches that served the houses and the agricultural areas through covered gutters or streams. The expansion pattern of Naeen was mostly in the opposite direction of the main *ghanat* toward the trade routes between the two major cities of Esfahan and Yazd. Although Naeen initially evolved out of agricultural settlements, trade played a major role in its later development. Since first century after hijrat the bazaar gradually has become the core of the city and consequently influenced the pattern of urban growth.

Figure 20 - First Settlements Area



RELATIONSHIP WITH NATURE

Naeen's inhabitants, as builders of their own houses and neighborhoods, knew their surroundings very well; they were always able to find proper materials and to utilize them most efficiently. This knowledge was passed from generation to generation. The soil, or loam, available in the plains proved to be a building material with excellent thermodynamic and acoustic properties, not only as kilt-fired brick but also as sun-dried brick, as freely shaped material or as mortar mixed with straw. These raw materials could be either reused or allowed to decay and thus blend back into nature. Because the material came from the environs, the buildings were in agreement with the landscape and became a part of it.

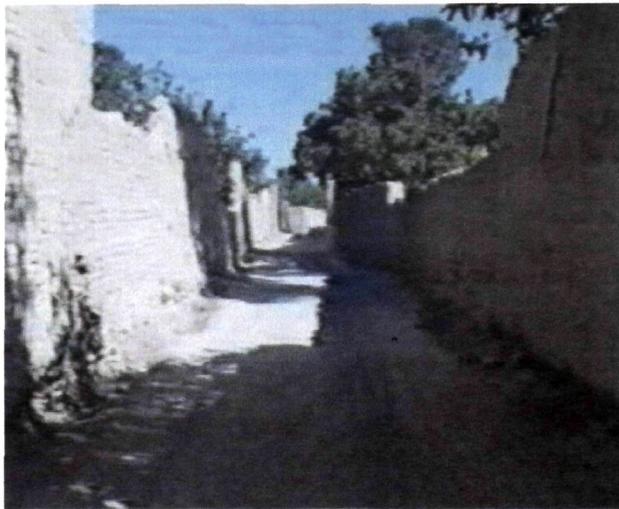


Figure 25 - A Passage between Orchards

"Owing to the thorough knowledge of the locally available building materials the constructions could be formed so perfectly that it was not in the least necessary to hide them behind claddings or facades. The Iranians felt themselves to be free enough not to be compelled to make their works obtrusively visible by facades, colors and splendid externals; yet they were as beautiful as they were simple."¹

The houses of all the inhabitants were constructed from the same materials, only their use, size and the embellishment varied.



Figure 26 - An Orchard

1. (Arthur A. Pope 69)

CONTINUITY OF FORM

A Consideration of building in the dry-arid region of Iran reveals the great influence of weather on architectural forms. Because of the acute problems associated with weather, people have tried to find the best solutions for minimizing the harmful effects of regional climatic elements and for exploiting any beneficial or comforting aspects as fully as possible.

These difficulties, and opportunities, necessitated the close proximity of the buildings. Hence all buildings were attached, one to the other, creating a compressed form in order to reduce the amount of surface open to sunlight.

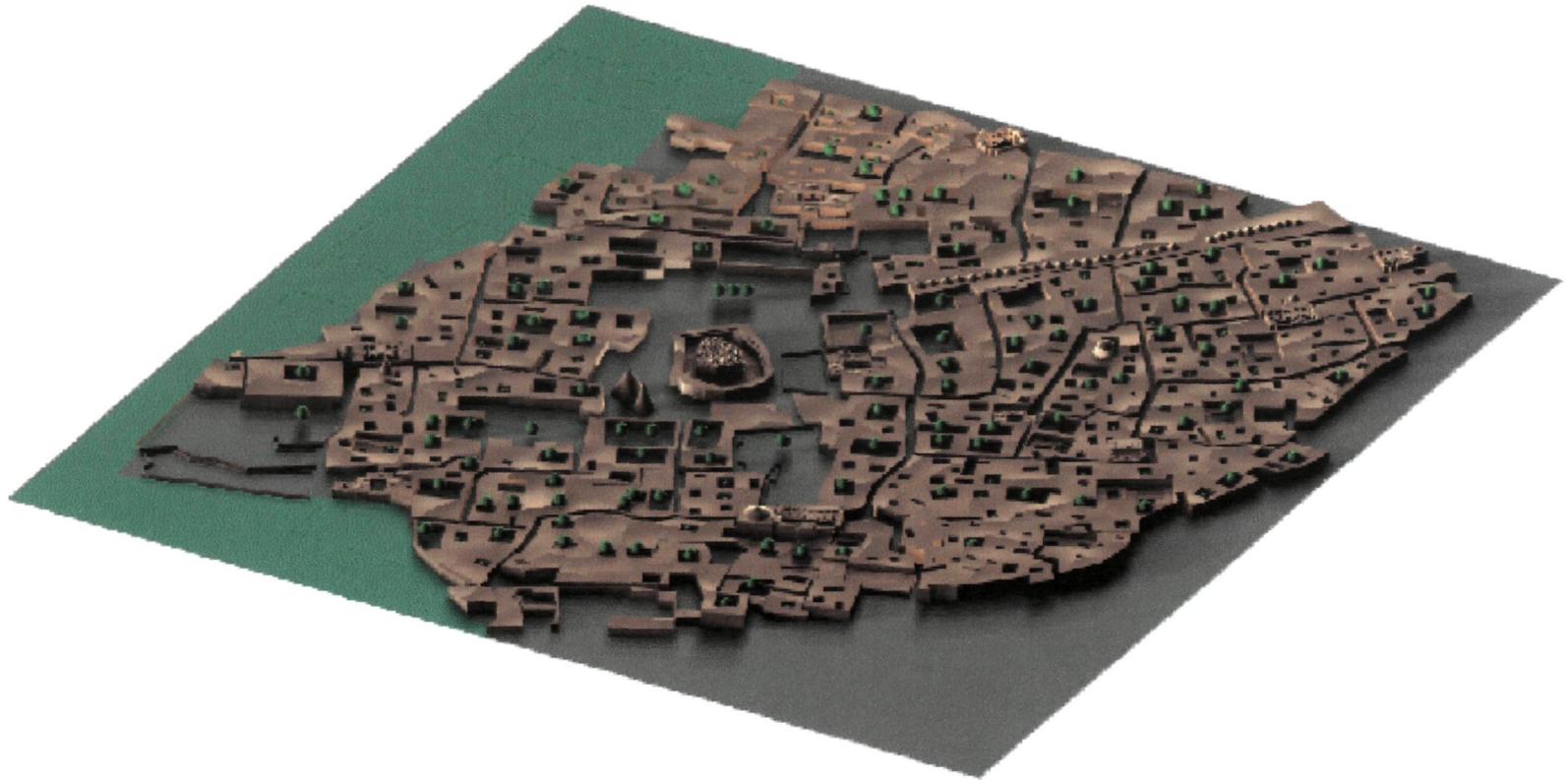


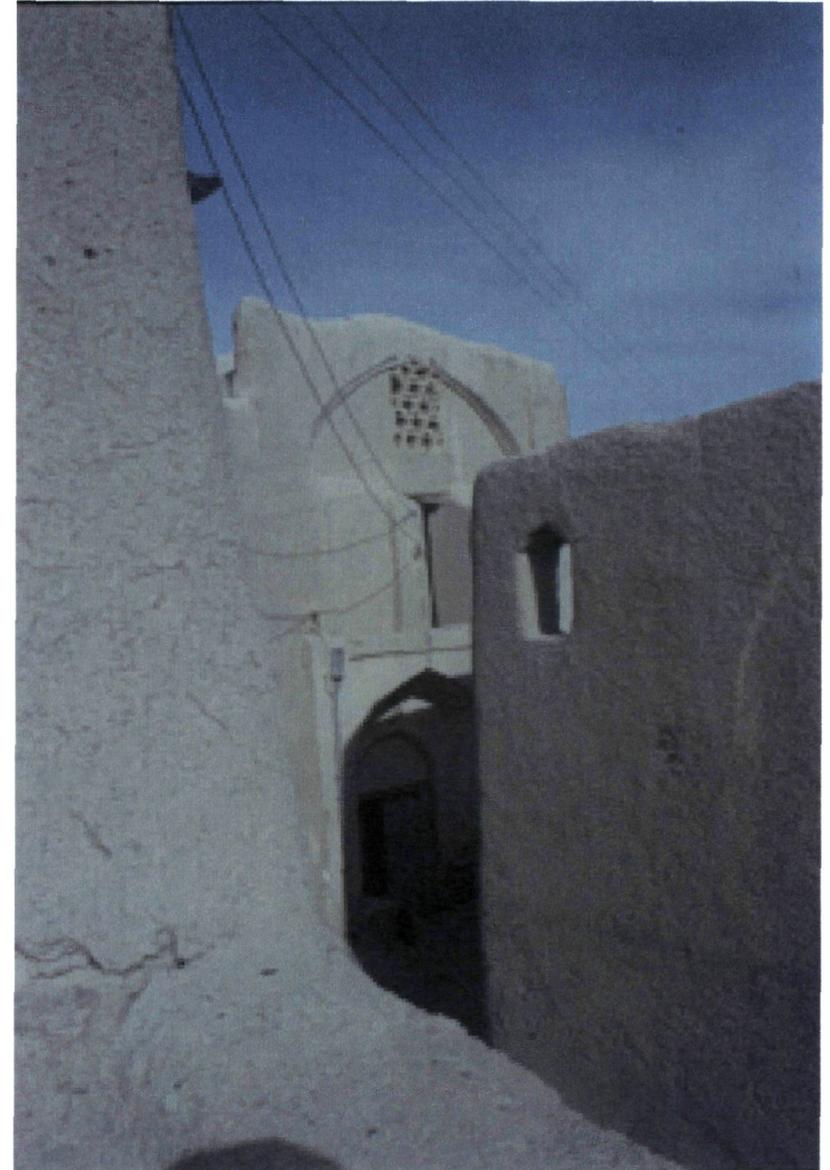
Figure 27 - Mass Model of Naeen

The form of the whole city, in this case Naeen, has specific climate-responsive architectural characteristics. The direction of streets and alleys is North-South to prevent the penetration of undesirable winds from the desert, streets are narrow with tall side-walls to generate as much shade as possible, and volumes are enclosed to minimize the penetration of direct sunlight.

The attachment of the buildings to each other also allowed their consequently contiguous roofs to provide another layer for socializing. Thus the volume of the whole town seems as one building with courtyards like pointed holes and streets like linear holes to keep heat out of the related inner spaces.

Cultural differences as well as economic level were important influences on the form of the seven neighborhoods, *Mahalleh*, in Naeen. Because of this we can see all types of houses in any one neighborhood. The separation of neighborhoods has no physical border and one cannot see any interruption marking their differentiation in the continuous fabric of the old town. All units are attached to their neighbors, which can be another house or a social place like an Inn (Caravanserai), public bath, or Bazaar or even a building in another neighborhood.

Figure 28 - An example of Narrow Street with tall side-walls



GEOMETRY OF ARCHES

Arch separating and connecting at the same time has individual and basic character to create spaces. Adding intimacy to related spaces arch's curved lines in contrast with the straight lines of walls reduce the roughness of crossing surfaces.

Arch within its simple geometric form accepts many different functions depending on the contexts. It can be considered as a form to shape a space, body, or surface.

Here we review five types of arches:

Arch 5 & 7 - highrise

Its original name is *Panj O Haft-Tond*.

In this arch the main length for drawing arch (distance between two stands) is divided by 5 and 7 for generating the geometry.

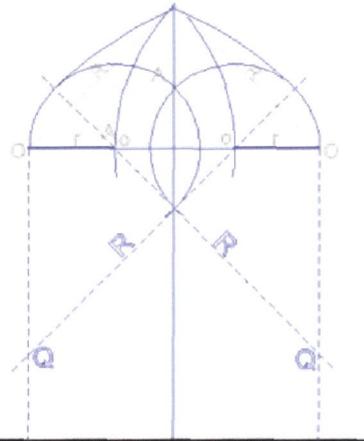


Figure 29 - Examples of Highrise Arch 5&7



Arch Broken-Bow

Its original name is *Shekasteh*. This arch has the same geometry with *Kamani* except that the last step uses bigger radius to produce the effect of break in the arch, but it can not be very different with the first one.

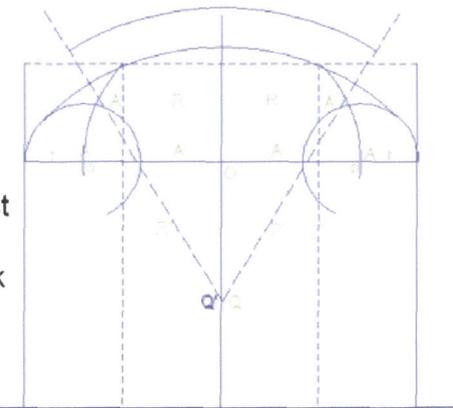


Figure 30 - Examples of Arch Broken-Bow



Arch Bow-Shape

Its original name is *Kamani*.
This arch's geometry is based on dividing the length between two stands by four.

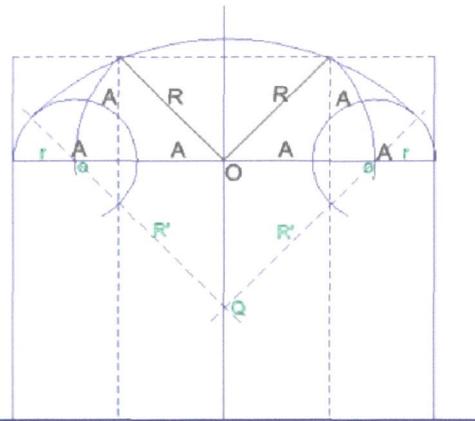


Figure 31 - Examples of Arch Bow-Shape



Arch Half Circle

Its original name is *Nim Dayreh*.
This arch is a half of a circle which its radius is half of the distance between two stands.

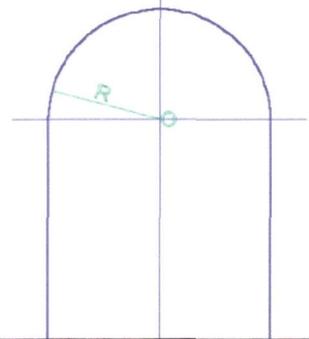
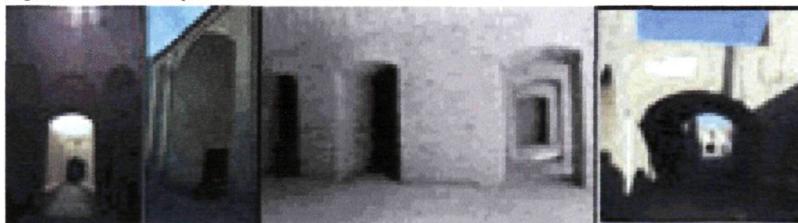


Figure 32 - Examples of Arch Half Circle



Arch 5 & 7 - low-rise

Its original name is *Panj O Haft-Kond*.
This arch is the same with the previous one except that goes one-step further to produce the low-rise arch for special situations.

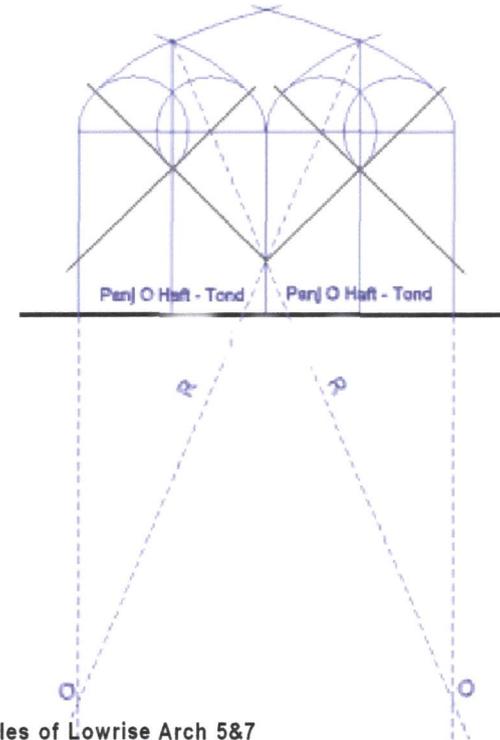


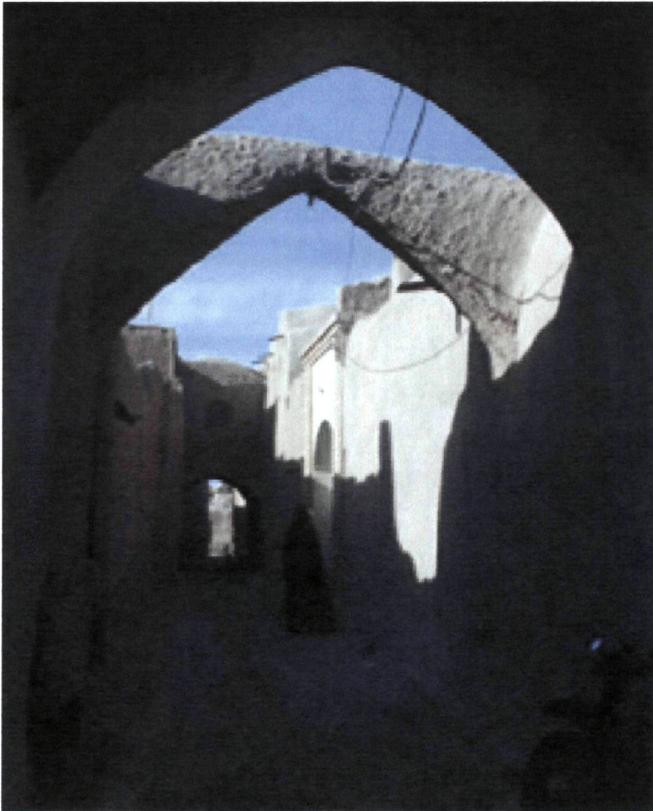
Figure 33 - Examples of Lowrise Arch 5&7



PASSAGEWAYS

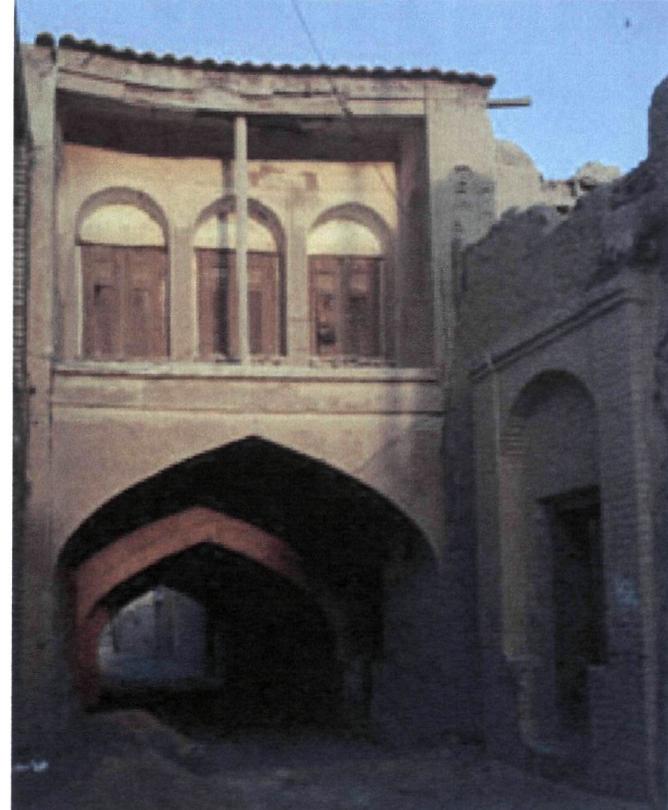
In Old town Naeen, passageways are long narrow corridors surrounded by tall walls and sometimes covered by arched ceiling and because of the hot and dry weather of this region, the most common passageway to decrease heat level in was arcade. They provide coolness and reduce intensity of daylight.

Figure 34 - Support for Tall Side-walls



The most important passageway in all Iranian old cities and towns is Bazaar. Bazaar has a linear plan with many branches which serve as neighborhood passages in residential areas (or *Mahalleh*).

Figure 35 - Covered passageway



SOCIAL /ECONOMICAL ELEMENTS

Ghaleh

In the center of the city, Narenj *Ghaleh* (or Qala, as most foreign sources called it) is situated on the highest natural elevation. Narenj *Ghaleh* has the remains of a sacred fireplace (a Zoroastrian sacred element) and an underground channel extending toward the city boundaries. The old city was dominated by the castle.

The original area of the *Ghaleh* is not clear because of the ruined walls and buildings attached to it, but inside *Ghaleh's* remaining boundaries we can recognize a garden with a house. This was probably the governor's house. There are two large water reservoirs outside of the *Ghaleh*, which are the oldest water reservoirs of the city. The Ab Anbars' entrances were inside the walls. The inner city and the citadel consist of very high and thick mud walls, and a deep, broad and dry ditch, with four large bastions, three at the corners and one at the middle of a face. The ditch has been filled with debris over a period of centuries and at the present time does not exist.

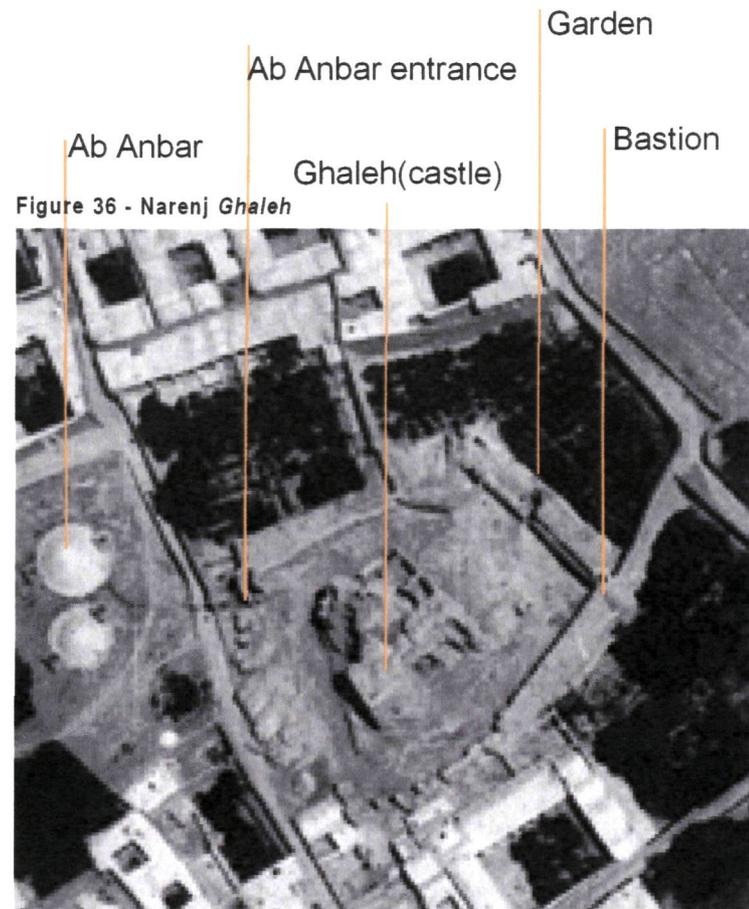


Figure 36 - Narenj *Ghaleh*

Masjed Jah-Meh

The main mosque of any traditional city is *Masjed Jah-meh*, where people gather and pray together, mostly on Friday, which marks the week's end. *Jomeh* in Farsi means Friday, which is another name for the main mosque, *Masjed Jomeh*.

In Naeen *Masjed Jah-Meh* is in Bob-OI-Masjed neighborhood, close to one of the main gates of the city, which is no longer extant. The construction date of the mosque is not clear, but some of the researchers believe it is from fourth century Hijri or 10th century A.D. However, some of its sections were added later, such as its 13th century AD minaret.

No dome was built for this mosque and the main spaces consist of four columned halls facing the four sides of the courtyard. There is one stucco *mihrab* or altar, which is from the 8 century Hijri. There are six entrances, three of which lead to the passageway to the south of the mosque. The facade of the mosque is in the brickwork of the 8th century Hijri Ilkhanian period .

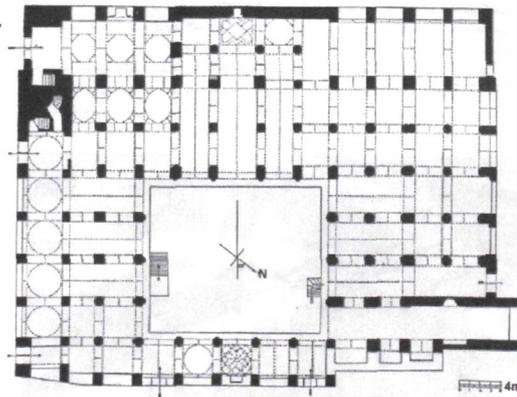
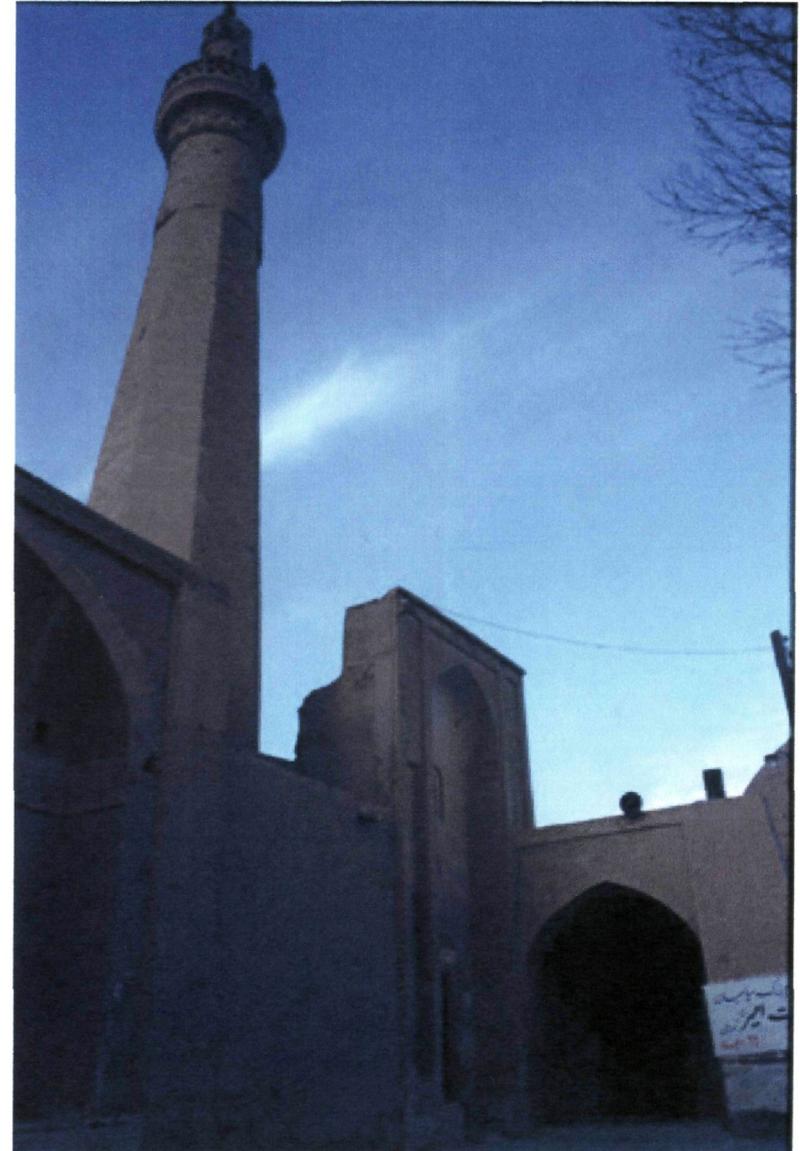


Figure 37 - *Masjed Jahmeh* Plan

source: A. Pope

Figure 38 - *Masjed Jahmeh* Entrance



***Masjed* Baba Abdolah**

Masjed Baba Abdolah was built on 7 century Hijri, according to a relief inside the main hall. This mosque is situated close to the bazaar's main route, and because of its large dome it is a landmark in the old town of Naeen.



Figure 39 - *Masjed* Baba Abdolah Courtyard

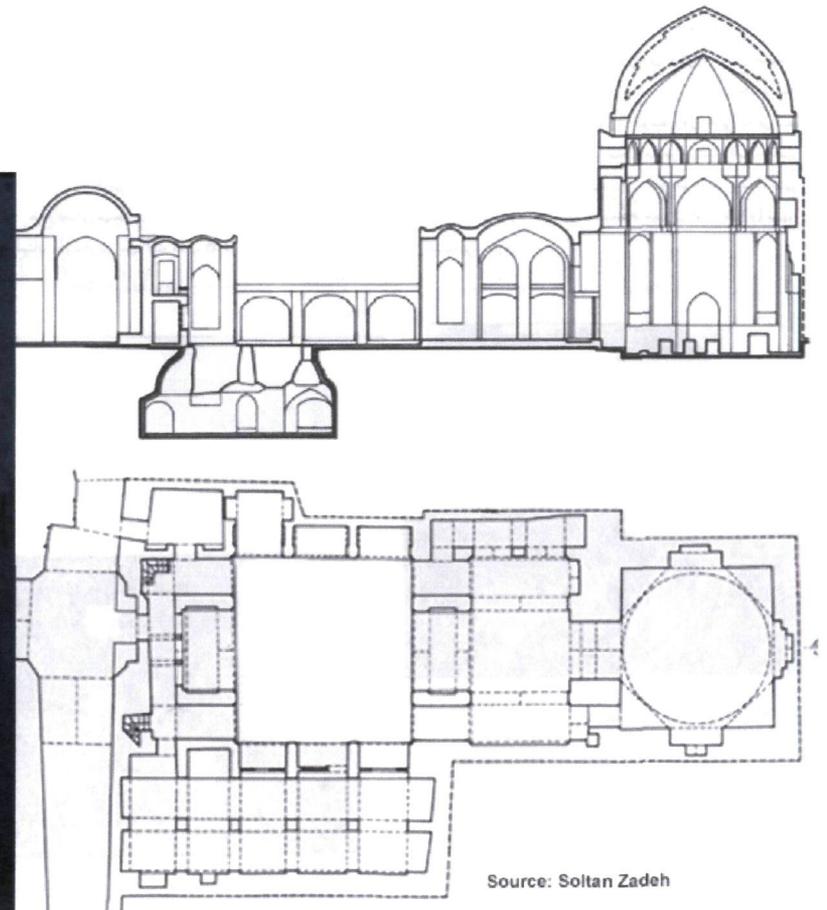


Figure 40 - Plan and Section of *Masjed* Baba Abdolah

Bazaar

One of the most important characteristics in the architectural composition of the traditional city was the bazaar. The bazaar has a linear shape and could be considered a structural spine of the traditional city. In fact, it is an arcade, which extended from one city gate to one of the main mosques of the city. It was a complex trading place and an important passageway, which intersected with many other passageways that served residential areas. The bazaar was the center of public life and the main public activities occurred in and around it. To serve the public, inhabitants and visitors, the bazaar had to provide a spatial arrangement suitable for the economic elements as well as the non-economic elements.

The economic activities included trade, storage, and production had specified places. For trade there was Rasteh bazaar, Chahar sue, and Timcheh; for storage Sarai, Caravanserai, and Khan bar; and for production Dalan, kargah, and gheisarieh. Gheisarieh was for the production and retail of some expensive goods, like jewelry. The non-economic

elements, like religious and educational buildings, public baths, caravanserais and water reservoirs were attached to the bazaar because, as the main passageway of the town, it afforded accessibility. The bazaar in Naeen extended along the main passageway of the old town from Chehel Dokhtaran Gate at one end to *Masjed Khadjeh* at the other end. This *Masjed* has blocked the main route and caused the 90° turns in direction of the main route, which goes to residential areas. There are 170 shops along its 350 m length and 3 m width. Because of the gradual formation of the bazaar, the shops have different sizes and designs.



Figure 42 - Naeen's Bazaar

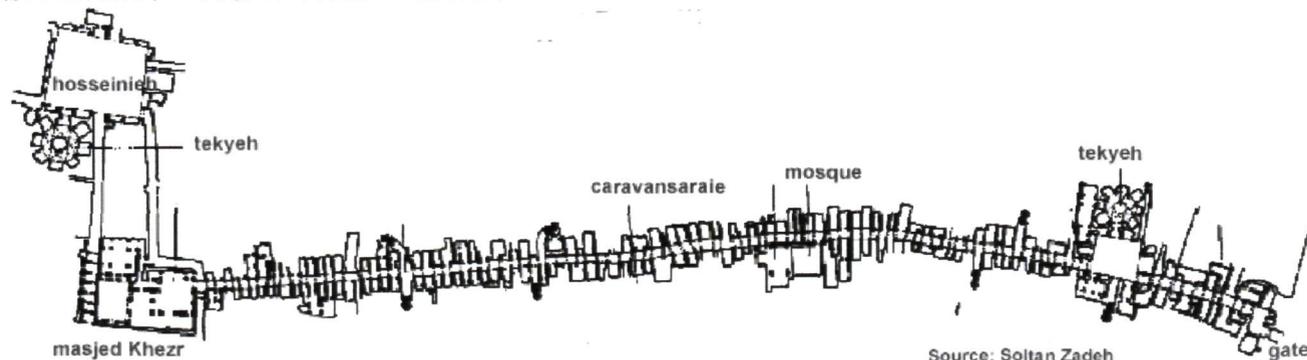


Figure 41 - Naeen's Bazaar Plan

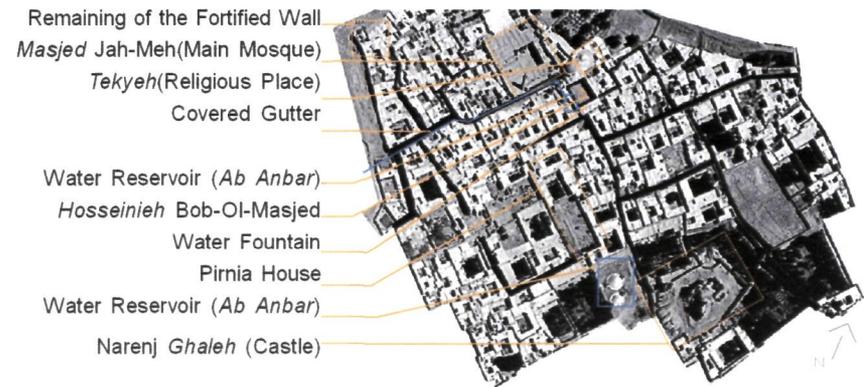
Source: Soltan Zadeh

Environmental Response at Neighborhood Scale

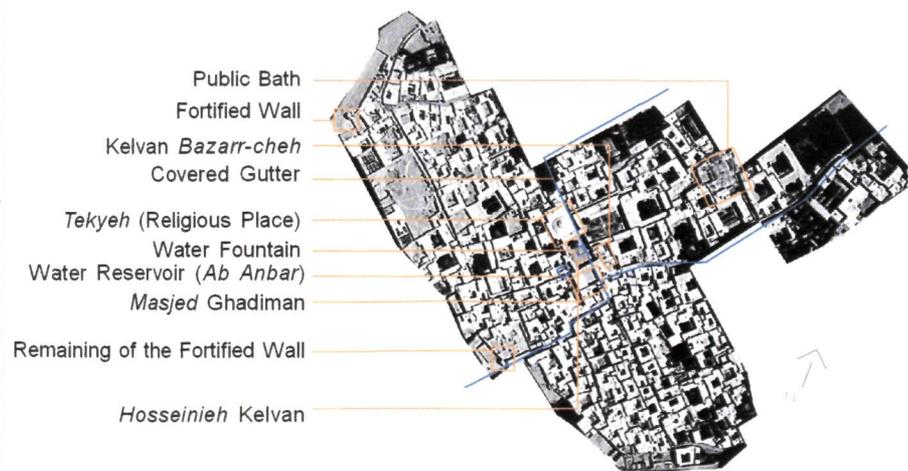
NEIGHBORHOODS

Naeen's old town has seven neighborhoods or *Mahalleh*. Kelvan neighborhood was formed as the first settlement area. Kelvan, Bobol Masjed, No Abad, Saray No, Panjaheh, Chehel Dokhtaran, Sang are the names of these seven neighborhoods in order of their formations.

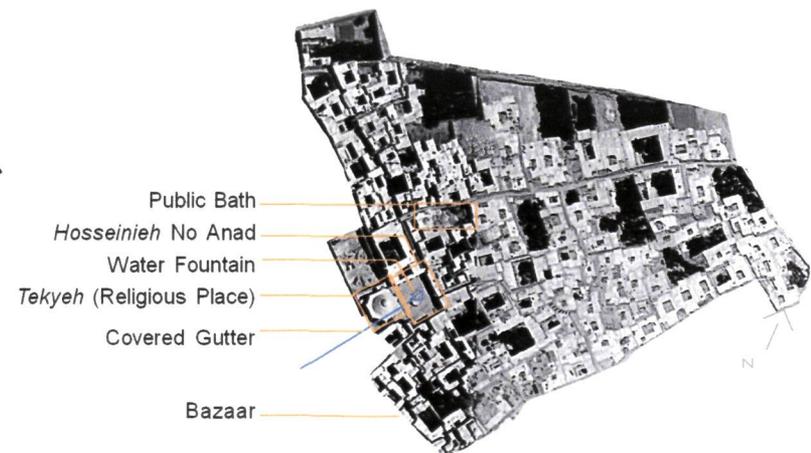
Bobol Masjed Neighborhood - Figure 44



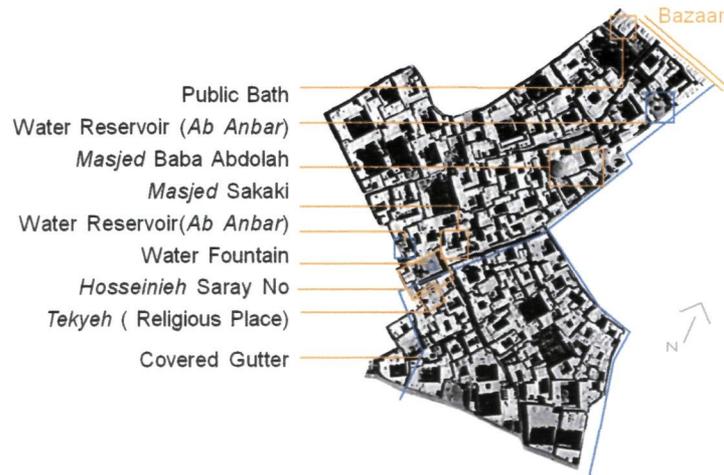
Kelvan Neighborhood - Figure 43



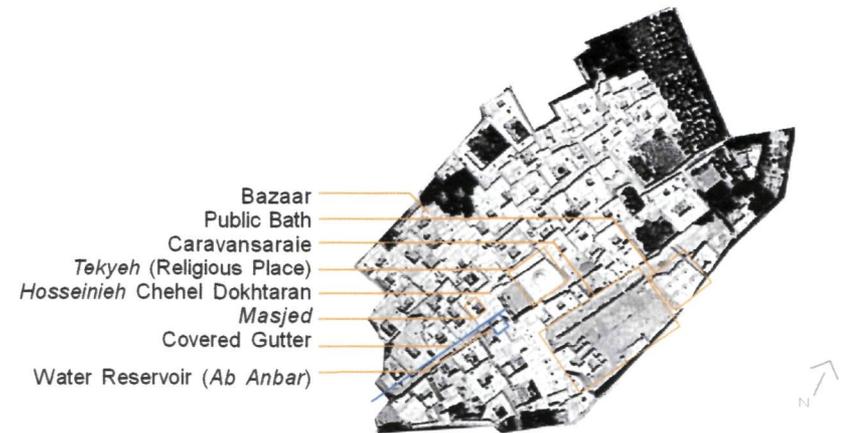
No Abad Neighborhood - Figure 45



Saray No Neighborhood - Figure 46



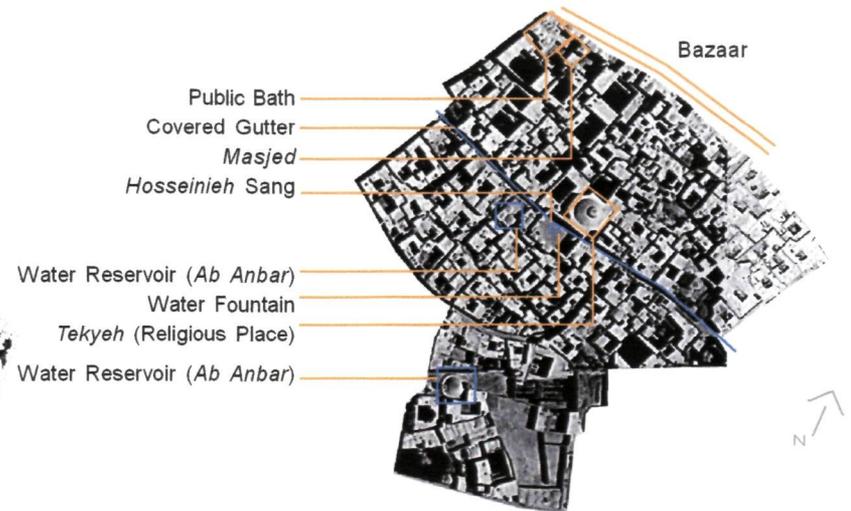
Chehel Dokhtaran Neighborhood - Figure 47



Panjaheh Neighborhood - Figure 48



Sang Neighborhood - Figure 49



Hosseinieh Kelvan (Kelvan courtyard)

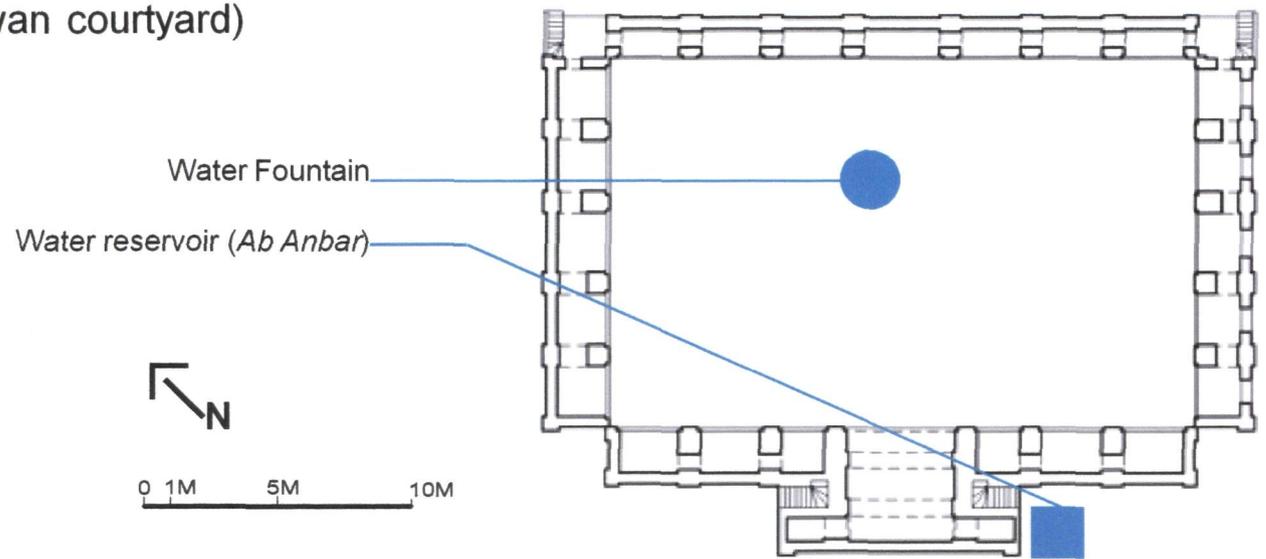


Figure 51 - Hosseinieh Kelvan's Model

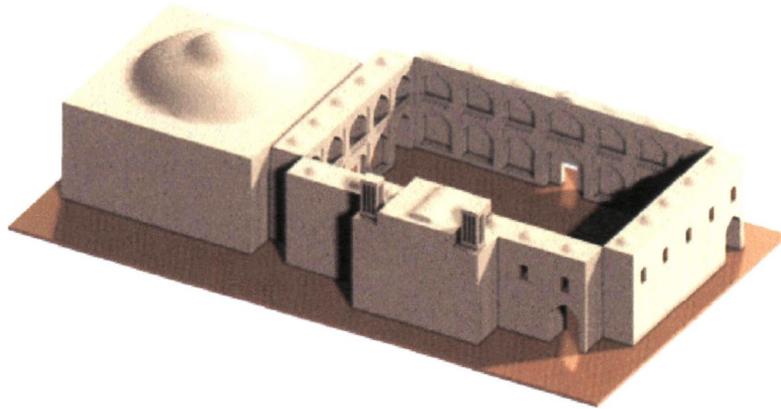
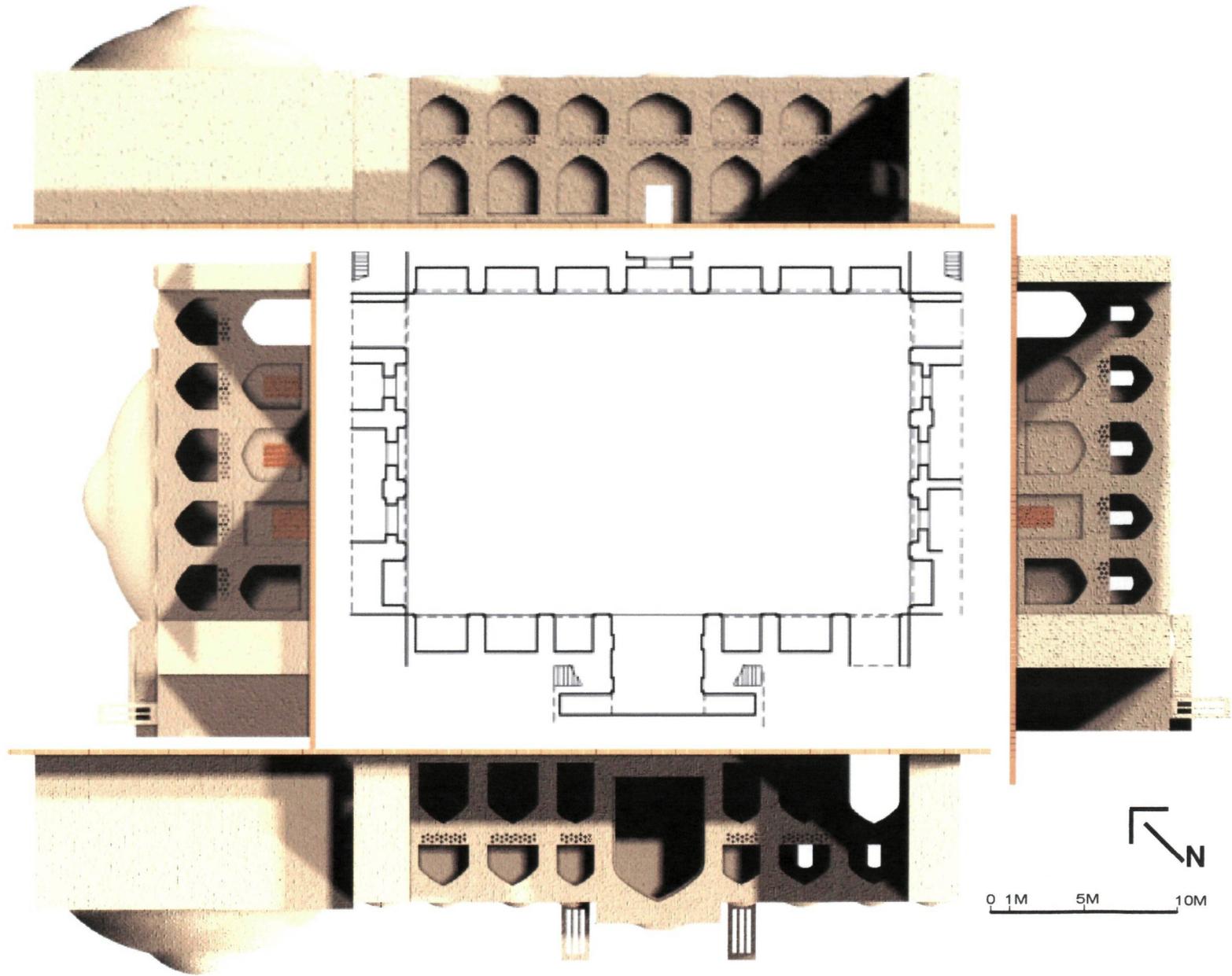


Figure 50 - Kelvan Courtyard

Figure 52 - Hosseinieh Kelvan's Second Floor Plan



Figure 53 - Hosseinih Kelvan's First Floor Plan and Models



Hosseinieh Bobol-Masjed (Bobol Masjed courtyard) - Figure 54



Hosseinieh Bobol-Masjed(Bobol Masjed courtyard)

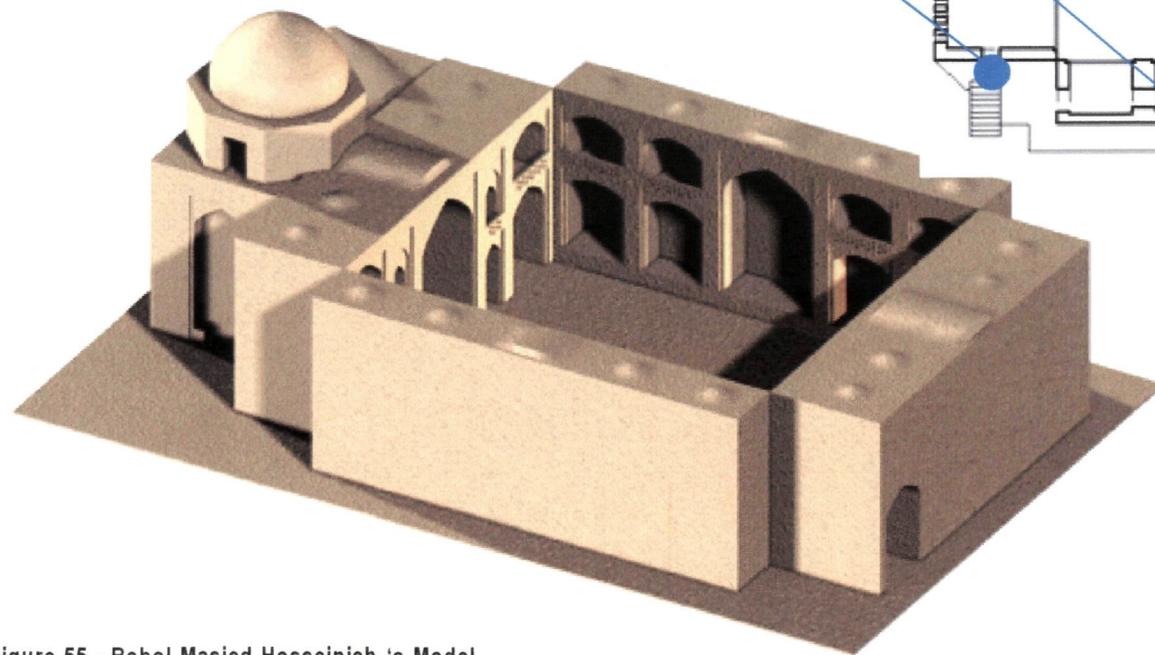


Figure 55 - Bobol Masjed Hosseinieh 's Model

Figure 56 - Hosseinieh Bobol Masjed's Second Floor Plan

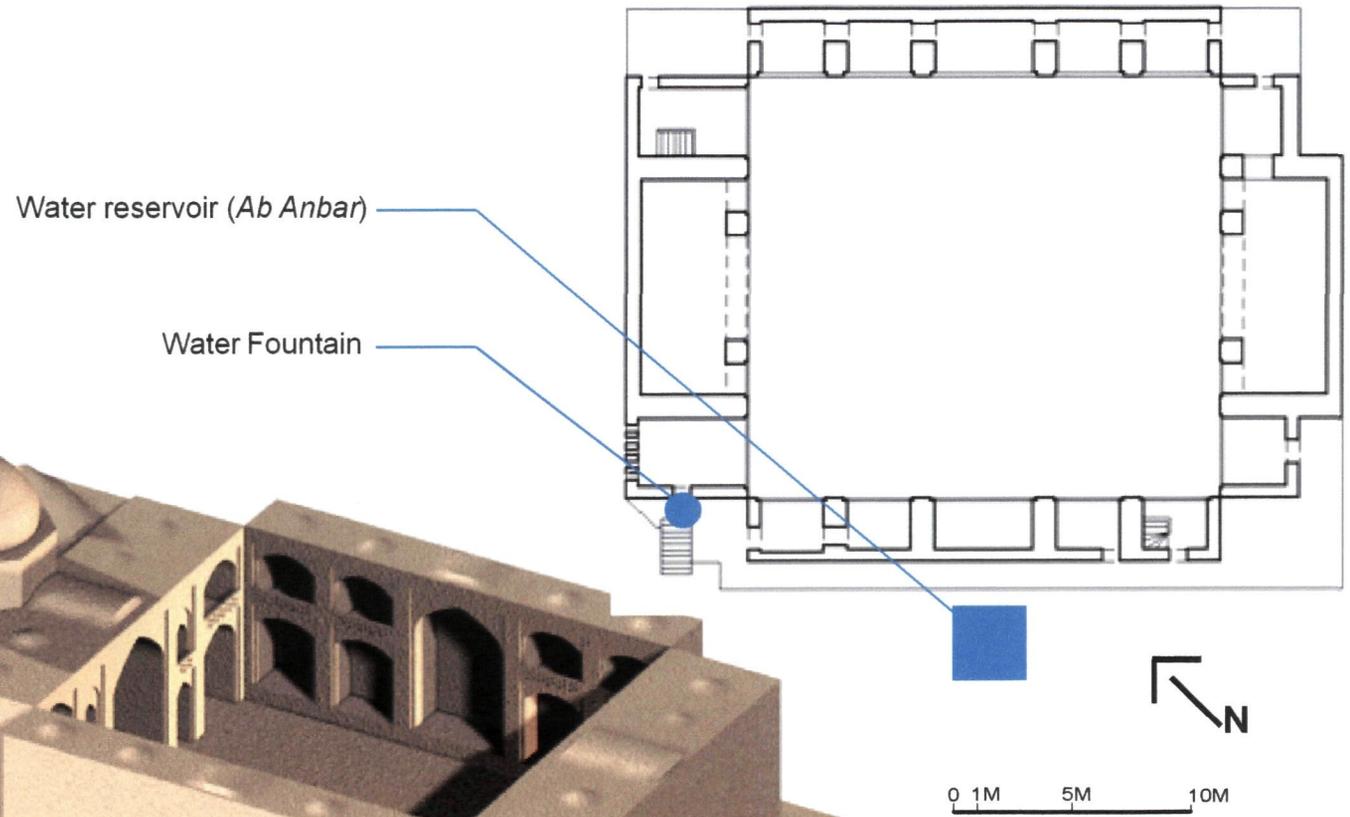
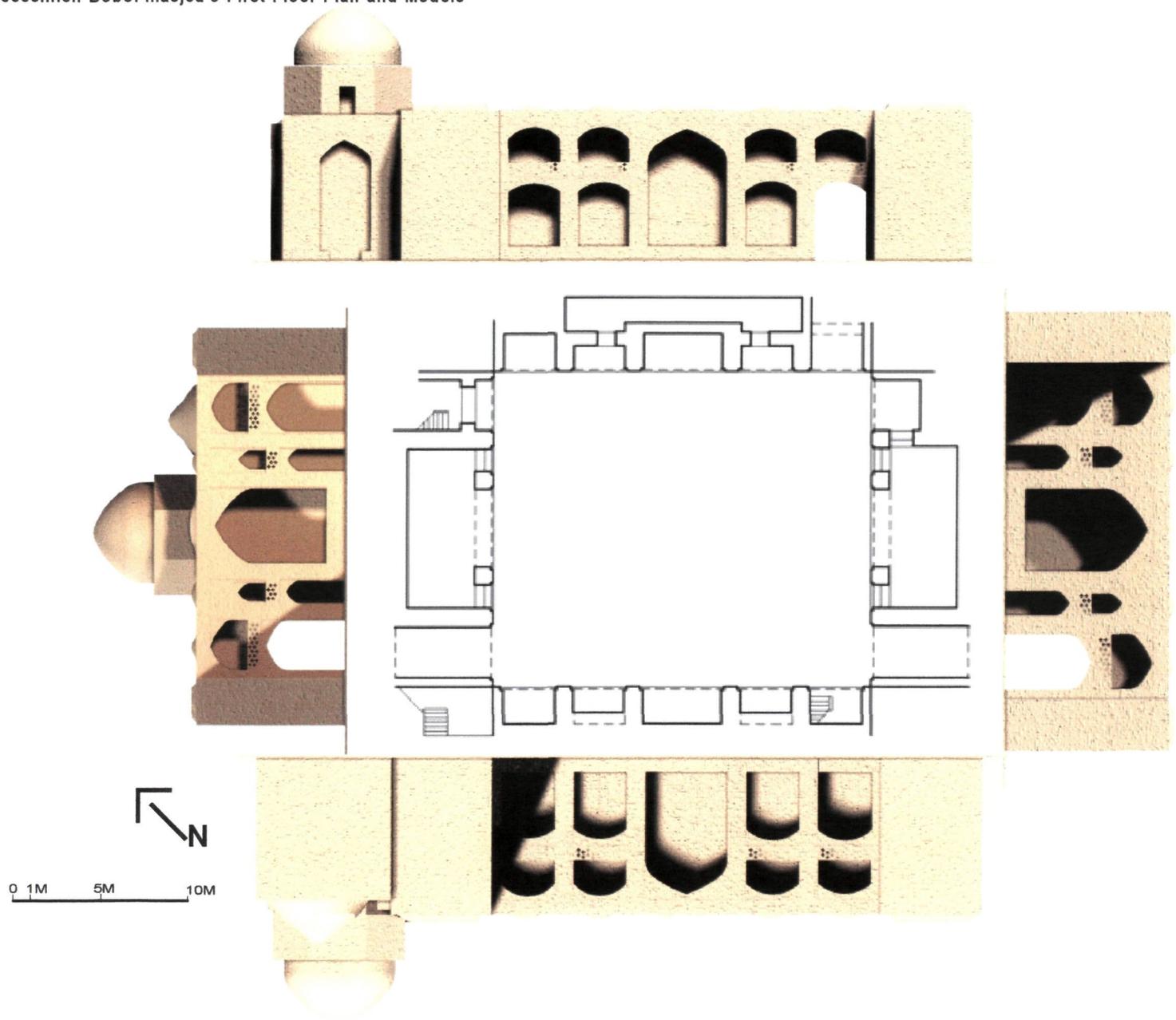


Figure 57 - Hosseinieh Bobol masjid's First Floor Plan and Models



Hosseinieh No Abad (No Abad courtyard)

Figure 58 - Hosseinieh No Abad's Plan

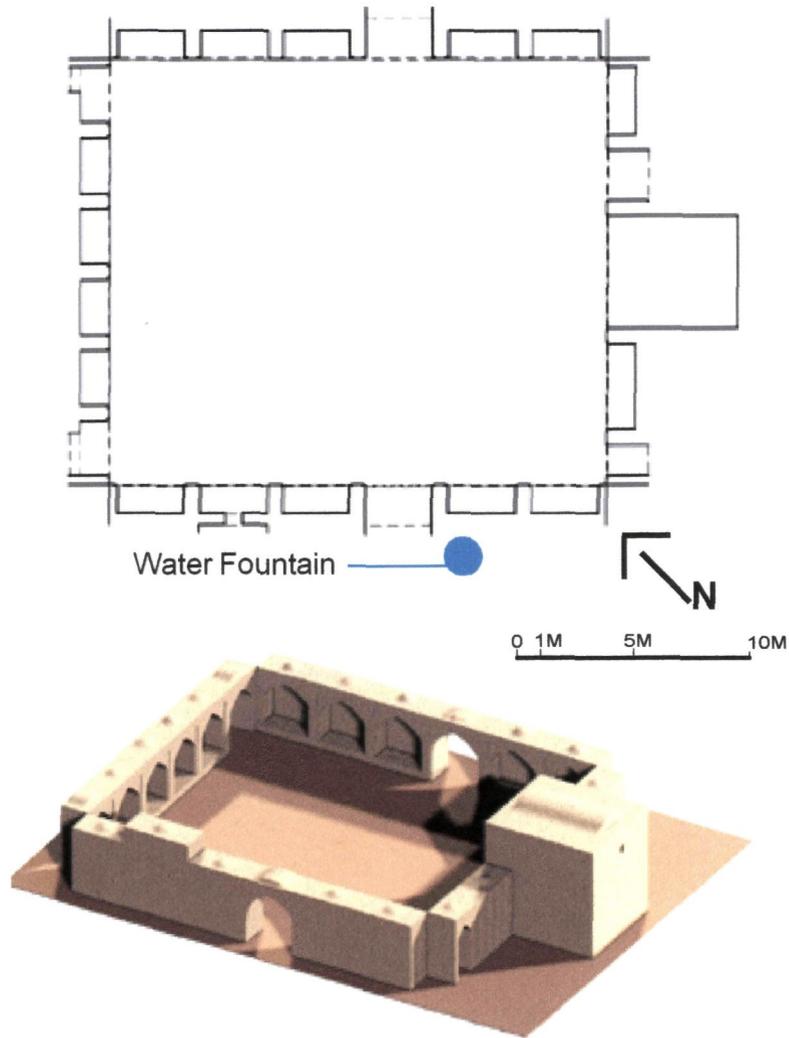


Figure 59 - Hosseinieh No Abad's Model

Figure 60 - No Abad Courtyard

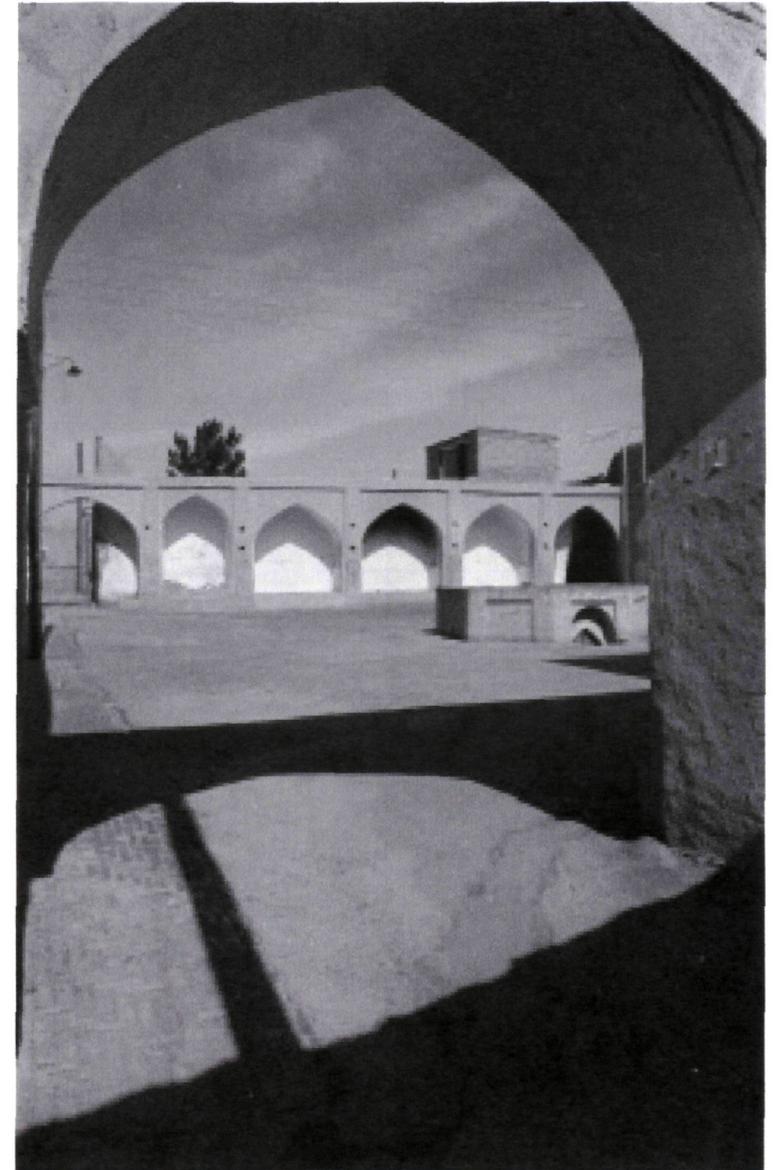
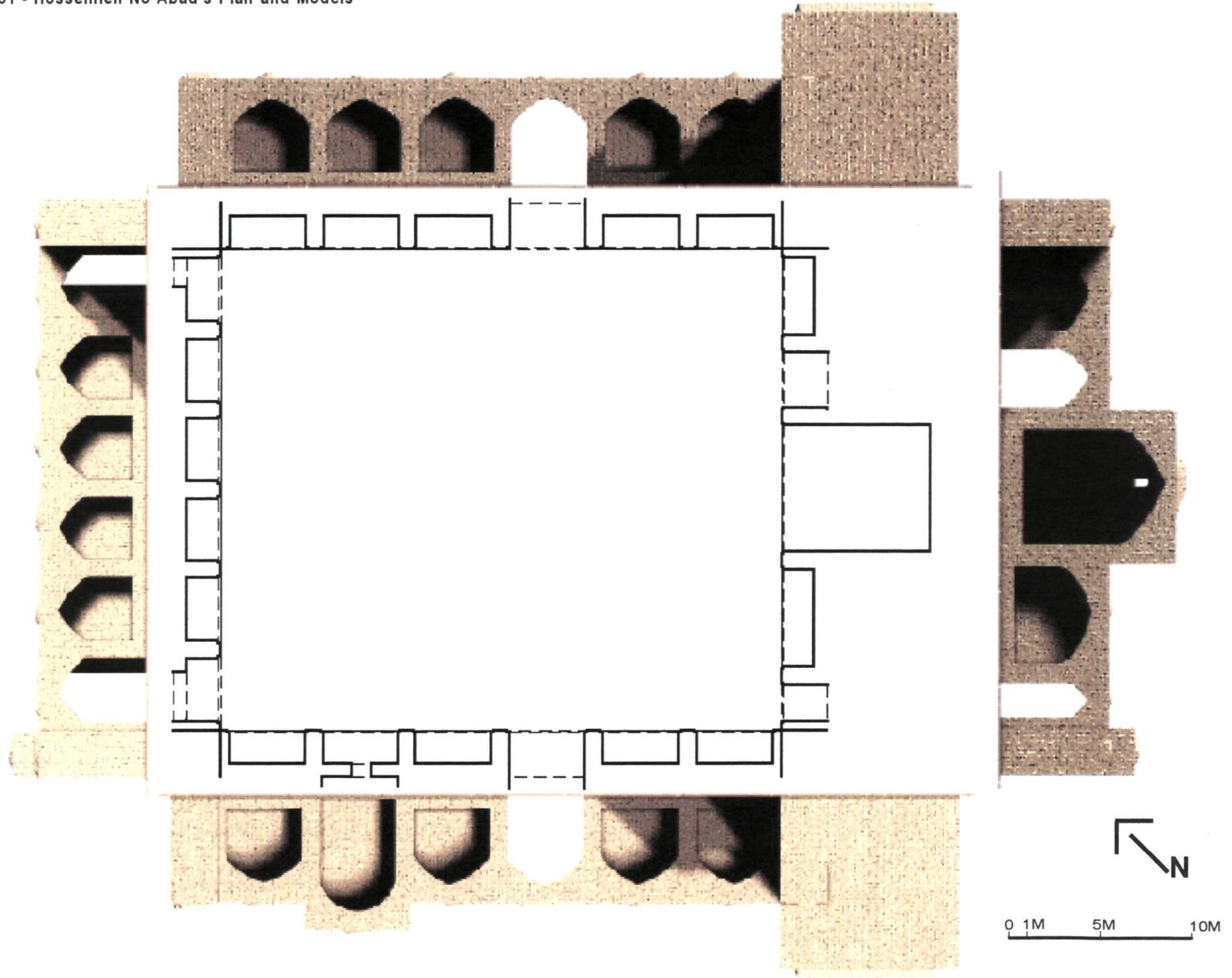


Figure 61 - Hosseinieh No Abad's Plan and Models



Hosseinieh Saray No (Saray No courtyard)

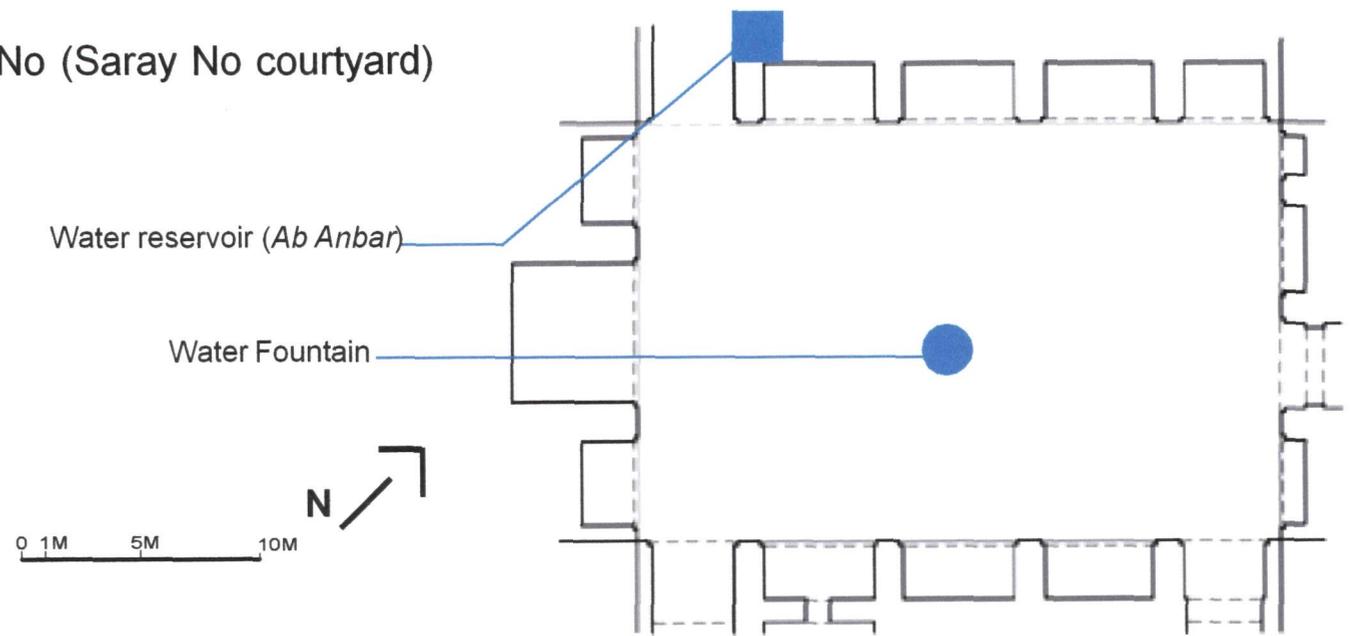


Figure 63 - Hosseinieh Saray No's Plan

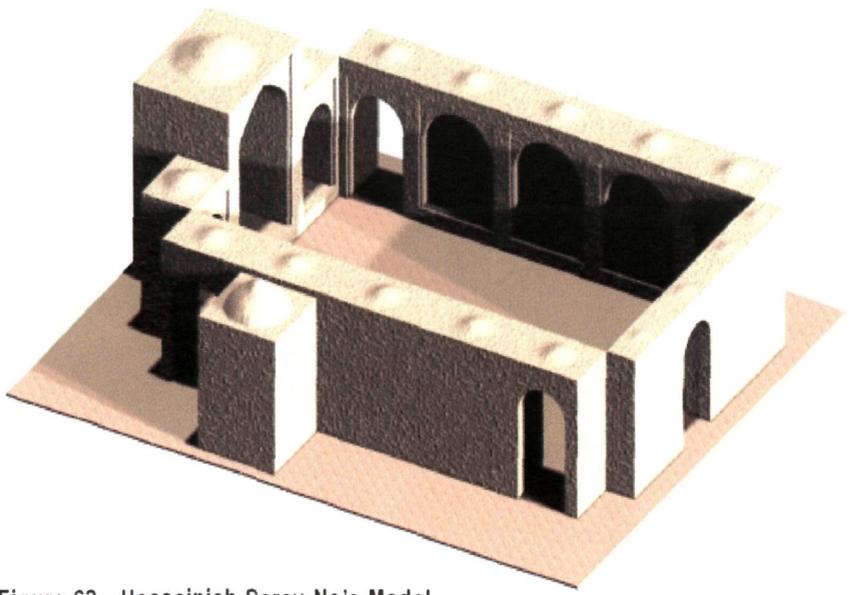
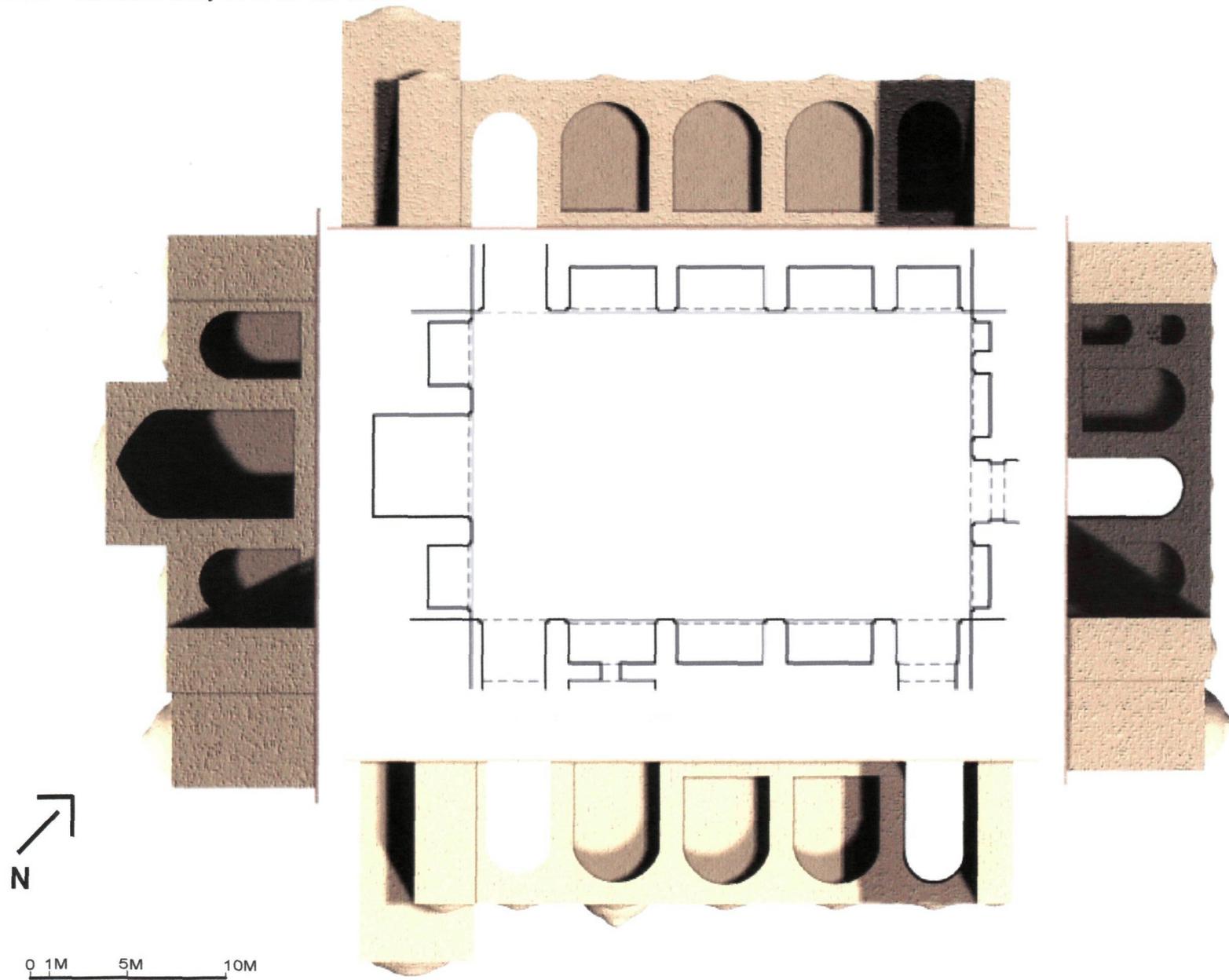


Figure 62 - Hosseinieh Saray No's Model



Figure 64 - Saray No Courtyard's Model

Figure 65 - Hosseinieh Saray No's Plan and Models



Hosseinieh Panjaher (Panjaher courtyard)

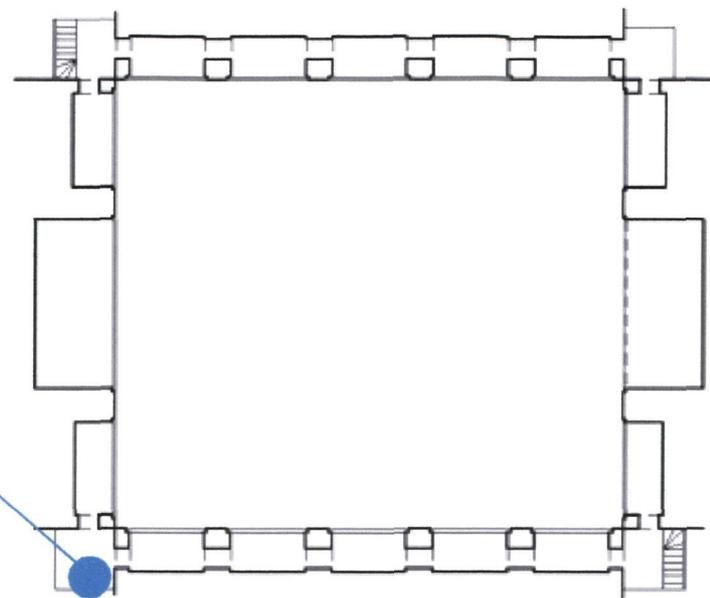
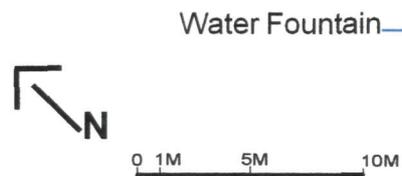


Figure 67 - Hosseinieh Panjaher's Second Floor Plan

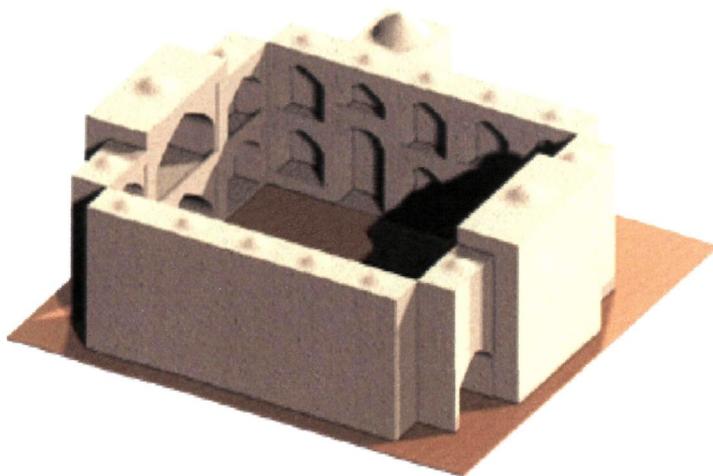
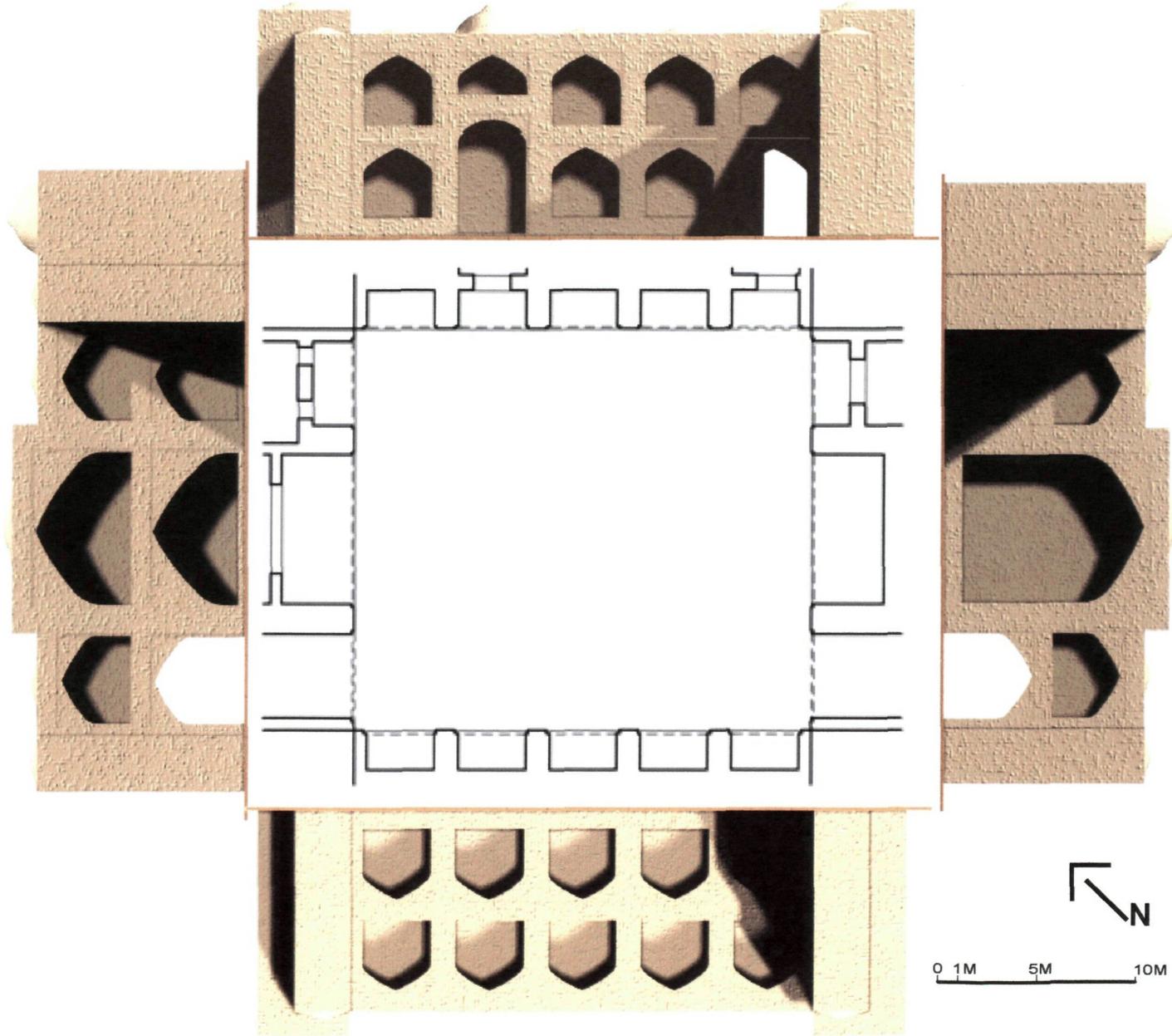


Figure 66 - Hosseinieh Panjaher's Model



Figure 68 - Panjaher Courtyard

Figure 69 - Hosseinieh Panjajeh's First Floor Plan and Models



Hosseinieh Chehel Dokhtaran (Chehel Dokhtaran courtyard)

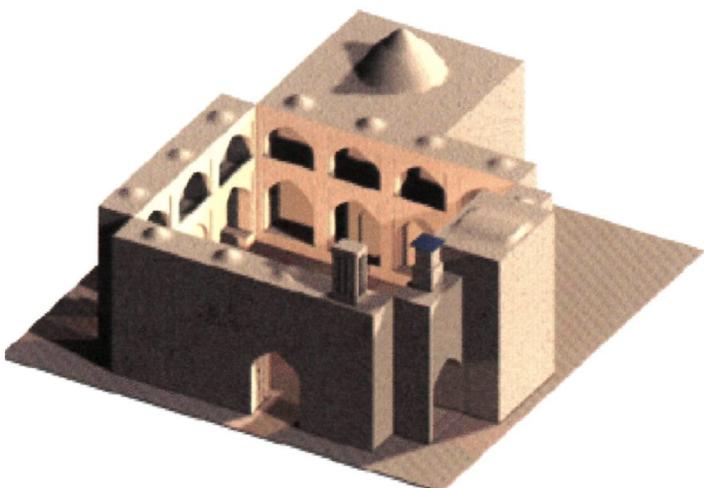
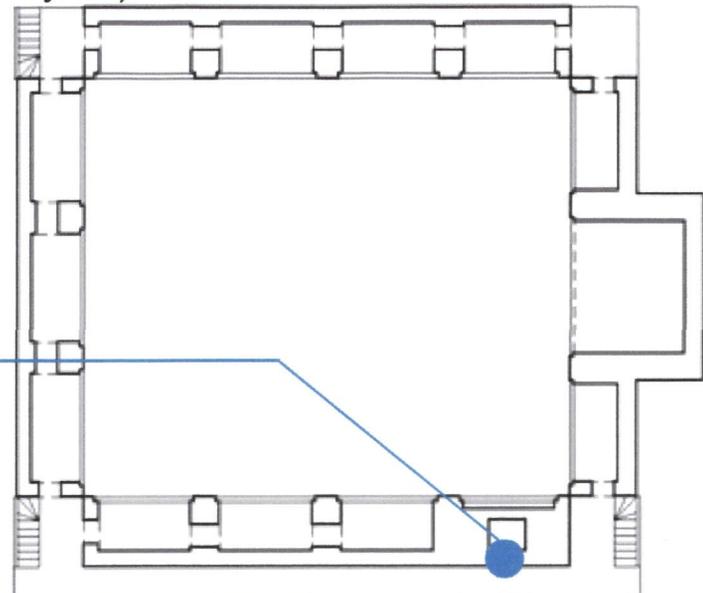
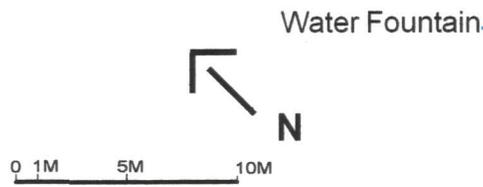


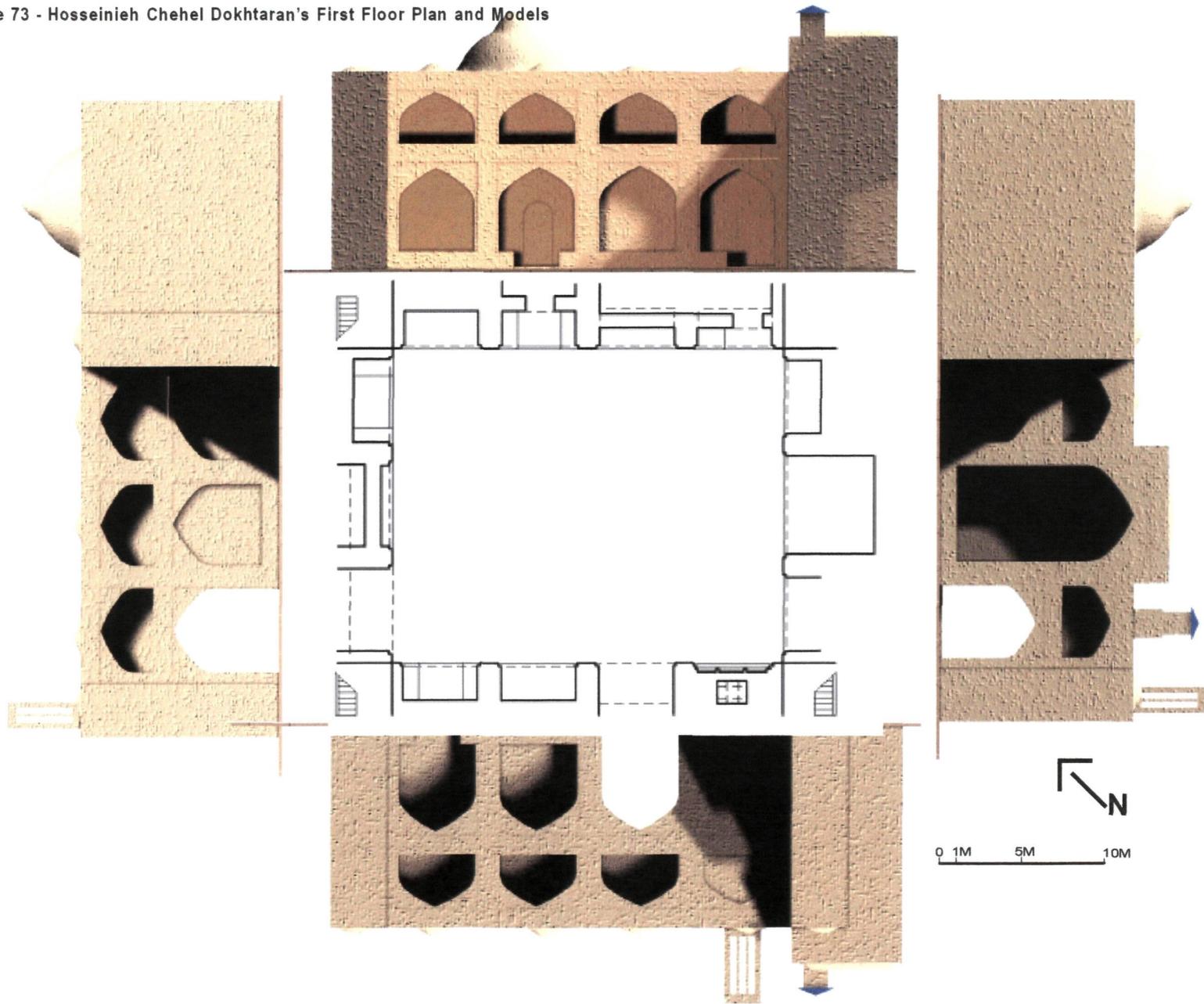
Figure 71 - Hosseinieh Chehel Dokhtaran's Second Floor Plan



Figure 70 - Hosseinieh Chehel Dokhtaran's Model

Figure 72 - Chehel Dokhtaran Courtyard

Figure 73 - Hosseinieh Chehel Dokhtaran's First Floor Plan and Models



Hosseinieh Sang (Sang courtyard)

Water Fountain

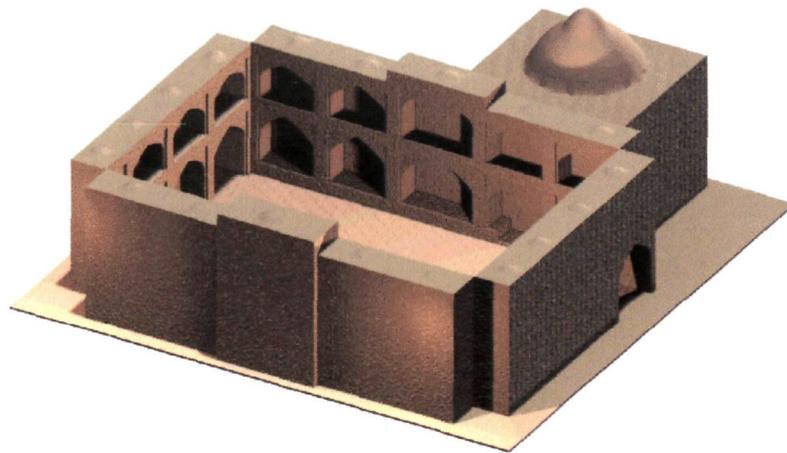
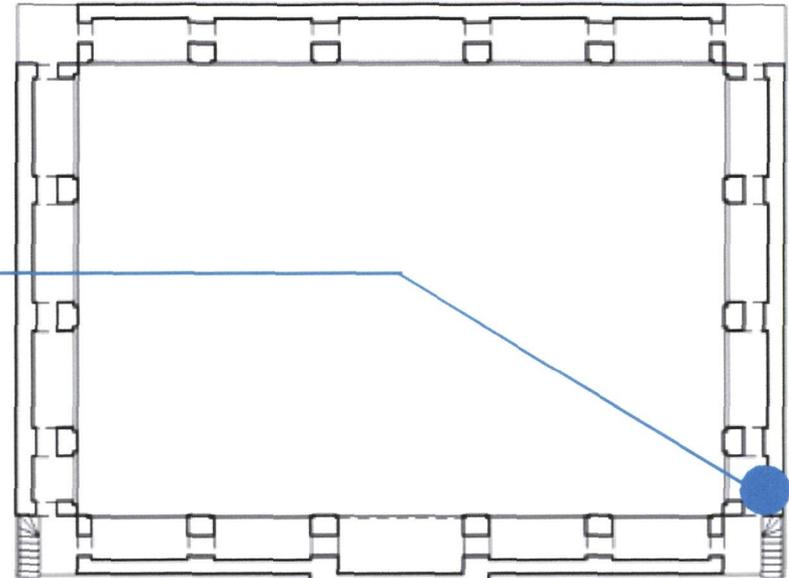
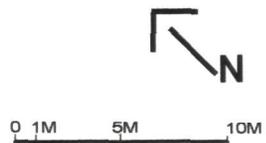


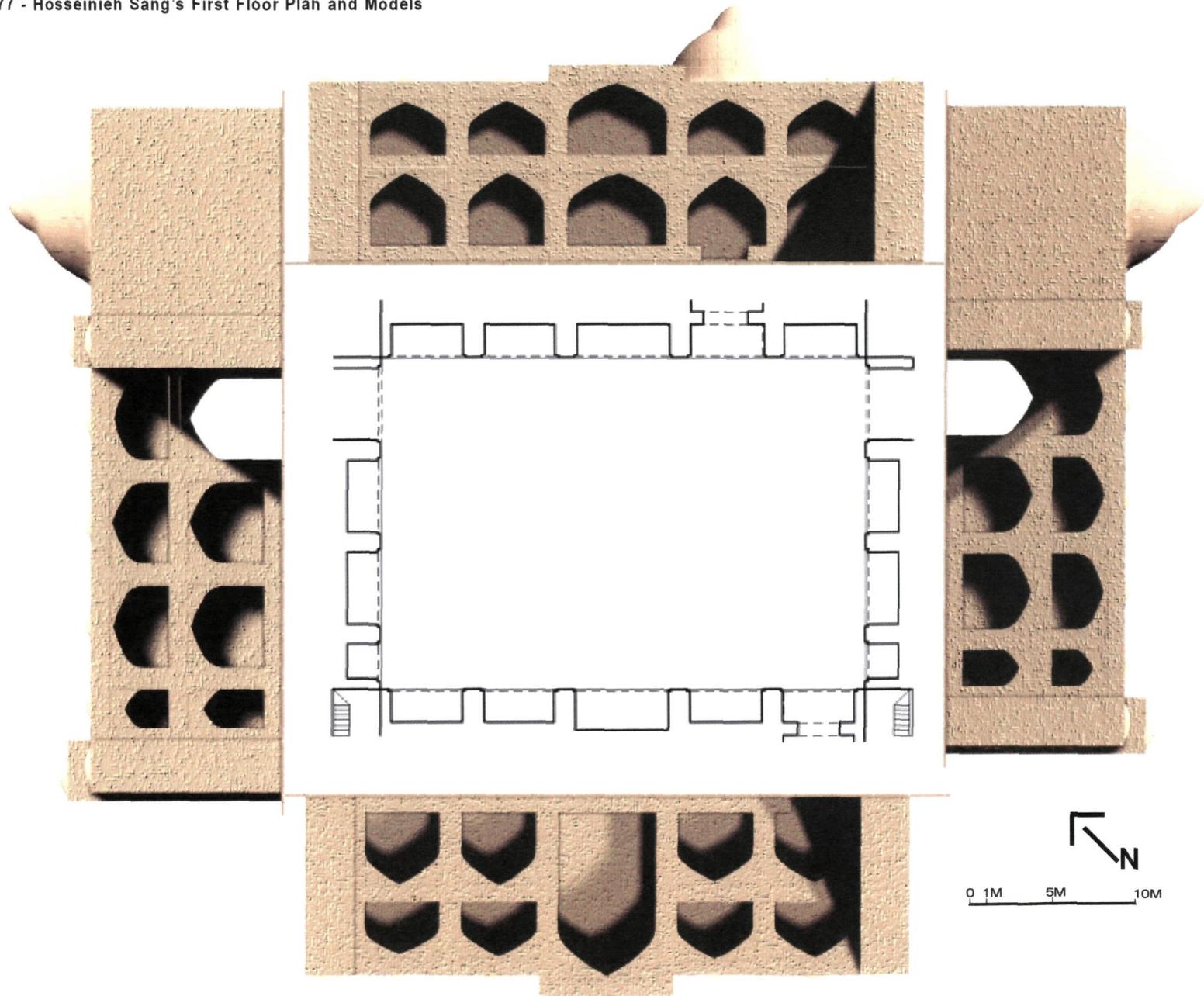
Figure 75 - Hosseinieh Sang's Second Floor Plan



Figure 74 - Hosseinieh Sang's Model

Figure 76 - Sang Courtyard

Figure 77 - Hosseinieh Sang's First Floor Plan and Models



Environmental Response at House Scale

HOUSE

In hot dry zones, air temperature drops considerably after sunset from re-radiation to the night sky. The air is relatively free of water vapor that would reflect the heat or infrared radiation back toward the ground, as occurs in warm humid regions. To enhance thermal comfort, this phenomenon has been used in the architectural design of houses by employing the courtyard concept.

Order in Structure

Structure in every unit of traditional architecture is ordered according to two axes. Sometimes the two axes have the same strength in ordering the spaces around them, as exemplified in the square. But in some cases one axis predominates over, as in the case of a rectangle. In the courtyard, the intersection of the two axes forms a center point while more generally the axes provide the references for symmetry. The order of four façades and the symmetry of elements demonstrate that these axes were worked out in plan as well as in volume; they also imply a third axis pointing toward the sky. The axes are orientated according to the sun and wind.

The courtyard's axes are from northwest to southeast and northeast to southwest to prevent the penetration of direct sunlight. This orientation was intended to help decrease heat and light by re-reflecting them. It has also helped the religious people of Naeen built their houses facing Ghebleh (house of God in Mecca - Saudi Arabia), which is also the indicator used in locating a mosque.

The Role of Water in Ordering the Structure

The direction of the crooked streets and passageways of the old town are diagonal, running Northwest-Southeast to offset the prevailing dusty desert winds and the rays of the sun.

The inhabitants of the old Naeen brought water to the town through the ghanats. Inside the town water was closer to the surface and transferred to the covered gutters. The routes of the gutter from the way to the *Ab Anbars* or water reservoirs, distributed water to the houses along the passages. Water entered the houses via an underground channel in the basement; from here it could be easily transferred to the garden or the basin in the courtyard. One of the important advantages of the house's interior water routes was the cool summer rooms as well as the freshness and coolness of water itself.

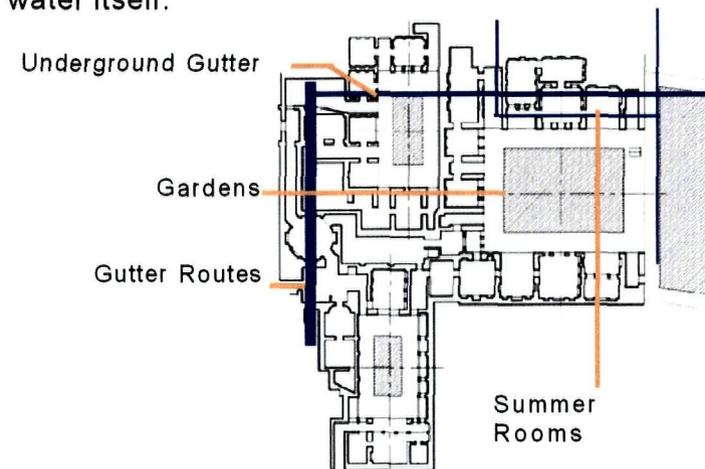


Figure 78 - An example of Gutter Routes in House

Andarooni (Inside) - *Beerooni* (Outside)

Most of large houses in traditional architecture have two parts, an interior or exclusive part (*Andarooni*) and an exterior or inclusive part (*Beerooni*). *Andarooni* was for the family and *Beerooni* for the guests and official events like social meetings for the men of the house. Every part had a courtyard and could be independent of the other.

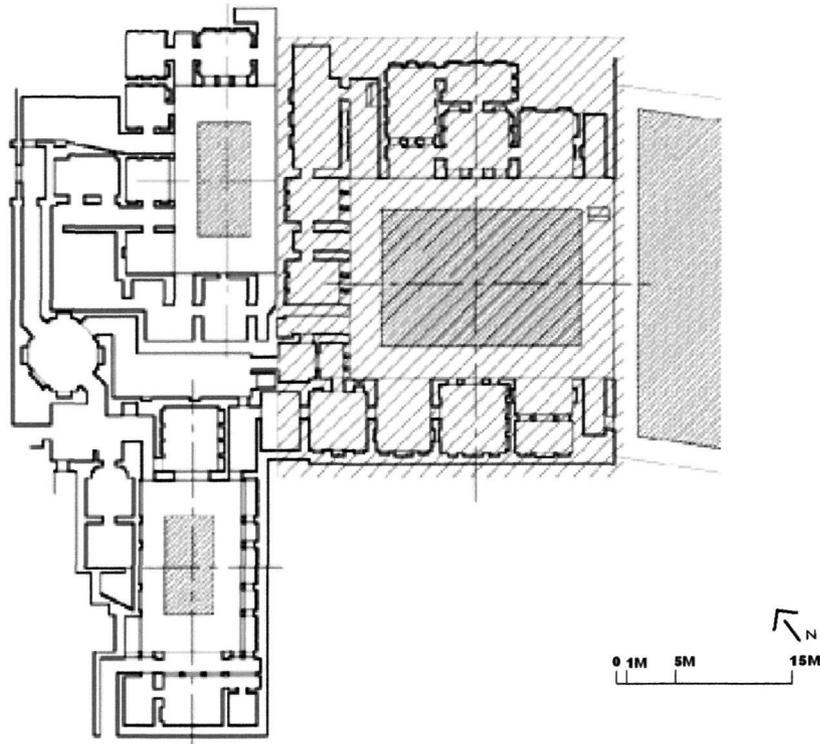


Figure 79 - An example of *Beerooni*

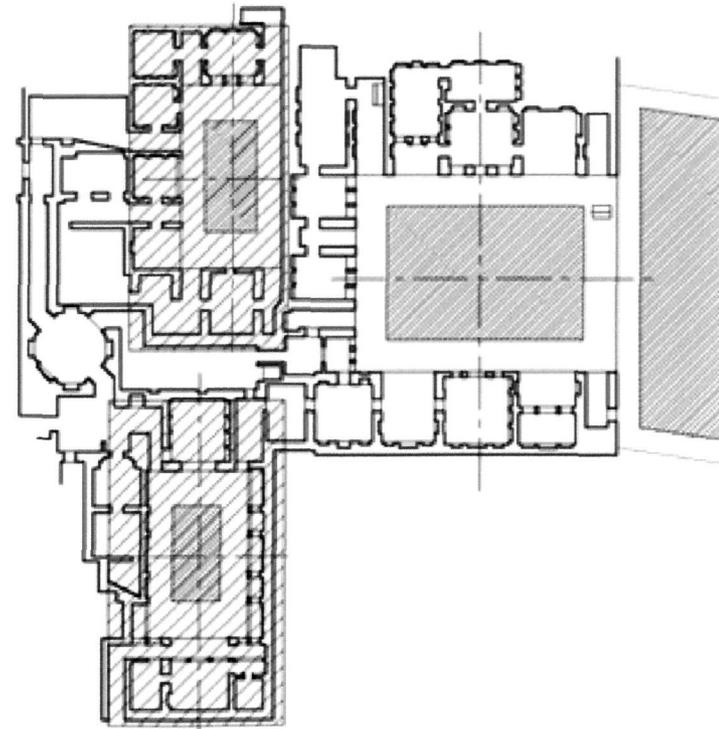


Figure 80 - An example of *Beerooni*

Courtyard

The cooling system used in the courtyard house is based on air movement by convection. Warm air is less dense than cool air and therefore will rise in an environment of cool air. In vernacular architecture, this effect has been exploited to produce small areas with cool breezes, using the ground heated by the sun as the heat source. As long as a large volume of cooler air is available and is unaffected by the heat from the sun, the hotter the sun heats the ground, the stronger will be the breeze.

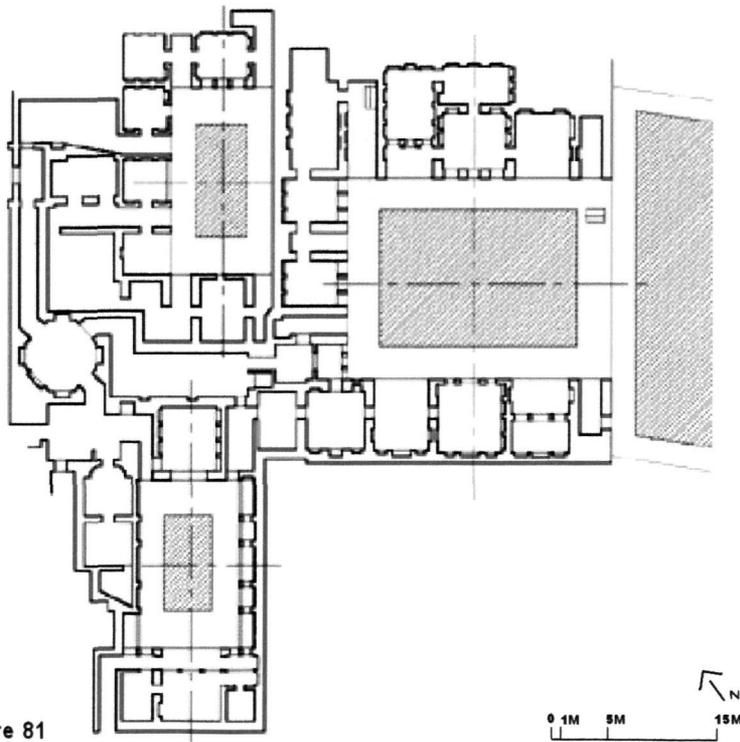


Figure 81

Entrance

Most of the houses had one entrance but there were some cases with one primary and one or two secondary entrances. In those houses of more than one entrance, each *Andarooni* and *Beeroni* had a separate entrance. Sometimes there was a shared space for neighbors at the juncture of public and private realms called *Hashti* (octagonal). The entrance in traditional architecture had a very complex design because of its role in providing the hierarchy of movement from outside to inside, from public to private; transition had to be step by step.

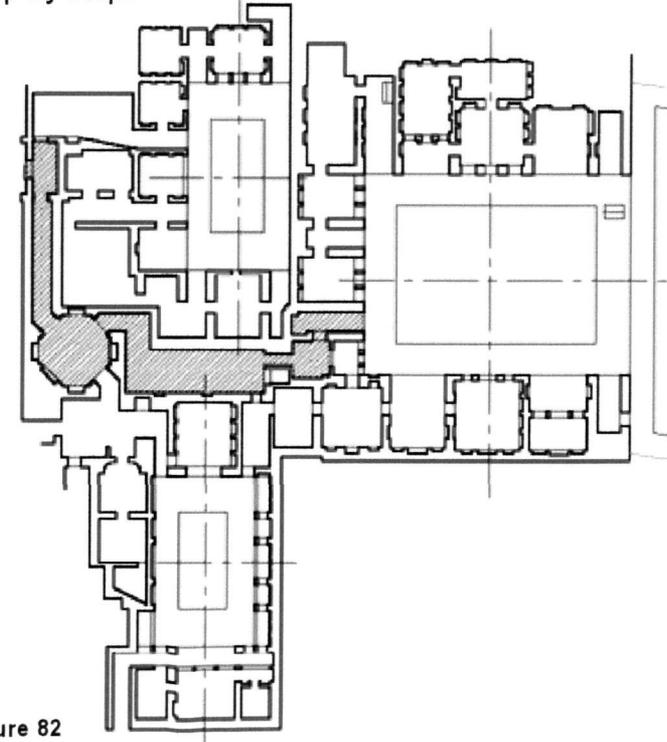


Figure 82

Veranda or *Eivan*

Attached to the courtyard, on the summer side of the building, was an enclosed covered place located, called *Eivan*, which is similar to a veranda. *Eivan* was a place to just be and enjoy the coolness of the courtyard as well as to provide access to the different spaces of the house.

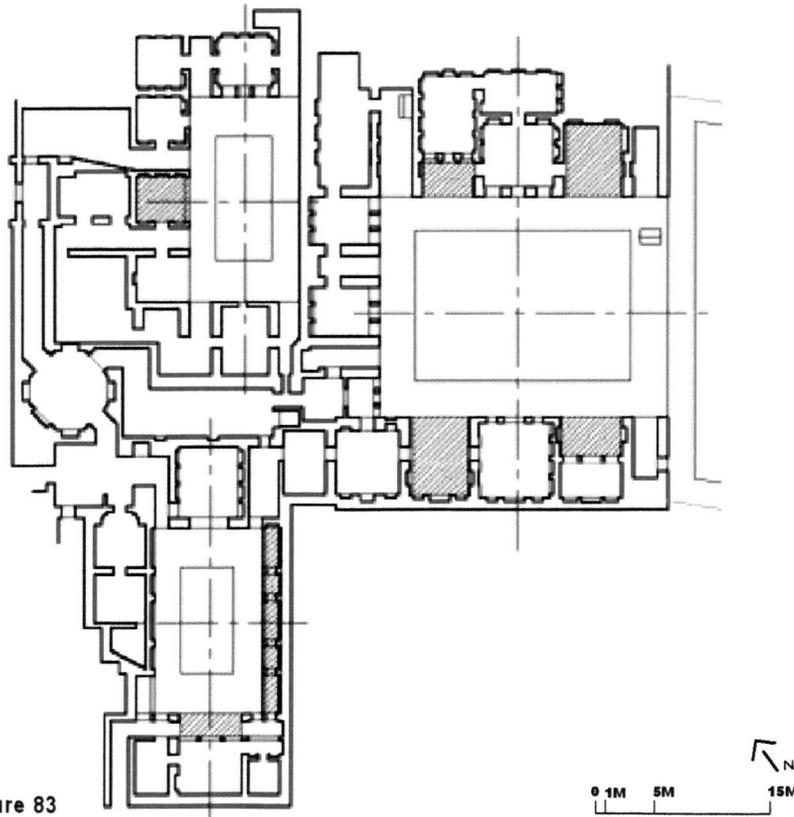


Figure 83

Main Room

The main room faced the courtyard and had high ceilings. It was used for most activities. The main room was named according to the number of openings to the courtyard that it possessed. Hence, it has been called three-door (*Seh Dari*), five-door (*Panj Dari*) or seven-door (*Haft Dari*). These entrances were decorated with lattices of colorful glasses called *Orsi*.

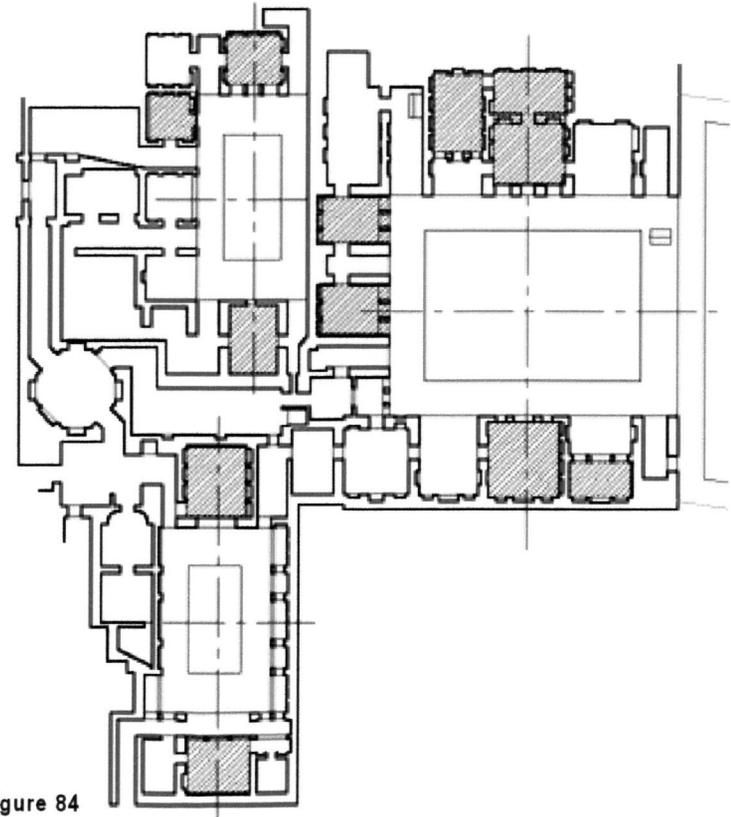


Figure 84

Services

Kitchen, washroom, storage were some of the service spaces of a house. They were located behind the main ones and in corners of the plan.

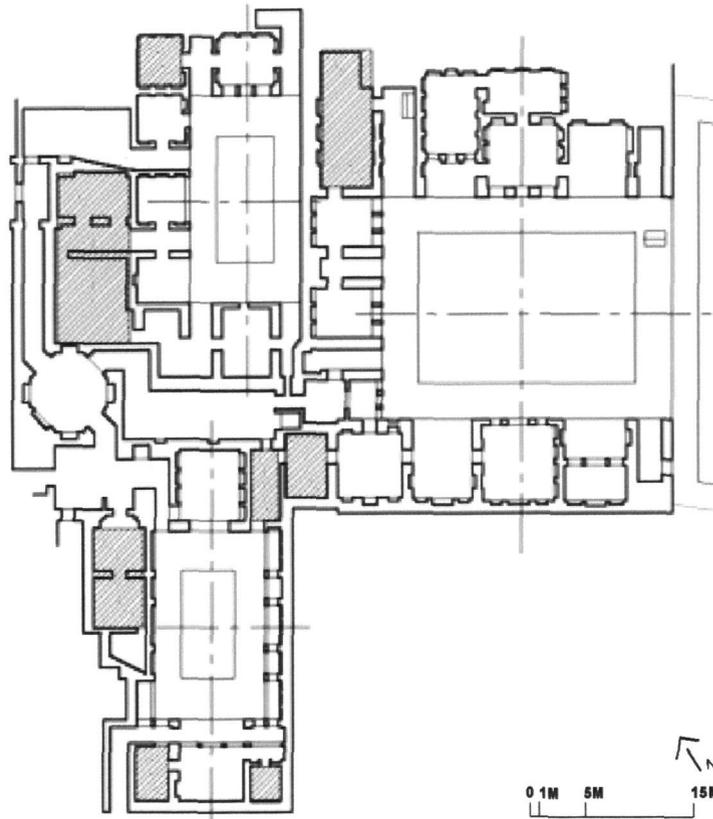


Figure 85

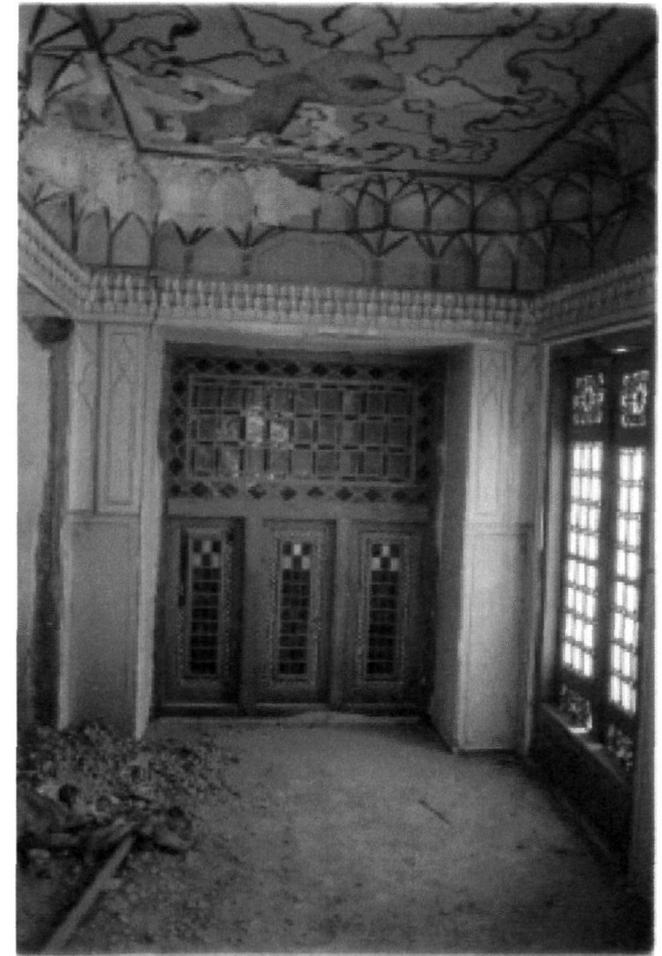


Figure 86
Inside the Fatemi House Colorful glasses of window and screen door called Orsi.

New town

NEW TOWN

GENERAL VIEW

On aerial photographs and plans of the new town of Naeen one will look in vain for the regular network of wide roads, which characterize the western world's town planning since Renaissance with completely detached buildings. The old town of Naeen in its entirety and in detail is the opposite of the "modern town".

The new town is completely detached from its natural surroundings, and it is formed by modern factors, like machines. In our industrial age the initial wishes and needs of the inhabitants to live with nature have been sacrificed for the sake of business. Wide, straight streets with regulated intersections suitable for cars, are characteristics of this new town.

This situation is clearly seen in an aerial view of some new neighborhoods in Naeen's new town. Actually, the term neighborhood does not have the same definition as did in the discussion of the old town. In this arrangement mere proximity defines a neighborhood; there is no defining center or edge. Street, alley, house and, of course, some small grocery shops are the only functions that we could find in these neighborhoods. The rest of the services like schools, market, parks, hospitals, are located according to the scale of the city. As we can see in this picture, residential blocks are separated by streets, which provide the proper connections for services. Some small-scale services are located along the edges of the streets.

Figure 87 - Aerial view of New Town

Main Connection

Wide Street

Residential Area

Alley

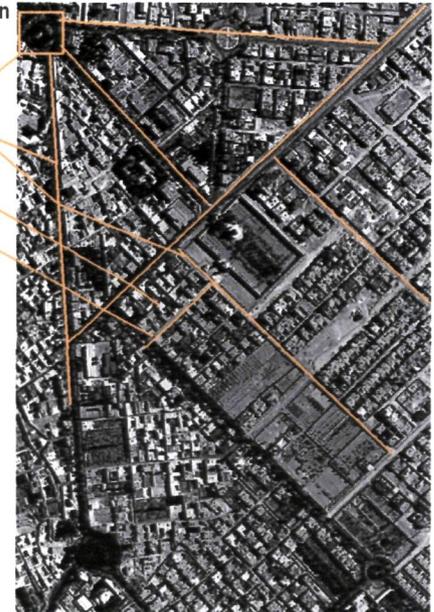


Figure 88 - New Market



COMPARING OLD AND NEW

This review of the environmental aspects of Naeen's long-established urban forms has verified how well the traditional town, through compactness, limited open space, uniform buildings, street forms and careful orientations, and order in house structure reduced the effects of the harsh climate, such as intense sun radiation and dusty winds.

Today most traditional cities have been disrupted by new urban developments. The old bazaar and residential areas have been built over and often replaced by new wide avenues and apartment complexes. Elements of the old town are often destroyed and replaced by new structures without any consideration of their cultural and ecological importance. Known as "old towns", traditional cities now suffer adjacent to the new cities. The urban poor, who often cannot afford to repair their dwellings, mainly inhabit these old cities.

The new city is the twentieth century expansion of the old town, often surrounding and spreading out of the old city and stretching over a large area, with prearranged wide streets mostly in grid patterns and Western style. It is a reproduction of modern Western cities, not necessarily appropriate to the arid climate of the Iranian Plateau; It is also largely incompatible with local cultural needs. One of the important changes concerns the *ghanats* and their replacement by deep wells.

Deep wells were introduced in Iran by the armies during World War II. In Iran, the total number of deep wells has increased recently because of their cheaper construction cost when compared to those of *ghanats*. Although *ghanats* require extra expenses for maintenance after construction to

keep them operational, they are more reliable than deep wells because the *ghanats* gather water from different water tables. Some studies indicate that the water table has fallen in parts of the region as a result of the use of pumped wells, leading to a significant reduction in use of many *ghanats*. Although their number has decreased through the years, *ghanats* still represent the best response to the problem of water shortage and the physical setting of the Iranian Plateau. In many regions of the plateau adjacent to deserts, as is the case with Naeen, the water tables are shallow and mineralized, therefore wells are not workable and *ghanats*

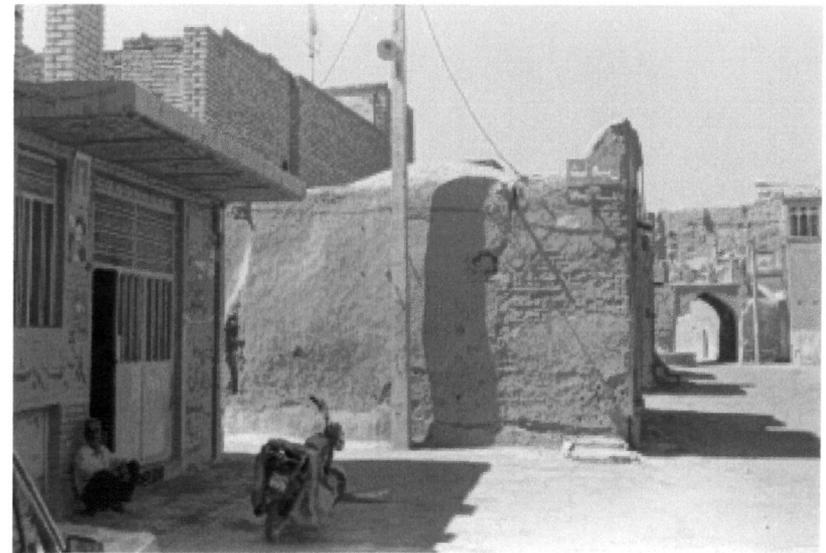
Figure 89 - Comparing Old & New



remain the only alternative.

The inhabitants of the Iranian Plateau gradually learned through time how to deal with the physical environment of the region. They effectively employed their limited resources to build their towns and cities in such a way that they could get along with their environment.

Figure 90 & 91 - Old & New



CONCLUSION

The initial impact of the Modern movement, in its formative years between the world wars has been limited to several countries mostly European countries, but by around 1960, it had found its way to many other areas in the world. The pattern of post-war economic development, including rapid industrialization, certainly played an important role in developing countries like Iran.

In Iran the government's development policies favored the urban over the rural and industry in general over agriculture. For rapid industrial growth construction of modern manufacturing plants was a high priority, especially for three major urban centers, Tehran, Tabriz, and Esfahan, and the provinces of Gilan and Mazandaran. The existence of a modern transportation system by the 1950s encouraged industrial growth, which was extended further to all other small cities and towns; and Naeen was one of them. Modernization accelerated the pace of life through changes in culture, education, and traditional social norms.

Until the 1960s Naeen was a city economically dependent on its agriculture and handcrafts, and there were several types of orchards and prairies around the city. Its hand woven rugs had a very strong impact on the rug market in Iran and later outside of the country. This was the pre-industrial condition. Emerging new ideas from abroad made major differences in the inhabitants' lives. Naeen had a closed shape and it needed to be opened up to get and give the new services. Therefore, a new street suitable for fast transportation was built (1965) right in the middle of the old city fabric.

Figure 92 - A ruined old house

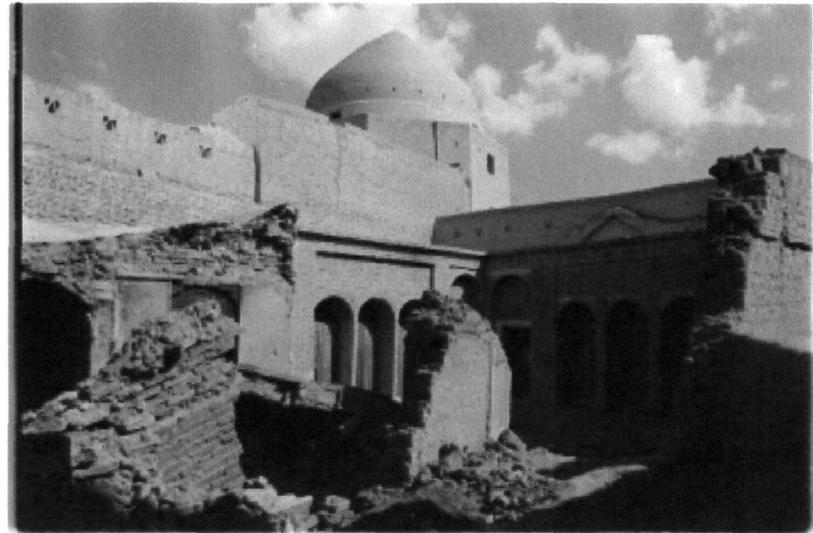
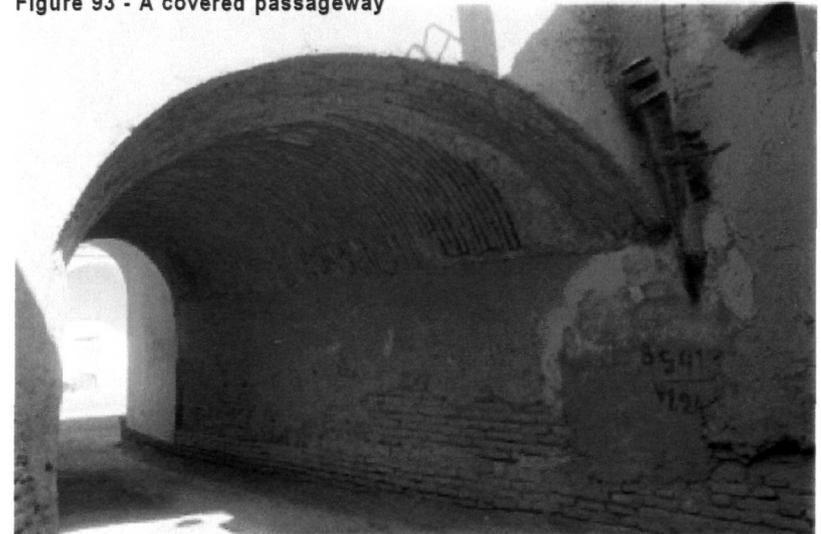


Figure 93 - A covered passageway



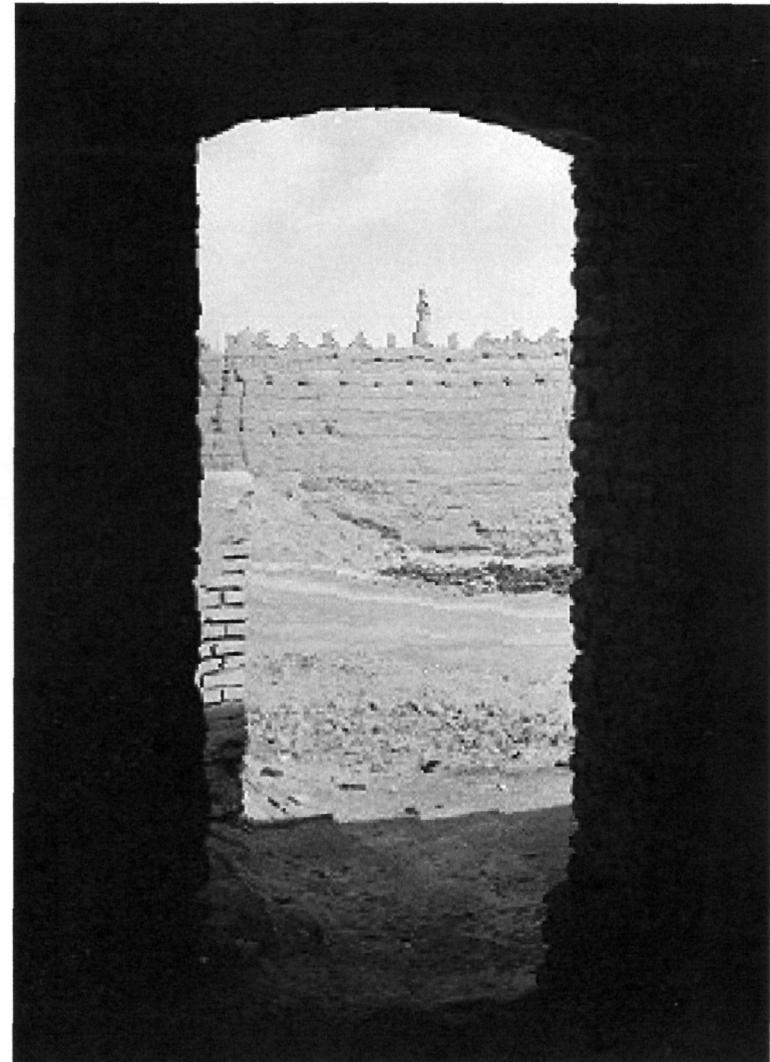
This plan did not work and through the years inhabitants have left their old houses and started to build new ones on the other side of the main connecting road between the two major cities of the region, Yazd and Esfahan.

Still, among all the cities in this region of Iran we can obtain the clearest idea of a traditional, small Iranian city by examining the old city of Naeen. The old city of Naeen is no longer inhabited, but it is preserved to such an extent that we can understand the original functions and features of the extant buildings. This is unlike other cities, such as Yazd and Esfahan, where the cycle of construction, abandonment, or demolition, and reconstruction has never been interrupted. Here in Naeen, the conditions are preserved as they were a hundred years ago.

An understanding of Iranian cities arises from knowledge of their complex production from a few interrelated factors. Those factors include the physical environment of the Iranian plateau, trade patterns, historic events and the religious structures of Iran. This study has endeavored to focus attention on one of the important factors of the environment, water, and its role in the formation of one of Iran's old cities, Naeen.

Naeen is located in the dry arid zone on the border of the Iranian Plateau and water shortage is of the main concerns of the inhabitants. Collected rainwater, brought to the town through ghanats, subterranean aqua decks, was distributed primarily through gutters lining the passageways. This had significant effects on the orientation of the buildings and the

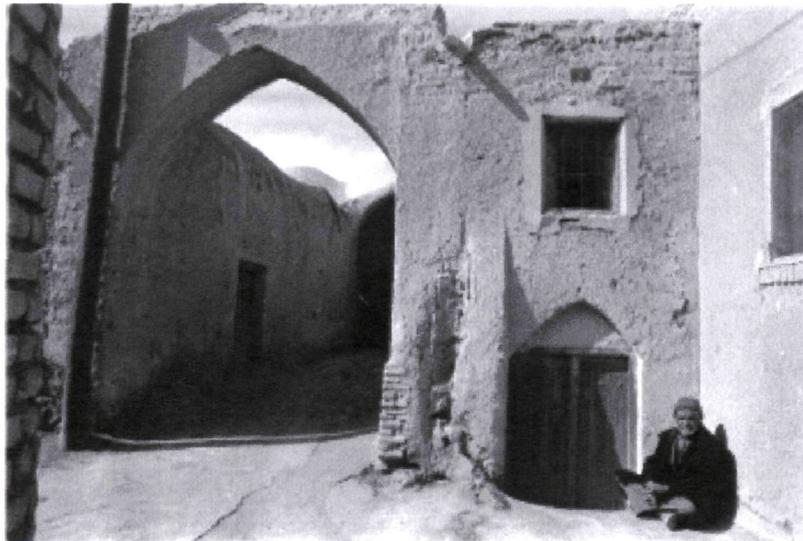
Figure 94 - A view of the Narenj Ghaleh(castle)



functions of their different parts. This project is a review of the different scales of environmental response found in Naeen: urban, neighborhood, neighborhood centers, and house.

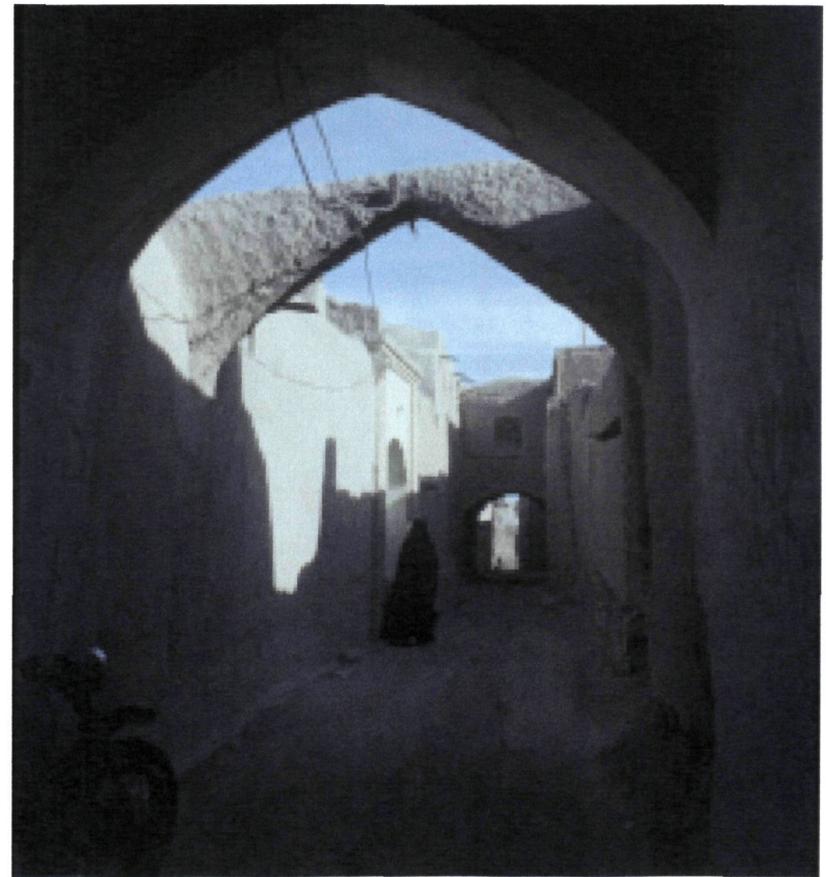
There are many lessons to be learned from a close observation of traditional Iranian cities like Naeen. Studies such as this open up an effective and useful communication line for re-evaluation of the past via Multimedia tools, which allow the organization of massive amounts of diverse data into more accessible format. The main objective of this study has been to generate a fluid integration of text, graphics, pictures, sound, and video sequences about Naeen. Using new media in the study of the traditional cities is a technique of investiga

Figure 95 - A view of the old Naeen



tion, which makes the logic of the old environmental responses comprehensible.

Figure 96 - A view of an old passageway



The Role of the Digital Media in this project

The core purpose of this study has been to create an effective and informative communication using multimedia tools, for which a brief description is given below. Using these tools we can group considerable amounts of varied data into analyzable information.

My first task was to formulate a set of interrelated ideas that could become the research focus and then gather the necessary information to support those ideas. At the same time I devoted considerable amount of time to develop working knowledge of diverse computational tools. Once the research intention was focused I went to Iran, in the summer of 1998, to visit the site and to gather facts and figures as well as pictures and films.

The next phase of development consisted of the clarification of the research intention as well as exploring different design and modeling programs.

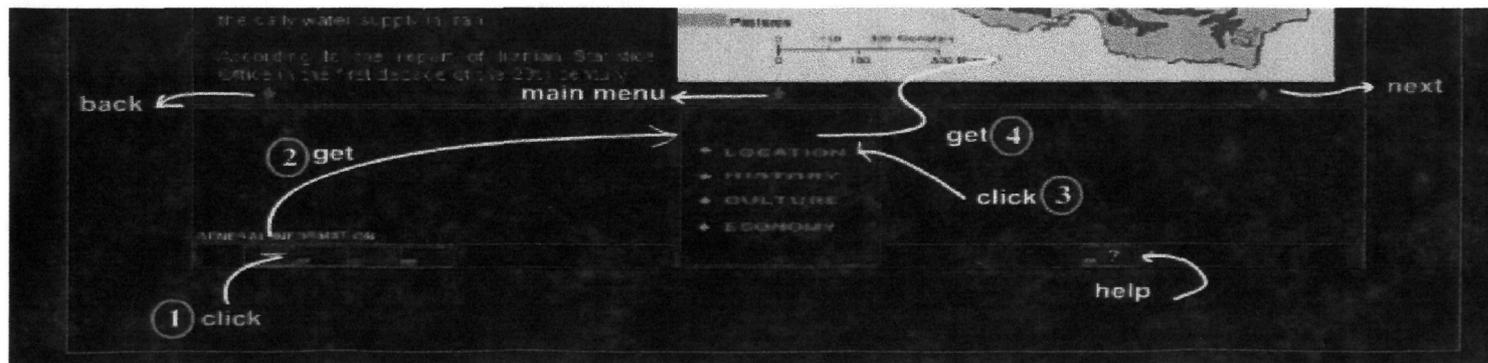
This was followed by the provision of a storyboard; this can be a process similar to that of pre-production process in film and theatre. The purpose of this section is to demonstrate how this project constructed multimedia storyboard.

Multimedia Storyboarding

Traditional storyboard is the product of the time spent deciding every camera and stage angle, every transition, every set element, every special effect and every word of dialogue. In case of multimedia storyboard is a communication tool used by multimedia designers and developers to map out and organize their project ideas before actually producing their product. There are different kinds of storyboards and navigational methods (chronological, relevant navigation, and investigative), but basically, good storyboards provide an overview of the project, demonstrate the functionality of the storyboard elements, and help delineate the project's navigation scheme. In addition, they can serve as a guide for whoever actually develops or programs the multimedia product. Storyboards can take many different forms and shapes, but ideally, storyboards should be customized to the designer's needs and wants.

Making a multimedia project starts from making a good storyboard, which

Figure 97 - Explanation of interactive menu in the Project Overview section in the CD



ultimately results in a better-organized, better-designed, and more time-efficient project. Linear storyboard and Non-linear storyboard are both combined in this project to get the best result in organizing various types of information. This meant that some Flash and some Quick time movies emerged in the main line of the Director movie.

An example of interaction in a linear storyboard is:

back next home

An example of interaction in a non-linear storyboard is:

Go to slide show open the movie window

step 1: Brainstorming ideas

The purpose of brainstorming is to generate as many ideas for the project as possible, based on project requirements, resource constraints, and the target audience. At this point, you want to record your ideas even if they seem insignificant, because your initial ideas may come in useful later. Furthermore, initial ideas are important because they serve as springboards for other good ideas. Your brainstorming can consist of lists, charts, and quick notes, but the point of brainstorming is to generate numerous ideas for what you want to include in your project.

step 2: Select the best ideas

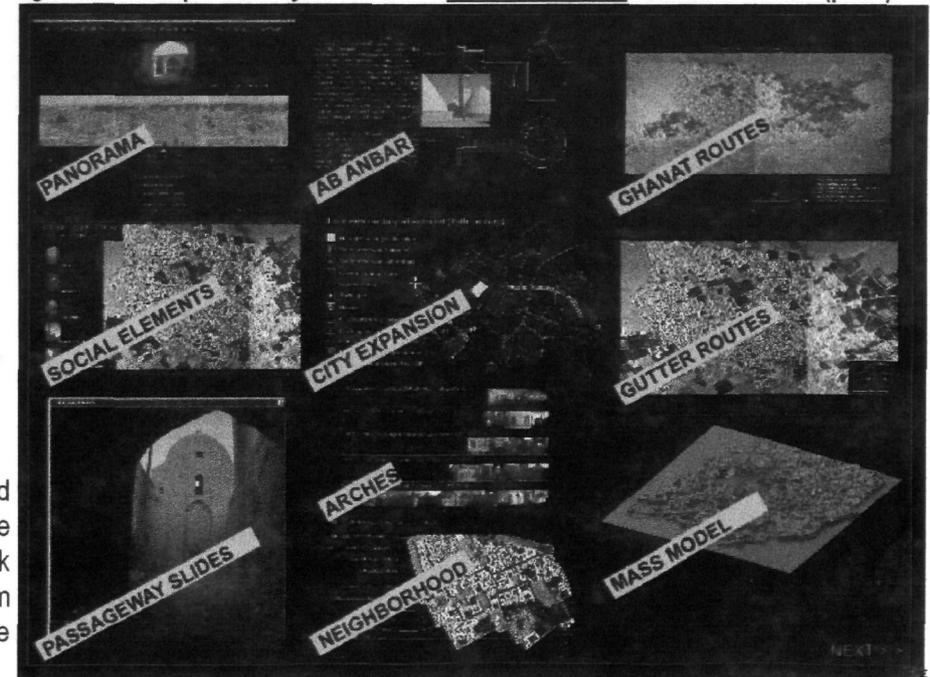
Once we have enough ideas listed, it's time to review those ideas and evaluate them. Re-consider the project requirements, time and resource limitation, and end users. You can eliminate ideas you don't like, and rank the remaining ideas. You select the top ideas and try to get feedback from others involved, before going on to the next step. Storyboarding takes time and energy, so make sure the ideas worth it.

step 3: Storyboard items

To make a storyboard, we can include the items described below, for each intended screen of the project.

Screen Shot - Draw what a particular screen or episode of your project would look like. Number the screen and try to group related screens together. For example, you might name all the menus in your program with an M and a number or short label, like "M01" or "Mchapter1." Also include a note about the screen dimensions (example. 800x600).

Figure 98 -Example of storyboard in the Project Overview section in the CD (part1)



Interactions/effects/transitions list - Interaction usually refers to user interaction, in which a user can input information or push a button. The result is what happens after the user makes an interaction take place, and transition is what happens as the interaction takes place. Sometimes, a transition might be a screen transition, or a sound, or something might appear on the screen. It is better to write down exactly what you want to happen. A smoothly flowing project needs some design concepts for interaction effects, transitional effects, and sound effects.

2D items list and descriptions - 2D refers to flat, general pictures and images that don't move and are represented on a 2-dimensional, flat plane.

3D items list and descriptions - 3D refers to images that are represented as having a defined length, height, and width. They look more realistic and have more depth than 2D images.

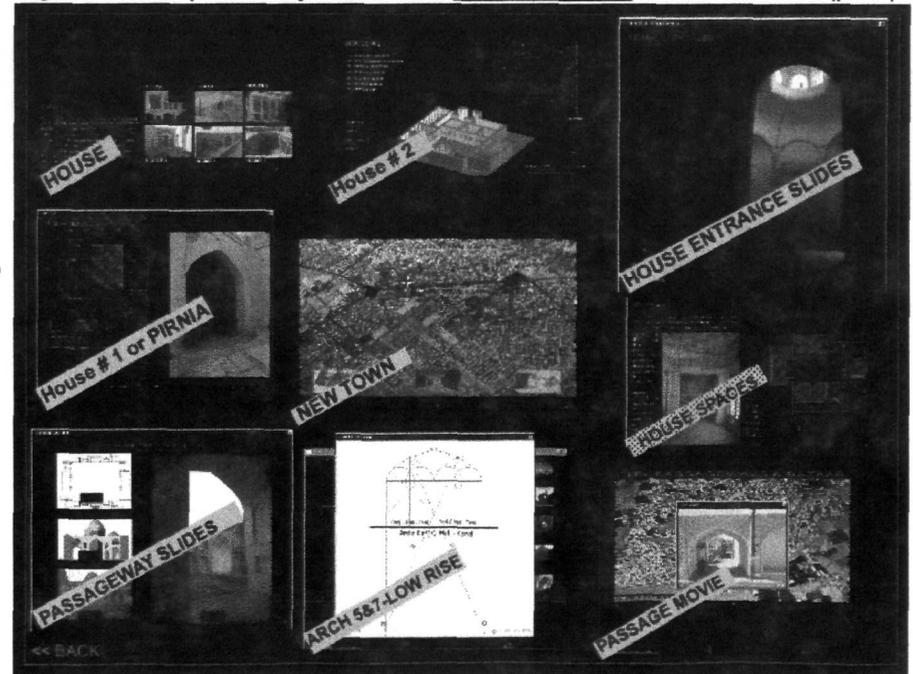
Animation items or other types of movies - Animation refers to images (either 2D or 3D) that move, or change over time. Animation is different from video, in that photo-realistic images are generally not used, and they are created differently by using various software programs like Flash and usually consist of fewer frames than does video.

Video items list and descriptions - Video refers to digital video files in your project that will play on that specific screen.

Music items list and descriptions - Music refers to background music that plays for that given screen.

Text items list and descriptions - Text refers to actual transcripts of the text items that you will use on a screen.

Figure 99 -Example of story board in the Project Overview section in the CD (part2)



Discussion of Software used

Macromedia Director

Director produces graphic motion with the same techniques used by common animators: It places elements on separate layers and moves them through the scene one frame at a time. This means that there is a high degree of control.

Macromedia Director is software used to create other software and it is often referred to as an authoring tool or a development platform. Since Director is available in both Mac OS and Windows versions, it is relatively easy to produce work that runs on both Macintosh computers and PCs. Director can incorporate sound as well as moving and still images. The production is usually called multimedia. Furthermore, since production can include viewer input, via keyboard or mouse, the word interactive is often applied. In the multimedia market, Director has long been the standard authoring tool, used not just for developing CDs, but also for creating special effects and for adding a whole new dimension to static pages on the World Wide Web.

Although Director has a pioneering history as a multimedia tool in today's pace of software development, many authoring platforms have come to challenge it. In the case of Director, the hard part is that lingo, a built in command syntax, has evolved as a language of its own and it makes the learning process more difficult. In Director instead of updating the imported files, the program asks for external editors, which makes it a memory consuming process especially when the image editor is the Photoshop.

In this study, the main line of the project is a Director movie, which was then used to create the projector. A projector is a stand-alone version of a movie. We can include several movies in a single projector. Projectors appear on the system desktop as applications. To add new

capabilities to the main Director movie, other Director movies and Flash movies were used as a single cast member or as a linked movie, saving the trouble of managing extra cast members and Score data.

Macromedia Flash

Macromedia Flash is a Web development tool. Its powerful multimedia capabilities and features have enabled Flash to transform the Web from the text/graphics medium into an interactive experience. A Flash produced movie can bring together a number of elements such as sound, movement, and interactivity. One thing that makes Flash a good Web development tool is its use of vector graphics as the default graphic mode.

Vector graphics are objects defined by mathematical equations, or vectors, that include information about the object's size, shape, color, outline, and position. This efficient mode of handling graphics keeps files relatively small. Bitmap graphic files are almost always larger in size than vector graphic files.

The Flash development approach also facilitates the creation of complex multimedia presentations while still maintaining small file sizes. Because such elements as vectors, bitmaps, and sounds are usually employed more than once in a given movie, Flash allows a single version of an object to be reused, rather than requiring the re-creation of the object every time it is required. Flash actually requires just one actual copy of the graphic and others (instances) are simply references to the main file.

Flash is able to create fast-loading multimedia over the Web because of its ability to stream content, which means users can view downloaded sections while other contents continue to load. Using different languages for Web design makes Web pages look different depending on the

browser and compatibility problems between browsers. But With Flash you can create the content at once with all the design and interactivity desired and know that it will look and act the same, regardless of what platform or browser is used.

In this study, Flash was used to produce the main interactive menu because of its capability to interact with the main Director movie within the Director movie. Flash was used also to create all animated navigation controls. Some stand alone Flash movies published as SWF files were also imported into the main Director movie to work as cast members.

Although Flash movie can send Lingo instructions to a Director movie some action scripts in the imported Flash movie do not work, especially when there is a two level Target in the movie. There is also a problem of importing Flash buttons into Director movies which always need a behavior for changing the cursor. A behavior is prewritten Lingo script that you use to provide interactivity and add interesting effects to your movie.

Adobe Photoshop

The Adobe Photoshop program allows photo retouching, image editing, and color painting software. The software has many capabilities, including color separations and coloring images, and allows the creation of original artwork as well as retouching and resizing photography proofs.

Images can be brought into the Adobe Photoshop program by scanning a photograph, a slide, or an image; by capturing images from video; by importing electronic artwork created with a drawing program. You can import an image document in one format and export it in another, depending on your needs. As a result, you can easily transfer Adobe Photoshop documents to other applications and computer platforms. This program, in conjunction with certain brands of scanners, allows you to control the

process through which a photograph or a slide is converted into a digitized image.

To scan images, you use the Acquire command in the File menu. The correct resolution for a scan is determined by the capability of the output device. If the image is to be used only on screen, the resolution need not be any greater than the resolution of the screen, typically 72 pixels per inch (ppi) for a Macintosh monitor and 96 ppi for a PC monitor. However, if the image is to be printed, as a general rule, to produce a high quality image, the image resolution should be 1.25 –2 times the lines-per-inch (lpi) value.

In this study, the Adobe Photoshop was used to control the scanning process of all the photographs or slides and converting them into digitized images. The resolution of the images were between 300 ppi and 150ppi, so later they could be easily resized. Another usage of this program was for importing digital work created with another program in this case Form Z, capturing images from video in this case QuickTime movies, and capturing on screen shots created by the *print screen* key of the keyboard. Although the Photoshop has a pioneering history for image manipulation, it is very memory consuming because it requires the preloading of fonts and plug-ins.

Adobe Premiere

Adobe Premiere is software that provides editing solution for video movies. It can combine various materials as clips to make a movie. Clips can include:

Digitized video captured from cameras, VCRs, or tape decks, QuickTime movies, Animations, Scanned images or slides, Digital audio recordings
Adobe Photoshop files, Adobe Illustrator files

In this study, Adobe Premier was used to capture video sequences from

VCR and edit them. Although this program can work with a wide variety of file formats, there is a digital movie format of .DAT, which is not utilizable by this program.

Adobe PageMaker

This is a program for page layout. PageMaker's importing and linking capabilities let you incorporate text, graphics, charts, and movie frames from most programs. Linking makes it easy to track file changes and update imported files, and it also has complete separation capabilities for text and graphics.

PageMaker has strong typography controls with numerous customization options. Files can also be published electronically by using two improved export features: one is by creating PDF (Portable Document Format) and the other by converting pages to HTML (hypertext markup language standard).

In this study, the Adobe PageMaker was used for the page layout of the paper version of the project. Although this program has many capabilities for importing different file formats and updating them because of the link options, it does not provide any library for the project. This make the size of the file very large because every time it reuses an imported file, for example an image file, the program handle it like a new imported file.

Form Z

Modeling and composing objects in 3D space is the main thrust of Form Z. The modeling environment of Form Z has two basic types, 3D and 2D. You can switch from one to the other by simply activating a modeling or a drafting window. You can transport modeling objects into drafting, and drafting elements into modeling by pasting them. To render the models we have to select the texture, color and material of the model. The next step

for rendering is to select the light sources and their direction and intensity.

In this study Form Z was used to generate the 2D drawings and 3D models of the buildings. Although this program is a powerful modeling program, there are some difficulties using 2D files (drawing or image) as sources for creating 3D files.

QuickTime Pro

QuickTime is not an application program. It enables other software to handle multimedia data, such as video, audio, and animation. It allows media to be viewed, edited, and combined. A QuickTime movie may be a standard time-based movie, linear movie, or it may be a QuickTime VR movie, which is spatial and interactive. QuickTime stores different types of media separately in what are called tracks. A video track is the standard track for holding visual data in QuickTime movies.

In this study, QuickTime was used to edit and/or combine some video sequences. The video sequences with the extension of QT were imported separately into Director files to create some of the linked Director movies.

Bibliography

- Abu-Lughod, Janet L.* **The Islamic City.** Middle East Studies. Cambridge: Cambridge University Press, 1987
- Alsayyad, Nezar.* **Cities and Caliphs on the Genesis of Arab Muslim Urbanism.** Westport, CT: Greenwood Press, 1991
- Ardalan, Nader and Bakhtiar, Laleh.* **The Sence of Unity.** Chicago: The University of Chicago Press, 1973
- Curtis, William J R.* **Modern Architecture since 1900.** London: Phaidon Press Limited, 1987
- Fathy, Hassan.* **Natural Energy and Vernacular Architecture.** Chicago: The University of Chicago Press, 1986
- Gaube, Heinz.* **Iranian Cities.** New York: New York University Press, 1979
- Godar, Andre.* **Iranian Art.** Tehran: Melli University Publication, 1979
- Ghobadian, Vahid.* **Climatic Analysis of the Traditional Iranian Buildings.** Tehran: Tehran University Publication, 1994
- Herdeg, Klaus.* **Formal Structue in Islamic Architecture of Iran and Turkistan.** New York: Rizzoli Publication, 1989
- Kheirabadi, Masoud.* **Iranian Cities Formation and Deveploment.** Austin: University of Texas Press, 1987
- Kiani, M.Y.* **Iranian Cities.** Tehran: Ministry of Islamic Guidance Press, 1987
- Pope, Arthur Upham.* **Persian Architecture: The Triumph of Form and Color.** New York: G. Braziller, 1965
- Siroux, Maxim.* **Caravansarais and Middle Road Buildings in Iran.** Tehran: Office of Preserving the Iranian Heritage Press, 1944
- Sultanzade, Husayn.* **Introduction to the History of the City.** Tehran: Abi Publication, 1986
- Sultanzade, Husayn.* **Nain City of Historical Millennia.** Tehran: Cultural Research Bureau, 1996
- Tavassoli, Mahmood.* **Architecture in the Hot Arid Zone..** Tehran: Tehran University Publication, 1975

Glossary

- Ab Anbar** water reservoir
Andarooni Private section of house
Bahdgeer ventilation tower
Bazaar-cheh small bazaar
Beerooni semi private section of house
Caravansarai inn
Chah well
Chah madar main well
Eivan veranda
Emam religious leader
Emam zadeh a tomb for religious leader
Ghaleh castle
Ghanat underground water channel
Haft dari a room with seven line up windows
Hashti entrance space in the shape of octangular
Hodood'l'Alam a reference book from 10th century about geography
Hosseinieh a place for religious ceremonies
Jomeh friday
Kamani bow-like
Kond low
Kooh mountain
Mahalleh residential area; nieghborhood
Masjed mosque
Mihrab altar
Minar minaret
Moghanni well digger
Nim dayreh half circle
Panj dari a room with five line up windows
Panj-o-haft five and seven(proportion for one kind of arch)
Orsi lattice used as a sceen for openings
Sagha khaneh home of the person who delivers water
Seh dari a room with three line up windows
Shekasteh broken
Tekyeh covered sacred place for religious ceremonies
Tond high