

Ancient Pigeon Houses: Remarkable Example of the Asian Culture Crystallized in the Architecture of Iran and Central Anatolia

Aryan Amirkhani (Corresponding author)

Ph.D. Student, Department of Architecture, Faculty of Art, University of Tarbiat Modares

Jalal Ale Ahmad St, Tehran, Iran

Tel: 98-21-4441-6537 E-mail: Aryan.Amirkhani@modares.ac.ir

Hanie Okhovat

Ph.D. Student, Department of Architecture, Faculty of Art, University of Tarbiat Modares

Jalal Ale Ahmad St, Tehran, Iran

Tel: 98-21-7786-4133 E-mail: h.okhovat@modares.ac.ir

Ehsan Zamani

M.Sc., Department of Architecture, Faculty of Art, University of Tarbiat Modares

Jalal Ale Ahmad St, Tehran, Iran

Tel: 98-21-4427-2493 E-mail: ehsan.zamani@gmail.com

Abstract

Architectural heritage is considered a fundamental issue in the life of modern societies. In addition to their historical interest, cultural heritage buildings are valuable because they contribute significantly to the economy by providing key attractions at a time when tourism and leisure are major industries. The need for preserving historical constructions is thus not only a cultural requirement, but also an economical and developmental demand. Herein, among different Iranian heritage buildings, pigeon towers, or dovecotes, are of a great importance. Hundreds of dovecotes, dating largely to the Safavid period, dot the fields in the vicinity of Isfahan.

On the other hand, valleys formed by creeks in central parts of Anatolia seem to have offered suitable environments for ancient settlements. Cappadocia region and two valleys nearby the town of Gesi accommodate a number of villages surrounded by hundreds of dove cotes in different types.

This paper investigates different types of dovecotes in Iran plateau and Central Anatolia, Turkey. The results show there is a fundamental difference between the structures of dovecotes in these two countries. However, ancient dovecotes in Iran and Central Anatolia can be considered good examples of 'architecture without architects' or 'spectacular vernacular architecture'. Master builders who designed and constructed these buildings for such a simple function, created impressive forms without much pretension and bringing forth the tectonic aspects of the art of architecture.

Keywords: Dovecotes, Architecture, Iran, Isfahan, Central Anatolia

1. Introduction

Pigeons were found in human settlements in Egypt and the Middle East since the dawn of agriculture, probably attracted to seeds people planted for their crops. In the Middle East, wild rock pigeons found safe havens in nest holes in the earliest human houses. Initially, humans found utility in their food and eggs, but soon realized that their rich, dry droppings made for valuable fertilizer. Hence, special pigeon towers were built so that thousands of pigeons could breed in them, their droppings accumulating at their base.

Dovecotes represent one of the most remarkable examples of eccentricity in Iranian and Anatolian architecture. The pigeon towers of these countries show a perfect example of humans and nature working together in the

name of mutual interest. At a time when chemical fertilizers did not exist, a method for generating large quantities of fertilizer was imminent. Taking advantage of their natural environment, the ancient architects created different types of dovecotes. By attracting wild pigeons with seed and a safe place to roost, the dovecotes acted as a natural collection point for waste which could then be used as fertilizer.

Methodology

The contents of this article rely heavily on three bases: 1) The information provided from observational studies as a part of the authors' field work. 2) The consultancy of leading experts on vernacular constructions and Asian architectural heritage specialists from the University of Tarbiat Modares in Tehran. 3) Historical documents concerning the traditional buildings techniques and the architectural heritage of the Asian Dovecotes.

Herein, the architecture of Iranian and Anatolian dovecotes are analysed with respect to the following factors:

- The architectural background of dovecotes in each region
- Construction methods and materials
- Construction measures
- Formation of the plans and sections

2. Investigating Dovecote's Types in Iran Plateau

Dovecotes are a great example of striking eccentricity in Iranian architecture. Generations of travelers have recorded the marvels of Isfahan (a historical city in Iran) and have been sufficiently amazed and intrigued to comment on the extraordinary dovecotes which dot the hazy green sea of orchards and gardens surrounding the city.

2.1 Isfahan, Iran

Isfahan or Eşfahān (historically also rendered as Ispahan, Old Persian Aspadana, Middle Persian Spahān), located about 340 km south of Tehran, is the capital of Isfahan Province and is Iran's third largest city (after Tehran and Mashhad). (Afshar Sistani, 1999, 28) With a population in 2000 of 2,040,000, Isfahan has been designated by UNESCO as a world heritage city, boasting a wide variety of Islamic Architectural sites ranging from the 11th to 19th centuries (Bakhtiar, Dehbashi; 2004, 112).

2.2 Isfahan's Ancient Dovecotes

In the 17th century, a European traveler counted up to 3000 dovecotes in the Isfahan area of Persia (Hadizadeh, 2006, 51-4). Today, over 300 historic dovecotes have been identified in Isfahan Province and a total of 65 have been registered on the National Heritage List (Rafiei, 1974, 118-24). Dovecotes were constructed to produce large quantities of high-quality organic fertilizer for Isfahan's rich market gardens. The largest dovecotes could house 14,000 birds, and were decorated in distinctive red bands so as to be easily recognizable to the pigeons.

The larger towers are free-standing, but many smaller ones are built into the walls of gardens, deceptively akin to bastions or corner towers in a defense system. Others brood protectively, but unstrategically, over the flat mud roofs of village houses. Their practical purpose was to collect pigeon manure that had been found to be beneficial in melon fields, however, the utter sculptural form and intricate interior patterns alone would make for a worthwhile expedition to Isfahan.

As in all traditional vernacular buildings, dating proves to be difficult. The only two (Figs.1, 2, 3 and 4) to which a period is even ascribed are thought to have been built during the reign of Shah 'Abbas (1587-1629) in the great royal gardens of the Hazar Jarib ("thousand acres"). These seem to have more highly developed plans than any others now extant, which compels one to infer that a considerable tradition lies behind them (Mirdanesh, 2007, 128-30; Darmirchi, 2004,35).

Amazing inventiveness has gone into solving the basic problem of the provision of the maximum number of pigeon holes with a minimum amount of building material. The material, unbaked mud brick plastered with mud, required great ingenuity. Timber was seldom used, as the whole structure must have been designed to withstand compression. Furthermore, the resulting vaults and domes can be individually considered to be works of art. Their fascinating ground plans show rhythm, with the sequence of solid and void comparing with the best architecture of that building tradition.

Each tower essentially consists of an outer drum battered for stability and buttressed internally to prevent collapse, with lateral support provided by an inner drum that raises half as high. The main drum is divided vertically by the galleries that interrupt the buttresses, and are connected by a circular staircase (Mattewes, 1951, 148). The galleries are further supported on barrel vaults and saucer domes. Between the buttresses, which look

like the spokes of a wheel on plan, the domes are pierced to allow the birds to fly up and down; similarly, the inner and outer drums are connected by open arches at every level. The pigeons enter only through the domed cupolas or "pepper-pots" with holes in lateral walls, not superiorly, of honeycomb brickwork at roof level (Pratt, 1954, 32). One of these crowns the inner drum while others ring the flat roof of the main drum below and vary in number according to the ground plan. A tower still in use at Chahar Burj has twenty, plus four in the central drum. In Kaempfer's *Amoenitatum Exoticarum*, Lerno, 1712, a three-tier tower is exemplified (Figs.5 and 6) (Ishraqi, 2000, 78).

Most builders seem to have been content to build the outer wall as a simple drum, alternately hollowed out and internally buttressed, which provides its architectural fascination. However, the two aforementioned towers attributed to the late 16th or early 17th century in the Hazar Jarib enjoy the further refinement of a corrugated outer wall that increases the stability of these larger towers without an increase in wall thickness. The eastern tower (Fig. 7) could be thought of as a cluster of eight small drums around a larger central drum. This allows for an increase in the surface area of the walls and therefore a concomitant increase in the number of pigeon holes (Honarfar, 2007, 194-6; sarfarazi, 1990, 43). The compelling quality of the interior of the towers comes from pattern repetition on every vertical surface, regardless of whether or not it is curved on plan of the standard.

Much of the sculptural quality of the structure is due pigeon holes measuring 20 cm x 20 cm x 27 cm above mud perches (Figs. 8-A and 8-B). Each perch is made of an asymmetrical mud pyramid of four unequal sides whose square base is clapped, while damp, on to the vertical brick face below the hole. Whether this is done at the time when the brick was made or whether it was put into position beforehand is not clear. When in position, the smaller top side of the pyramid forms a horizontal perch and the other sides slope away, making access to the neighboring holes easier for the pigeons next door.

In Isfahan itself, all of the towers seen at that time were circular in plan. Even the two well-known towers in the Hizar Jarib, although much more complex, are based on a circle. Towers were usually relatively separate from their neighbors, although a large number might occasionally occur in a small area (Bourgeois, 1983, 91-5). It was not until the Khunsar-Gulpayagan area to the north-west of Isfahan was explored that we came upon big rectangular towers reminiscent of small forts. Some were sited singly while others were grouped, with nine built into garden walls. A typical tower measured 12.25 m x 4.45 m at the base and rose 7 to 8 m. The walls, which were battered at the base, were decorated by a board plastered band 2 to 3 m above the ground (Sarfarazi, 1990, 43-45). This smooth surface may have been to prevent the entry of reptiles. The top of the walls were crenellated. Their plans have been similar to that of the square tower in the ruined village of Jozdan, towards Gavart, to the east of Isfahan. This consisted of a two-storey outer structure 10 m high, surrounding a three-storey inner tower. Surprisingly, there were also a large number of small pigeon towers of the usual circular plan, set close together in the small village. The towers are entered once a year for the collection of manure. A small door (occasionally, there are two), usually at ground level, is sealed. One tower presumed to be in use, as it was in very good repair, had no entrance below roof level. This was almost certainly to reduce the danger of snakes. It is thought that the cause of structural cracks (Fig.9) was the tremendous vibration set up by the wings of the thousands of terrified birds if a snake got into the tower (Ferrier, 1989: 54-8). Some cracks may also have been caused by earthquakes; a mud-brick building without timbers to take tensile stress might be expected to crack badly in such conditions (Mc Cann, 1998, 168).

There are various designs of pigeon towers based on their capacity, different tastes of their constructors. Tables 1 and 2 divide the pigeon towers of Isfahan into eight groups. Such attractive pigeon tower designs typify the traditional Persian enjoyment and mastery of pattern and color. External decoration varies according to the grandness of the tower; however, even the most exotic ones demonstrate a dual function of allowing entry of pigeons while preventing entry of snakes. The bands of smooth gach plaster, usually colored in lime wash or red ochre are certainly for this purpose (Figs.10-A and B); a snake might otherwise creep up the drum of the tower, aided by the rough kahgil (mud/straw) plaster of its surface. Moreover, string courses of brick and molded mud or brick cornices and friezes, besides providing an effective decorative capping to the wall, also provide projections that snakes would find difficult to navigate. Perhaps these intricate decorations were in use before the smooth plaster bands were introduced.

The honeycomb brickwork, which gives the pigeons access through the cupolaed turrets, is by itself very decorative and is usually carried around both drums as a balustrade, giving the birds somewhere to perch (Akay, 2004, 108-14). During Shah's time, the function of the towers was the collection of manure. It was the most valuable in Persia and was mixed with ash and soil in varying proportions for different purposes, of which the cultivation of melons and water melons was the most important. Both towers and birds belonged to the landlord who paid a tax to the Shah on the manure sold (Olgyay, 2003; Mirzaie, 2002, 117). Although hundreds of

towers have disappeared, there may be as many as fifty still in use in the Gavart area, along with others scattered around Isfahan.

Despite the high value of their manure, it is surprising to an outsider that the towers did not emphasize the provision of pigeon meat, their chief function in Europe. In medieval England, when the peasant had little redress if the landlord's pigeons ate his corn, they were common and Church as well as lay landlords, tucked in to pigeon-pie. In Persia similar eating habits might have been expected.

The fact that we refer to these birds as pigeons and not as doves is in itself a reflection of the fact that there is a very long-standing tradition of sacredness surrounding this particular bird. It is also remarkable that the Persians do not eat pigeons, although they are flavorful. This free, but semi-domesticated bird living close to human dwellings is often felt to be an appropriate symbol for the soul. Thomas Herbert, a 17th century traveler, after describing how much grander the dovecotes of Mehiar (Mahyar) were than the ordinary house, explains: "This reason they give: some of the pigeons (as tradition persuades at least) are descended from Noah's dove, while some others communicated to him intelligence from some angel" (Herbert, 1928, 117). In any case, while Europeans lived well on pigeon squabs, the Iranian peasant from the 17th to 20th century seemed to have abstained.

Incidentally, Fryer (1672-81), on a journey up to Isfahan from Shiraz " encountered almost in every village old castles made of mud and almost turned to earth again: in whose stead, at the Emperor's charge, are maintained many Dovecotes, pleasantly seated in gardens, for the sake of their dung, to supply the magazines with saltpeter for making gunpowder "(Fryer, 136). We were surprised by this statement on the use of the dung, since no other source suggests it.

Although the birds were not taken for food they have been hunted for sport. Olearius, writing in 1660, gives a curious description: "The King sent to us betimes in the morning to invite us to go to pigeon-hunting. We were carried to the top of a great tower, within which there were about a thousand nests. The King commanded our trumpets to sound the charge, and immediately there were driven out of the tower pigeon-house great numbers of pigeons, which were most of them killed by the King and those of his company. This was the end of that kind of hunting." Perhaps such practices have not quite ended, for today it is a popular sport to drive the pigeons out of the qanats by throwing stones into the well and catching the birds by hand or hitting them with sticks.

It will be seen that much remains to be found out about the towers. No one knows exactly when construction of the pigeon houses began, but the "Majma' al-Tawarikh" written by the historian Hafez Abru (1430 AD) at the order of the Timurid ruler Shahrokh, refers to the structures in only one sentence that may give a clue into how ancient they are. It reads: "Ghazan Khan, the seventh ruler of the Ilkhanid dynasty (1271-1303) has banned hunting near the towers to protect the pigeons." (Pirnia, Memarian, 2003, 272-6). Unfortunately, the plans reproduced here seem to be the only ones in existence; a more representative survey could be very interesting. The two great Towers of the Shah Abbas period in Hezar Jarib have already lost their turrets and most of the roofs have vanished. It is much hoped that funds will be found to prevent further decay. The structures have been deteriorating with little maintenance ever since they were rendered functionally obsolete with the modern use of chemical fertilizers and tanning chemicals. There has been a significant drop in pigeon tower numbers from the thousands reported in 17th century accounts of Safavid Isfahan by French traveler Chardin, to the present day count of approximately one hundred remaining in the entire province.

3. Investigating Dovecotes' Types in Central Anatolia

Central Anatolia is well-known mostly for its natural landscape, and especially Cappadocia's volcanic chimney-like structures that create a dreamlike atmosphere by blending nature with history in a dramatic fashion. These structures housed many people for millenniums, and are still in use today. Moreover, the remains of wild dovecotes in this region show the relationship between birds and mankind from ancient time. Besides, there are other types of dovecote just neighboring the Cappadocia region. Hundreds of large tower-like stone structures are scattered around the landscape outside the town of Gesi, in Kayseri, Turkey.

3.1 Cappadocia's Ancient Dovecotes

The dove cotes in Cappadocia are mostly designed like rooms which are set up by carving the rocks. The oldest samples of these cotes in the region were built in the 18th Century but they are not many. Most of the cotes in the region were built in the 19th and early 20th century (İşçen, 2008). It is significantly evident that the cotes were constructed near to water sources, on a place, above the valley and their entrance, called as mouth of the cotes were mostly built in the east or south direction of valleys. By this way of construction, it was proposed to protect the cotes from cold and get sun light inside. The cotes were generally constructed by carving the rocks as a room.

The inside area of the cotes range from 5 to 10 m². The outer wall has 4 or 5 holes, which is used as an entrance for doves. Cote builders used to paint around the holes in order to attract the birds. Inside the cotes, there are hollows, which allow doves to lay their eggs and are called as 'Niş.' There are also roost poles, which lay between two walls and connect them with each other. Hence, this simple mechanism eases to collect the manure clustered on the floor. The cotes have a capacity to accommodate 100 doves. They were built quite above the valley level and on the rocks, which prevent humans and other creatures to disturb doves. In order to protect the cote against enemies, people use to make a mixture from plaster, white part of egg and lime and spread it to the walls for protecting the cotes. This mixture makes the surface slippery, which avoids dangerous wild animals to reach the dovecote. There is also an outside door, in the shape of a tunnel allowing a person to enter the cote for collecting manures and it is reached by means of the ladders (Fig.11) (İşçen, 2008). There are several kinds of ornaments on the outer side of the cotes in Cappadocia and its surroundings. Thus dovecotes lead us to see the unique examples of Turkish-Islamic paintings (Fig.12). The red color, prevalently used in the region is produced from kind of a soil called 'Yoşa', mostly found in the region. People also use root-paints produced from different plants and some paints produced from soil consisting of iron oxide.

3.2 Gesi region of Kayseri, Turkey

Kayseri (named in classical antiquity as Mazaka or Mazaca, Eusebia, Caesarea Cappadociae, and later as Kaisariyah) is a large and industrialized city in Central Anatolia, Turkey. It is the seat of Kayseri Province. The town of Gesi is 20 km away from Kayseri and has a population of 9000. Upon approaching the town, there is an intersection of roads; left turn leads to Gesi, right turn to a hilly ground that turns into a fascinating landscape; at first a few, then dozens of large tower-like stone structures are seen. These are the upper parts of underground caves each of which accommodates hundreds of dove nests.

3.3 Gesi's Ancient Dovecotes

Unlike the mud brick dovecotes examples in Isfahan, Iran, the dove cotes near Gesi are all built in the ground with brick towers above them. These towers have square, rectangular, circular or ellipsoidal base plans (Fig.13), good workmanship, and strong architectonic expressions. Their forms resemble the fairy chimneys of neighboring Cappadocia region, but they have well-finished geometric shapes. Generally, the structure of Gesi's dovecotes is divided in two parts: 1) nest (hazne). 2) the tower or the chimney (bun). The nest (hazne) or shelter part is like a lofty room or a well, in square, rectangular or circular plan, usually measuring 5m x 5m or 5m x 7m and their heights varying between 205m and 405m. Hundreds of regularly carved small cotes surround this central space from top to bottom, each to be used by a dove family. Sometimes one may come across larger nests that have complex plans and sections. Such nests usually have a large central hall connected to smaller individual rooms around, all surrounded by dove cotes. The towers in these cases are constructed on top of the central space. In order to let the incoming doves to adapt to the interior space, four or five timber beams or rafters are placed across this space. Doves coming into the central hall perch for a while on these beams before they move to their own nests (Altina, 2001, 336-339). Each of the caves or nests takes its air and natural light from the opening on its top, extended by the structure of the tower (Fig.14). The periphery of the nest (or central hall and all other nesting spaces around) is surrounded by dove cotes arranged in a clear egg crate order. The sizes of each cote are around 20cm x 20cm or 25cm x 25cm, just large enough to house a bird couple and their eggs. The depths of cotes range between 18cm and 25cm. Hundreds of these tiny small niches carved around the nest exhibit an interesting display; light coming from the tower above emphasizes the edges, leaving the caves in darkness and creating a dramatic atmosphere. If it is a nest with doves, upon their perception of a moving body, birds get frightened and start flapping their wings; at which time a small dust cloud fills the nest. After a period of time they adapt to the new situation and start humming and filling the space with noise (Korumaz, 2002, 128).

Nests open to the sky by a large hole formed at the top of the space over which the dove tower is built. The diameter of the hole measures around 100cm to 150cm. Just underneath this opening, on the floor level of the nest, there is a bowl hewn into the tufa rock to collect rainwater and snow from which the birds may drink. Human access to the nesting space is through a short tunnel and a door in the end. This tunnel or passageway is just wide enough for a person to pass. It starts from the lower part of the sloping land and reaches the floor level of the central hall. Depending on the slope of the site, it is either sloped or stepped up towards the entrance door. The entrance door and its lock are made of timber. This door is located a few steps higher than the main floor of the nest and its threshold is designed in such a way that snakes can not pass through it. Bird drops that accumulate on the floor are collected at certain intervals, filled into sags and carried down the tunnel. Birds can feed themselves from spring to fall, but they need to be fed by people during winters. In order to feed them, a small hole connected to a 10cm diameter drop-tunnel, on the lower side of the tower is used. Food poured into this hole accumulates on the nest floor without disturbing the doves.

Dove towers or the chimney (bun) define and identify each unit crowning the upper parts of nests. They are strong enough to stand against natural forces and suitable to protect the birds from their enemies. As noted above, their plans vary from square to rectangle, from circle to ellipse. Sometimes, due to the slope of the land, they may have a rectilinear plan on the lower part, but curved on the upper. The width of tower structures varies between 150cm to 450cm, and lengths between 200cm to 650cm. Since mouths of towers always look toward the valleys, their sidewalls have to go parallel to the natural slope of the site and fit to it. The heights of these structures also vary. In order to protect the nest from predators; the minimum wall height is around 210cm to 250cm. The higher parts of a medium-sized unit may reach 350cm to 400cm. Towers that have larger dimensions or those located in steep slopes may have higher walls, reaching 300cm-350cm at their lower sides (Korumaz, 2002, 134).

Sidewalls of dove towers that go parallel to the slope of the land rise from lower to upper parts. This rise in the mouth of the towers is solved either by consecutive steps or by a sloping wall (Fig.15). The top of each wall or step, on the other hand, is finished with a strongly emphasized railing, which runs all around the mouth of the tower. The width of this stone railing changes depending on the thickness of the tower walls and generally varies between 40cm. to 75cm. They function as a small protecting eave for the tower walls as well as a watch platform for the doves. Birds coming in or going out of the nest land on these platforms; they rest and control the surroundings. Walls of dove towers are all built out of rubble or cut stone. The choice depends on: (a) The slope of the land in each location; (b) Existing towers nearby or around it; and how the designer interprets the existing structures and the surroundings; (c) The chosen or preferred plan type; (d) The proximity to the stone quarries or the creeks that accumulate rubbles nearby.

4. Conclusion

Until the second half of the 20th century, dove breeding was a popular occupation for the Iranian and Turkish villagers and pigeon houses were an important part of the agricultural sector in middle east countries included Iran and Turkey. Therefore, different types of dovecotes were constructed by intelligent local architects. Nowadays dovecotes lost its importance for some reasons such as development in agriculture and technology, Fast growth and spread of contemporary poultries that diminished the need for dove meat, wide spread of chemical fertilizers and fast urbanization and changes in living styles in Iran and central Anatolia.

However, structures built for doves still beautify the landscape and create a fairy tale atmosphere in these countries. They are valuable components of Iranian and Anatolian vernacular architecture. As a result of this paper, eight pigeon tower types in Iran Plateau and two different types in central Anatolia are recognized.

Iran's Pigeon towers often covered with a mix of straw and mud to protect pigeons from the cold in the winter and the heat in the summer. The upper parts of the towers were covered with a glossy surface plaster, which prevented snakes from entering the tower. These structures also had a door for the farmers and smaller openings for pigeons. Farmers used to open the door once a year to gather pigeon droppings for their fields.

In central Anatolia two different dovecote types are existed, a particular type in Cappadocia and the other in Gesi region, as discussed before. Gesi's dovecotes built over the ground level are simple and effective buildings having their own identity and glamour. Each dove tower has its architectural value, but the way they are grouped or clustered together is more exciting for the observers. It is like an opener sculpture exhibition made out of various forms and shapes. A rich variety of forms, their homage to landscape and neighboring units is quite impressive. Although their togetherness at first seems accidental, upon closer examinations, they give the impression of being the end result of a sensitive design approach. However, these are spectacular examples of Iranian and Anatolian vernacular architecture remaining from the past periods. Unless any positive action in order to maintaining these structures is taken, most of them will have crumbled. Thus, In the name of architectural heritage, it is hoped that any further decay of such historical dovecotes can be prevented by funding.

References

- Afshar Sistani, I. (1999). Recognition of Isfahan Province. Hirmand.Tehran.
- Akay, F. (2004). *Bird House, Skylife*. pp. 108-114.
- Altina, M. E. (2001). Kayseri ve Civarmda Bulunan Ku~ Evleri, V. Ortac;ag ve Turk Donemi Kazi ve Arestirmslen Sempozyumu Bildiriler, Hacettepe Oniversitesi, Sanat Tarihi Bolumu, 4, 336-354.
- Bakhtiyar RN; Dehbashi A. (2004). Isfahan, the House of Culture and Art. Tehran.
- Bourgeois J, Pelos C. (1983). *Spectacular Vernacular: A New Appreciation of Traditional Desert Architecture*.

Peregrino Smith Books, New York.

Damirchi, A. (2004). pigeons and the pigeon towers of Isfahan. *Journal of Art and Mankind*, 115, 34-37.

Ferrier RW. (1989). *The Arts of Persia*. Yale University Press, Yale.

Fryer. (1963). A new account of East-India and Persia in eight Letters being nine years, began 1672 and finished 1681, Cultural research association, Tehran.

Hadizadeh Khaki S. (2006). *The pigeon towers of Iran*. Cultural research association, Tehran.

Herbert T. (1928). *Travels in Persia, 1627-29*. Broadway travelers' edition, London.

Honarfar L. (2007). *Isfahan, Culture and Science*. Isfahan.

İşçen, Yavuz. (2008). Cappadocia pigeon cotes, Website: Turkish Tumblers, Turkey. [Online] available: <http://www.turkishtumblers.com/Capadociacotes.htm> (November 6, 2009).

Ishraqi F. (2000). Isfahan, in foreign travelers' viewpoint, Atriat. Tehran.

Korumaz, M. (2002). Korunmasi Gereken Bir Yapi Dokusu, Kayseri Giivercinlikleri, 6. Ortac;ag ve Turk Donemi Kazi Sonucleri ve Sanat Terihi Arestirmeleri Bilgi Soleni, Erciyes Oniversitesi, Kayseri.

Mattewes, G. V. T. (1951). *The experimental investigation of navigation in homing pigeons*. University of Cambridge.

McCann J. (1998). The Dovecotes of Suffolk, Suffolk Institute of Archaeology and History, Suffolk.

Mirdanesh M. (2007). *Acquaintance with historical monuments*. Madrese, Tehran.

Mirzaie, A. (2002). Investigating the cultural and economical qualities of cylindrical dovecotes. *The Iranian journal of Anthropology*, 4, 115-139.

Olgyay V, Hainline J. (2003). Architectural Infrastructure for Ecological Restoration. *Journal of Green Machines*, New York.

Pirnia, M, Memarian Q. (2003). Recognition of Persian architectural styles, Pazhoohandeh, Tehran.

Pratt, J. G. (1954). An Investigation of Homing ability in Pigeons without previous homing experience. *Journal of Experimental Biology*, 32, 70-83.

Qobadian V. (2006). A Survey on the Climatic design of the Iranian traditional buildings, Tehran University, Tehran

Rafiei Mihrabadi A. (1974). National Monuments of Isfahan, National Monuments Association, Tehran.

Sarfarazi, M. (1990). Dovecotes of Golpayegan. *The Journal of Jahad*, 128, 43-45.

Table 1. Different kinds of Isfahan's pigeon towers. [Authors]

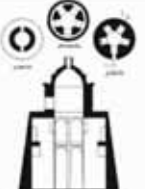
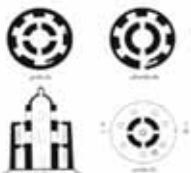
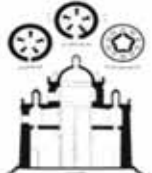
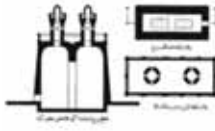
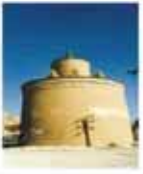
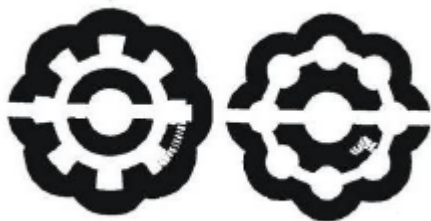
Group	1	2	3	4
General format of the plan and section				
Example	destroyed	destroyed	destroyed	
Location	Probably in old Isfahan	Near Isfahan(largon tower)	Isfahan(shah tower)	Isfahan(Emam tower)

Table 2. Different kinds of Isfahan`s pigeon towers. [Authors]

Group	5	6	7	8
General format of the plan and section				
Example				
Location	Gavart village (Isfahan)	Radan tower (Isfahan)	Hezar jarib tower(Isfahan)	Safa tower (Najaf Abad- Isfahan)



Figures 1 and 2. plans of Hazar Jarib towers believed to date from the reign of shah Abbas.
(Fryer, 1963) [From the Image Archive of Tarbiat Modares University]

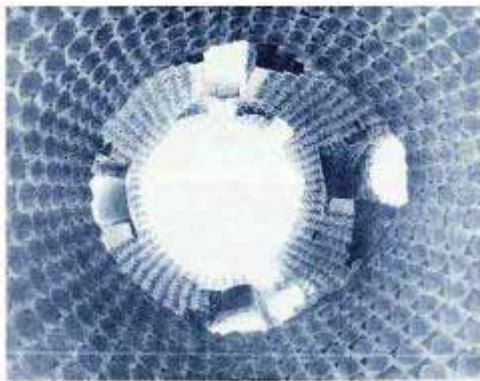


Figure 3. Interior of the central drum of the east tower on the Hazar Jarib. (Qobadian, 2006)
[From the Image Archive of Tarbiat Modares University]



Figure 4. The west tower in the Hazar Jarib, (see Fig. 2). (Fryer, 1963)
[From the Image Archive of Tarbiat Modares University]

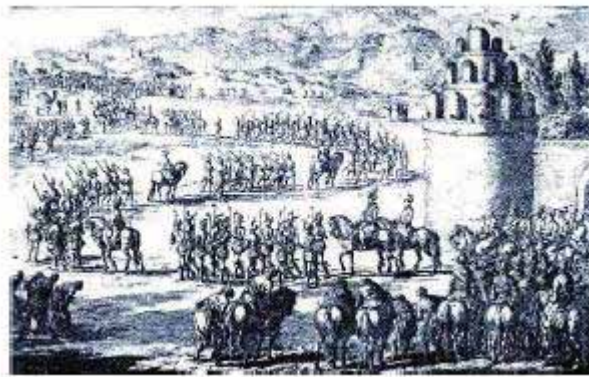


Figure 5. “Columbarium”, etc., in the Hazar Jarib 1684-85, From Kaempfer’s *Amoenitatum Exoticarum*, 1712. (Honarfar, 2007, 194) [From the Image Archive of Tarbiat Modares University]



Figure 6. Looking up the central drum of the tower. (Darmirchi, 2004, 35)
[From the Image Archive of Tarbiat Modares University]



Figure 7. The eastern tower in the Hazar Jarib. (Fryer, 1963)
[From the Image Archive of Tarbiat Modares University]



Fig8- A

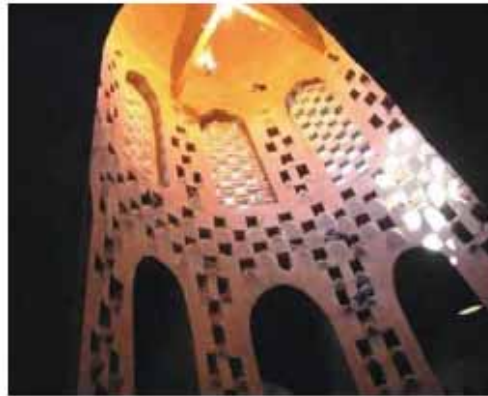


Fig8-B

Figures 8- A and B: Pigeon holes in inner buttresses. (Qobadian, 2006)
[From the Image Archive of Tarbiat Modares University]



Figure 9. Tower near Ateshgah. (Mattewes, 1951, 148)
[From the Image Archive of Tarbiat Modares University]



Fig 10-a



Fig 10-b

Figures 10-A and B. Smooth plaster bands were to prevent snakes climbing the towers, but their function seems to be undermined by the addition of buttresses. (Fryer, 1963)

[From the Image Archive of Tarbiat Modares University]



Figure 11. Front view of Cappadocia's dovecotes. (İşçen, 2008)

[From the Image Archive of Tarbiat Modares University]



Figure 12. The red color paintings on the outer side of the cotes in Cappadocia. (İşçen, 2008)
[From the Image Archive of Tarbiat Modares University]

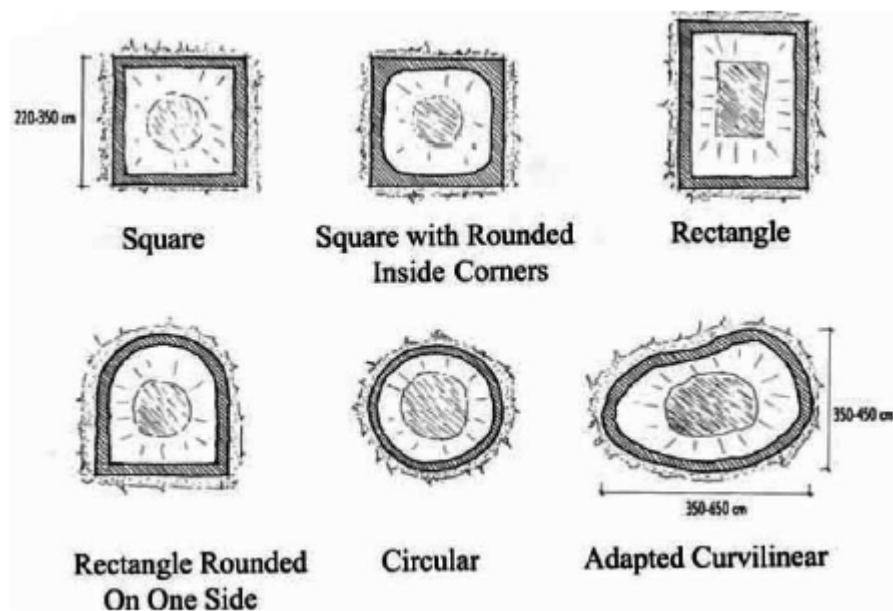


Figure 13. Different plan types of dove towers in Gesi region. (Korumaz, 2002, 128)
[From the Image Archive of Tarbiat Modares University]

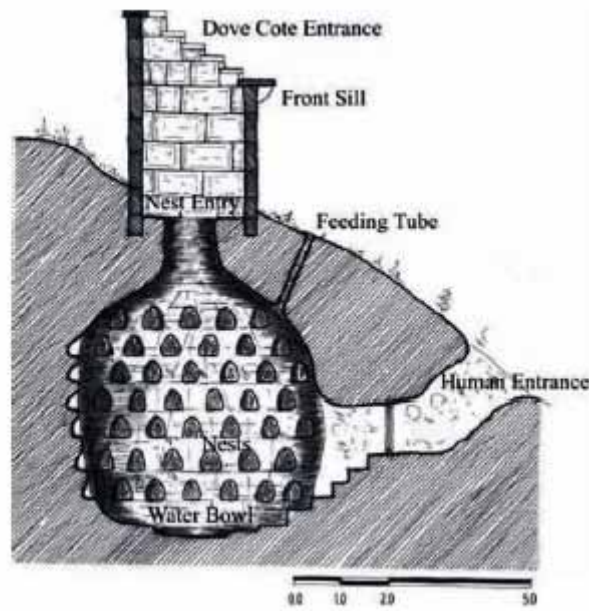


Figure 14. A typical section of a dove cote through the nesting space. (Korumaz, 2002, 128)
[From the Image Archive of Tarbiat Modares University]



Figure 15. Examples of dove towers with different openings and railings. (Altina, 2001, 336-339)
[From the Image Archive of Tarbiat Modares University]