

A STUDY ON DISTRIBUTION OF HOUSES WITH DOMICAL VAULT
ROOFS IN HERAT CITY - AFGHANISTAN

ヘラート市におけるドーム状ヴォールト屋根伝統住居の分布

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Traditional houses in Western Afghanistan have domical vault roofs. Such houses are not limited to the Old City but are instead distributed throughout the municipal area of Herat. For this study, we used satellite images from 2017 to locate 11,754 houses with domical vault roofs within the municipal area of Herat and then calculated their density. Field surveys were conducted to investigate the sites with a higher density of such houses. The study identified seven high-density sites and classified them into three groups; 1) monumental, 2) pre-1960s old residential villages along canals and 3) post-1960s residential settlements at the urban fringe.

Keywords: Afghanistan, Herat city, Traditional house with domical vault roof, Distribution
アフガニスタン, ヘラート市, ドーム状ヴォールト屋根伝統住居, 分布

1. Introduction

Herat province is located in western Afghanistan and borders Turkmenistan in the North and Iran in the West. The oasis city of Herat is located on the Silk Road within a region historically known as Khorasan and forms the center of Herat province. Great Khorasan and Persian culture have had a strong influence on the architecture of this historic city. In the 9th century, it became the ruling center of the Khorasan region and was later occupied by the Ghaznavids, Seljuks, Ghorids, Mongols, Karts, Timurids and Safavids. The Timurid period is one of the most important periods in the history of Herat, when architecture reached its peak with elaborate tile designs. Timurid Shahs settled in the city and delimited it as the capital of the empire (Noelle-Karimi, 2014). During the Timurid period, new residential sites (villages) outside of the walled Old City of Herat emerged (Fig. 1). Today, Herat is the third largest city in Afghanistan and has an urban population of 493,600 people residing in 12 districts (Loda et. al, 2013).

Previous literature on traditional houses in Herat consists of the following.

Najimi (1988) has studied the Old City and traditional houses of Herat before 1967, compiling a comprehensive and useful document on the subject. After Timurids, the architecture of houses and the city's urban structure remained unchanged until the 1960s, when new construction methods and industrialized materials were introduced. A map of Herat in 1963, Fig. 2, shows the Old City, surrounding villages and the new urban area expanded in the north and east of the Old City. Herat City has since undergone significant changes.

Traditional houses with domical vault roofs in Herat City have been examined by Kawish et al (2017). The study examines three traditional houses in Herat: Faqir house (110 years old, located in the north of the Old City), Nabi house (75 years old, located in the north of the Old City), and Ahmad house (30 years old, located inside the Old City). All three houses are constructed with common construction methods and materials. For the roofs, they make use of masonry curved roof construction (mainly domical vaults). Fig. 3 shows a sample of traditional houses in the Old City.

Samimi et al (2017) have studied the transformation of Herat Old City. The changes can be seen both in physical aspects and in terms

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of a changing demographic of residents. New residents have been moving into the Old City, renovating old houses with non-traditional materials or removing old buildings to build new houses. As a result, the physical structure of the Old City is rapidly changing.

As the landscape of Herat City formed by traditional houses with domical vault roofs is rapidly changing due to new construction, examining how traditional houses are presently distributed in the city is necessary. In Afghanistan, while the cultural value of historical monuments such as mosques have recently gained recognition, the historical landscape formed by traditional houses is not considered culturally valuable, meaning that their conservation is often neglected. So far, no scientific research has been conducted to address this issue in Herat. Therefore, we aim to identify the distribution of traditional houses with domical vault roofs in Herat and to examine the features of the sites on which they are concentrated in order to contribute to a broader understanding of the state of traditional houses in Herat.

2. Methodology

For the purpose of this study, we acquired a satellite image (30cm by 30cm resolution) of the Herat municipal area taken in 2017 by Digital Globe Co. The study area, which is Herat municipal area, is divided into 12 districts. Through the satellite image, one can distinguish the boundary walls of houses and two distinct types of buildings, those with domical vault roofs and those with flat roofs (Fig.4).

While buildings with domical vault roofs are mostly residential houses, those with flat roofs are a mixture of residential and other buildings and their functions cannot be identified by the satellite image alone. In addition, among the residential houses with flat roofs, there are those which have been built on new vacant lots and those which were built after demolishing old houses. This uncertainty necessitates handing out questionnaires to residents. Therefore, this study includes only limited information on flat roof buildings for the Site A in Chapter 3.

The boundary of each building compound is drawn in a polygonal shape based on the satellite image and the type of building is defined by the roof type. The network of streets is also drawn in lines using the satellite image. The locations of canals and agricultural lands inside the municipal boundary of Herat are also drawn in lines. The canals are divided into two categories: open cut canals (Juy) and covered canals.¹⁾ Herat has 3 Juys, known as Juy-e-Naw, Juy-e-Enjil and Juy-e-Karbar. They flow from the east to the west and their water is mainly used for the irrigation of agricultural lands. Covered canals are not made for irrigation and are instead used as spillways for the overflow from Juys or storm water drainage. The southern branch of Juy-e-Enjil was an open-cut canal and was used for irrigation and as a spillway for overflow from Jue-e-Enjil, but was rebuilt in 2009 as a covered canal by the government and is no longer used for irrigation. The canals around the Old City are newly covered canals and are used for draining storm and sewage water from the central business district. In addition, the locations of public spaces are shown, and the

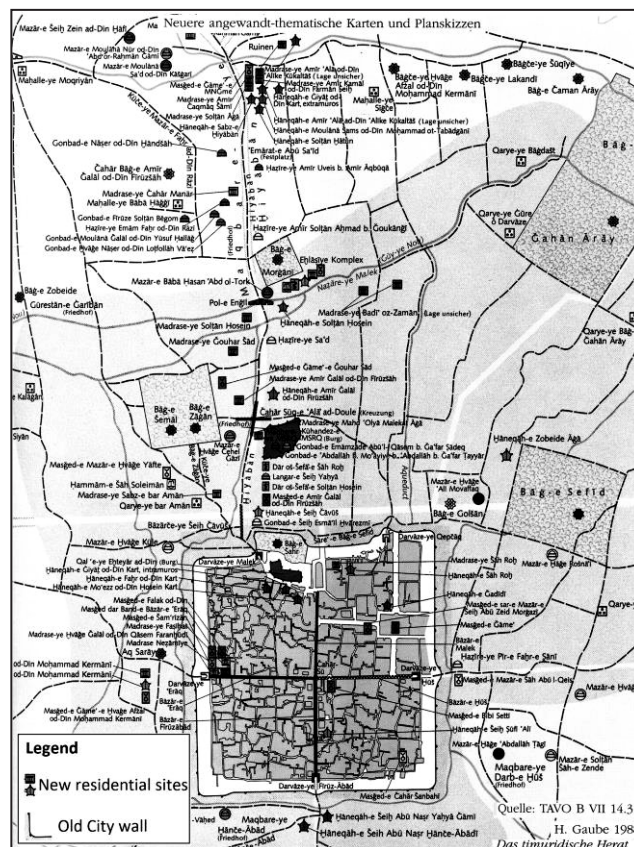


Fig. 1 Timurid Herat. (Source: Wirth E. 2000, Taf. 35 Das timuridische Herat, based on: H. Gaube 1988)

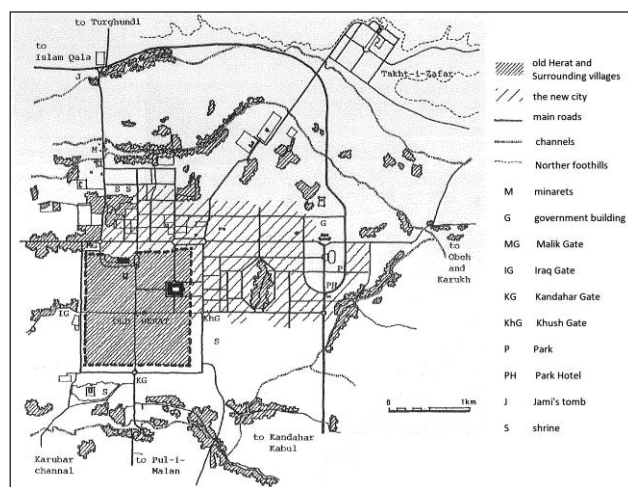


Fig. 2 Map of Herat 1963. (Source: Najimi 1988)



Fig. 3 Sample of traditional house with domical vault roofs

remaining areas such as non-residential or mountain range areas are shown as "others." With this information in mind, a detailed land use map of Herat has been created (Fig. 5).

For the purpose of this study, we separately show the locations of houses with domical vault roofs and buildings with flat roofs within

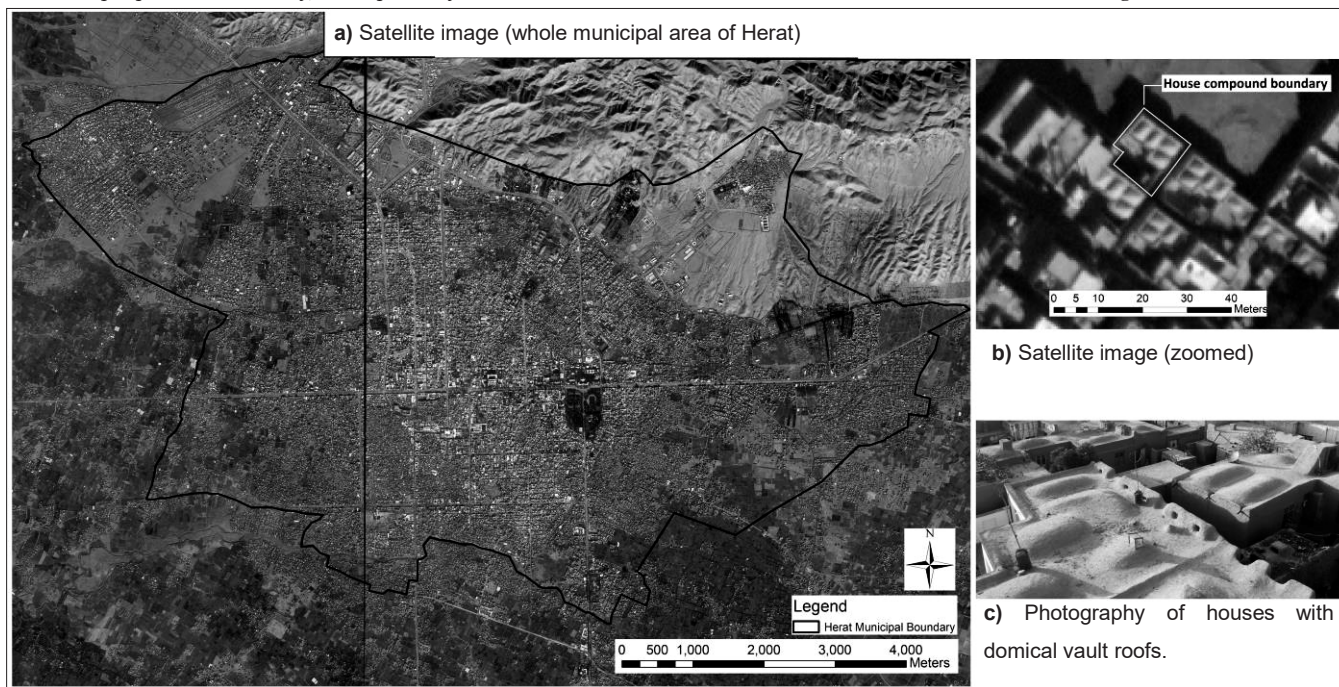


Fig. 4 a) Satellite image (source: Digital Globe), b) Zoomed part of satellite image (source: Digital Globe), c) Photography of roofs.

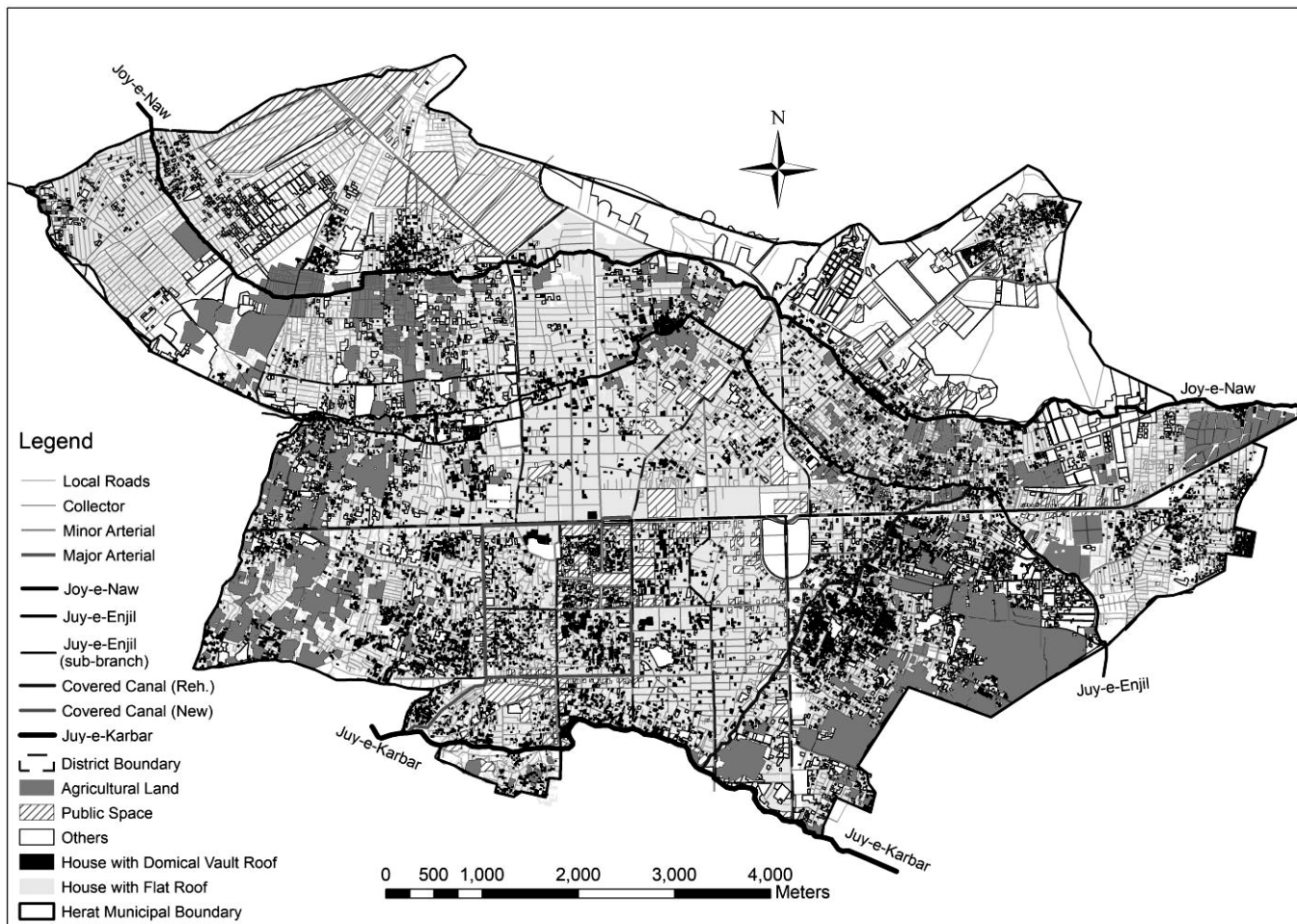


Fig. 5 Land use map of Herat.

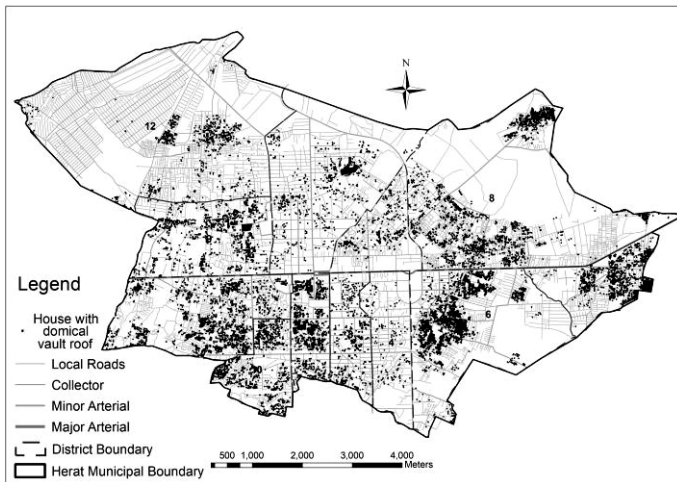


Fig. 6 Houses with domical vault roof (11,754 houses counted)

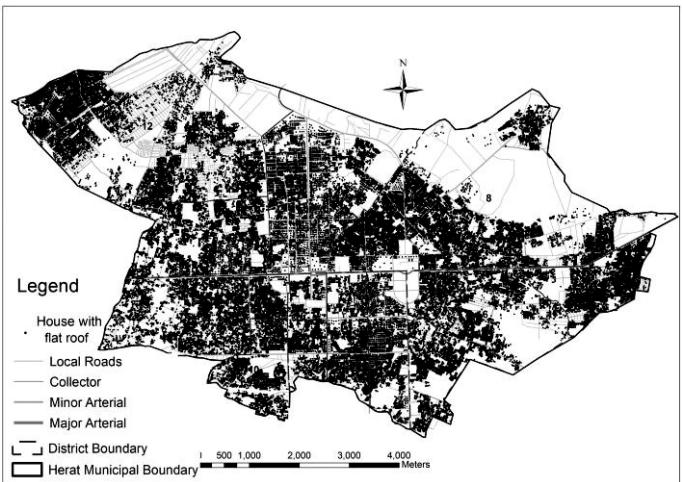


Fig. 7 Buildings with flat roof (73,203 buildings counted)

the municipal boundary of Herat. Each point shows the centroid of each polygonal shape indicating a building (Fig. 6 and Fig.7). In Fig. 6, the locations of houses with domical vault roofs are shown. We counted 11,754 houses with domical vault roofs. The distribution of houses of this type is not uniform. Some areas of Herat have higher numbers of these houses than other areas. Fig. 7 shows the distribution of buildings with flat roofs. Buildings with flat roofs are distributed in almost all built-up areas of Herat. We counted 73,203 buildings with flat roofs in the study area.

In order to find the density of houses with domical vault roofs, we divided the municipal area of Herat into 100m by 100m grids and counted the number of houses with domical vault roofs inside each grid. The range of numbers of existing houses of this type in each grid varies from 0 to about 50. To make a density map, we categorized the range of numbers into six categories: 0 (No houses with domical vault roofs observed), 1-10, 11-20, 21-30, 31-40 and 41-50. Based on the density of houses with domical vault roofs, we identified seven high-density sites in the study area as shown in Fig. 8.

The map of the seven high-density sites is then overlaid on the map of the Old City and settlements in the 1960s (Fig. 9). The base map of older Herat is compiled from two sources. First, a map of Herat in 1963 (Lezine 1964, shown in Najimi 1988, p. 72) showing the development of the new city center of Herat is used as the main source. To show the historic

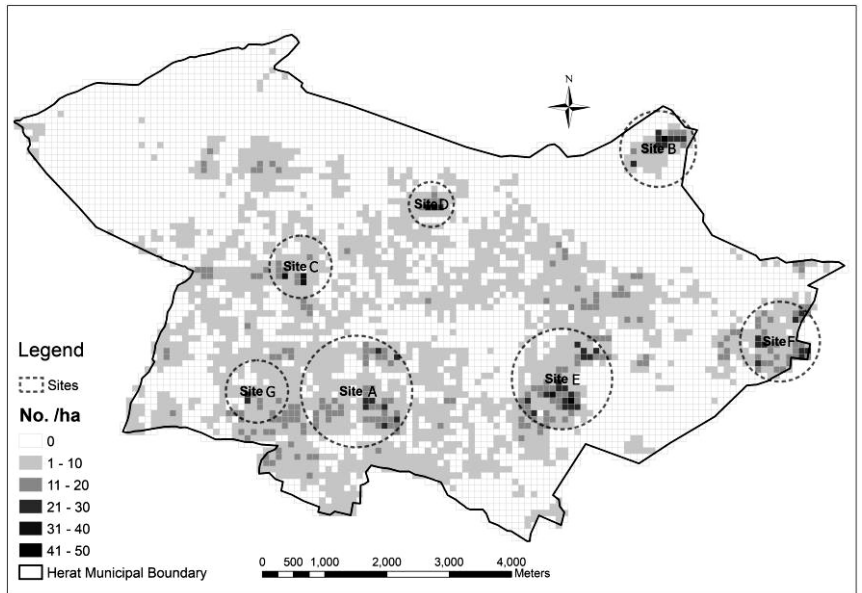


Fig. 8 Density map of houses with domical vault (No./10000 sqm grid).

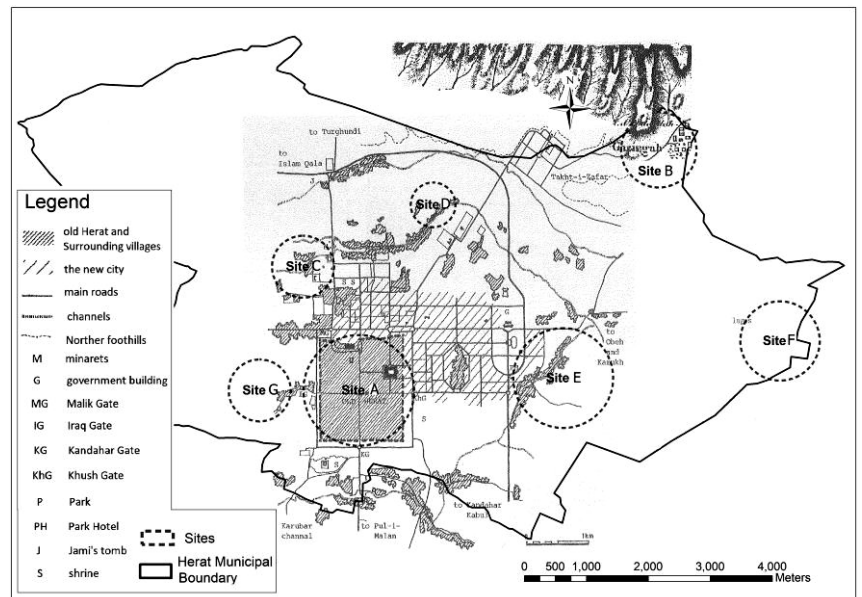


Fig. 9 Old City of Herat and surrounding villages (Base-map: Najimi 1988 pp.33&72)

village of Kazergah, another map (The archeological map of Herat, reported by Khanikof in 1858, shown in Najimi 1988, p. 33) is also used.

Fig. 10 shows high-density sites of houses with domical vault roofs and the locations of the Old City and old settlements based on historic maps (Fig. 9 and Fig. 1). The names of surrounding villages in Fig. 10 are obtained from the historic maps prepared by Wirth (2000) and Najimi (1988) and have been confirmed by residents of each site.

3. Details of the seven high-density sites

It appears that the old settlements outside the Old City are mostly concentrated around irrigation canals. As seen in Fig. 10, five out of seven sites are located around the Old City or old settlements of Herat. We surveyed each site separately and took photographs of each site in June 2017. Below, the characteristics of each site are described based on our observations and interviews with elderly residents of each site.

Site A (located partially in district 2, 10 and 7): Site A is Herat Old City. The Old City is known as the origin of Herat and has many houses with domical vault roofs. The Old City also has numerous historic monuments; most famous are the citadel of Herat, Qal'a-i-Ikhteyaruddin, and the Friday Mosque or Masjid-e-Jame. The Old City is divided into four quarters by two streets running north to south and east to west. The network of streets consists of narrow alley ways and dead-end alleys. The site is defined as the core zone of Herat by UNESCO and any new construction and repair that may endanger the historic urban fabric of the area is prohibited. However, according to our previous study (Samimi et al. 2017a), due to a lack of re-enforcement by the new government of Afghanistan (established in 2001), residents started building flat roof houses with new construction methods and materials, especially after 2005. In the Momandha quarter of the Old City, more than 40% of the buildings have flat roofs with industrialized materials. They are either houses which have been rebuilt after the demolition of old houses or renovated/added houses mostly constructed between 2007 and 2013. As a result, the historical urban fabric of Herat, originally formed by traditional houses with domical vault roofs, has been transformed. Based on our survey, the oldest house that remains on this site is Kababi house at 150 years. Fig. 11a shows the street view inside the Old City.

Site B (located in district 8): Site B is the historic village of Kazergah. This area is famous because of the tomb of Khwaja Abdullah Ansari of the 11th century. His tomb was a pilgrimage site until it was rebuilt during the Timurid period under the reign of King Shah Rukh in the 15th century. Most land around this shrine is Waqf ⁱⁱⁱ⁾ (an Islamic endowment) under his name and the land is managed by the department of Awqaf ⁱⁱⁱ⁾ of Herat. Because this village has water fountains and is located in the hillside to the north of Herat, it was an attractive place for the kings and rulers of Herat at the time. Site B is also defined as a core zone of Herat by UNESCO. Based on our survey, the oldest house on this site is Hashem house, which is more than 150 years old. Fig. 11b shows the street view and landscape of the site.

Site C (located in district 9): Site C is located in the west of the complex of Musalla and Minarets of Herat. There are five minarets that are 55 meters high. These minarets are from the 15th century and are decorated with tiles which are still partially remaining. The government of Afghanistan and UNESCO are working to preserve these monuments. To the west of these minarets, there is a high-density area of houses with domical vault roofs. While the minarets of Herat and the compound of Musalla are defined as a core zone of Herat by UNESCO along with the Old City of Herat, Site C is residential and is not defined as a core zone. Based on our survey, the oldest house on this site is S. Ahmad house, constructed 60 years ago. Fig. 11c shows the area of houses with domical vault roofs to the west of these monuments.

Site D (located in district 5): Site D is one of the most well-conserved sites of Herat. It covers the historic area of Baghe Dasht. This area has no particular historical monuments but the area adds value to the architectural heritage of Herat. Almost all the houses have domical vault roofs constructed with traditional materials. Streets are narrow, with many Dalaan (covered passageway), ^{iv)} and are therefore inaccessible by car. The residents of the site are mostly cattle farmers and have lower incomes. They use water from Juy-e-Naw to irrigate their agricultural lands. The University of Herat is located in the eastern part of this area (formerly a part of the Baghe Jahan Aray.). Based on our survey, the oldest house on this site is Payande house, which is more than 200 years old. Fig. 11d shows the Dalaan

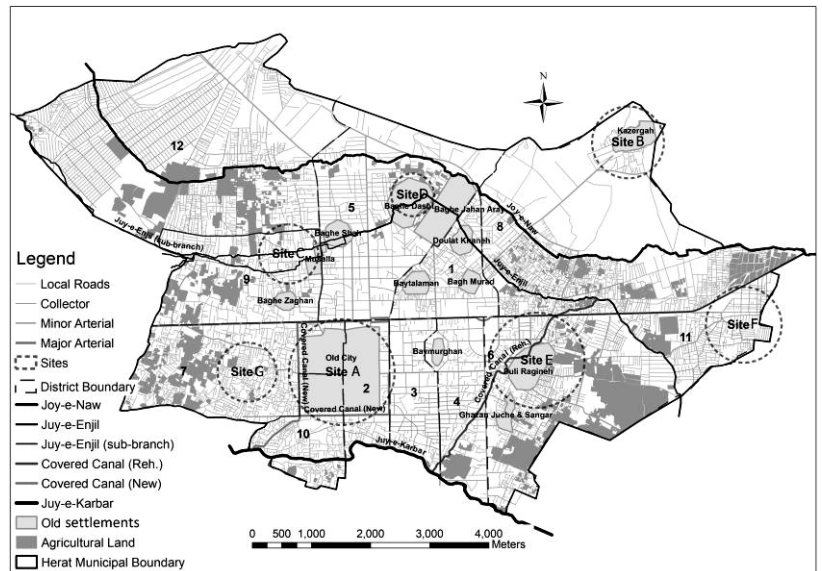


Fig. 10 Location of sites with higher density and the old settlements.

and the street view of Baghe Dasht.

Site E (located in district 6): Site E is located to the south of the administrative center of Herat and the historic area of Pul Rangineh. Like Site E, the site has no historical monuments. Houses with domical vault roofs in this area are located around the network of narrow local streets and are in most cases inaccessible by car. During the internal war, this site remained relative peaceful because families of Mujahidin were mostly living in this area, while the front line of the war was in the west of the Old City. Based on our survey, the oldest house on this site is Rahman house, which is 110 years old. Fig. 11e shows a sample of the street network and photographs of the site taken from the top of a new 4-story building.

Site F (located in district 11): Although site F is one of the areas with the highest density of houses with domical vault roofs, it is a part of newly developed area of Herat City which was settled in the last 20 years. Based on our survey, the oldest house on this site is Mohammad house, which is 20 years old. The family moved here from Ghor (other province of Afghanistan). Unsurprisingly, no historical monuments exist in this area. Most houses have been constructed by migrants from other provinces who moved to Herat due to safety concerns and the ongoing war. After their arrival, they built houses with available materials. Because houses with domical vault roofs are made with sun-dried bricks and mud which are locally available, they were the cheapest type of shelter to construct. The government has tried to organize and control the growth of this area by creating a network of streets and banning new constructions to the north of the major road of Herat (Fig. 11f).

Site G (located in district 7): Site G is located in the west of the Old City (Fig. 11g). Although no historical monuments exist in this area, it is next to Site A which contains numerous historic monuments. During the internal war, the front line was in this area. The site was vacated by residents and heavily bombed. After the war ended, residents who were evacuated from the area returned and began repairs and new construction. Although new methods of construction were introduced and many new houses were constructed with flat roofs, this area retains a mixture of houses with domical vault roofs and flat roofs. Based on our survey, the oldest house on this site is H. Nabi house, which is 35 years old.

These sites can be classified into three groups: 1) monumental, 2) old villages, and 3) new residential settlements (Table 1).

Site A and Site B belong to the first group. In these sites, houses with domical vault roofs are constructed around significant historic monuments of Herat. Site A is the Old City and Site B is the historic village of Kazergah. Both sites existed before the 1960s. They were defined as the core zones of Herat by UNESCO in 2005.

The sites in the second group are old villages which developed around irrigation canals before the 1960s. Site C, Site D and Site E are in this group. Site C is next to the Mosalla Complex and the Minarets of Herat. Site D is the historic village of Bagh-e-Dasht. Site E is located around the old villages of Gazan Juche & Sangar and around Puli Ragineh.

The sites in the third group contain houses with domical vault roofs which have been constructed recently (after the 1970s). They are situated neither in old villages nor next to old irrigation canals, and no historic monuments

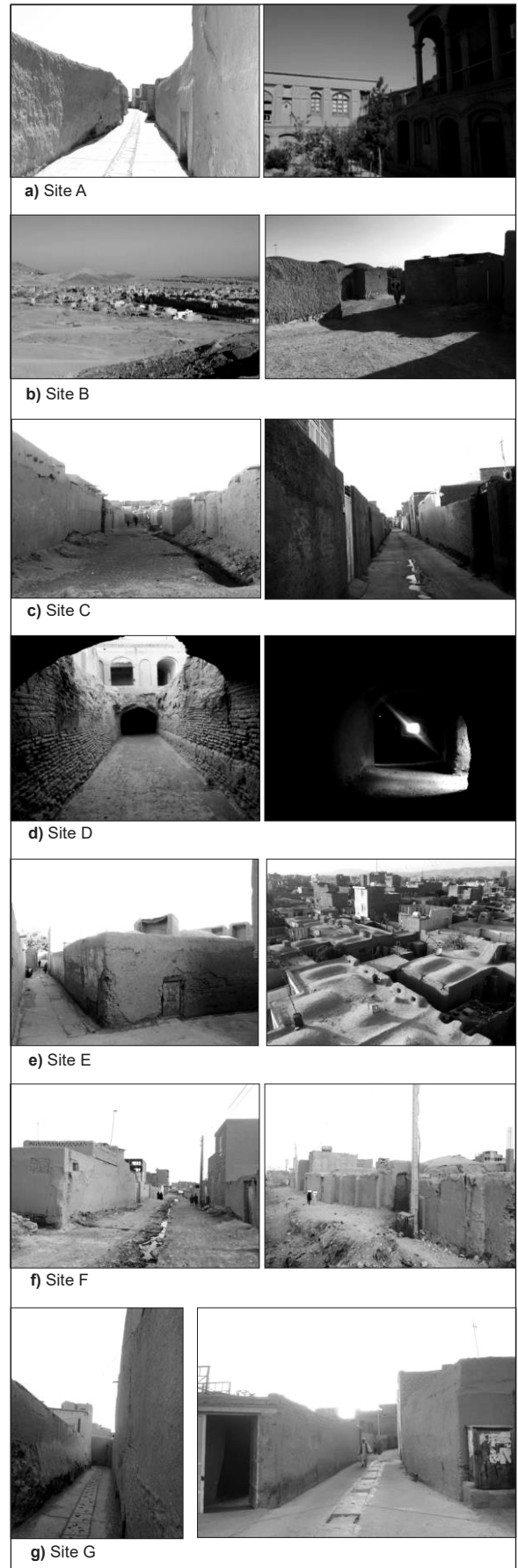


Fig. 11 Photography of 7 sites with higher density of houses with domical vault roofs.

of Gazan Juche & Sangar and around Puli Ragineh.

The sites in the third group contain houses with domical vault roofs which have been constructed recently (after the 1970s). They are situated neither in old villages nor next to old irrigation canals, and no historic monuments are observed. Site F and Site G are in this group. Site F is the new development of Herat settled by internal migrants coming from unstable areas of Afghanistan. Site G is located to the west of the Old City,

the area was the front line of the internal war. After the war, residents returned and rebuilt houses with flat roofs, resulting in a mixture of buildings with domical vault roofs and flat roofs. Based on our survey of each site, none of the interviewed elder residents remembered the existence of flat roof residential houses with modernized materials before the Taliban period (1996-2001).

Table 1 Sites with similarities in three groups.

Group	Site	Existence of monument		Old vilage	Next to irrigation canals
		inside of site	next to site		
1	A	O	-	-	-
	B	O	-	O	-
2	C	-	O	O	O
	D	-	-	O	O
	E	-	-	O	O
3	F	-	-	-	-
	G	-	O	-	-

4. Conclusion

Based on the findings of this study, the density of houses with domical vault roofs varies within the municipal boundary of Herat. The study identified 7 sites that have a higher density of traditional houses with domical vault roofs. They are classified into 3 groups: 1) monumental, where important historic monuments are located and are defined as core zones of Herat, 2) old villages, where old settlements of Herat outside the Old City took place, along the irrigation canals, which are important because they form the historic urban fabric, 3) new residential settlements with domical vault roof houses after the 1970s, which have emerged due to urbanization by low income families who migrated from other provinces.

The conservation of sites with traditional houses is necessary because they form a historic urban landscape which has significant cultural value. The findings of this study show that sites with similar urban fabric may have different historical contexts. Such previously unknown areas have now gained visibility and can be further studied from both social and physical perspectives by field surveys in order to contribute to the conservation of Herat's cultural heritage.

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Notes

- i) The location of covered canals are taken from the Department of Urban Development and Housing (DUDH) of Herat and processed by the authors.
- ii) Waqf: term used to explain an Islamic charity system. It refers to property dedicated as charity under this tradition (Kalfan 2014).
- iii) Awqaf: plural form of waqf when referring to multiple properties (Kalfan 2014). In Afghanistan, the Department of Awqaf, a governmental organization, is responsible for the administration of properties categorized as Waqf.
- iv) Dalaan: corridor, space between two doors, roofed space between home and its door (Dehkhoda 1958). In Herat, the term is used to refer to both roofed space between home and its door and the traditional covered alley or passageway.

和文要約

本研究は、2017年に撮影された高解像度(30cm×30cm)の衛星写真を用いて、ヘラート市内のドーム状ヴォールト屋根伝等住居の分布を分析するものである。衛星写真の分析の結果、ヘラート市内には11,754件のドーム状ヴォールト屋根伝等住居が存在することが明らかになった。またヘラート市内には、7か所のドーム状ヴォールト屋根伝等住居が高密度に分布する地域があることが明らかになった。文献調査と現地調査により、それらの集中地域は1)伝統的なモニユ

メントの周辺地域、2)1960年代以前に形成された運河沿いの伝統集落、3)1960年代以降に形成された比較的新しい周縁集落に三分類されることが分かった。

ドーム状ヴォールト屋根伝等住居はヘラート市の伝統的景観の基層をなすものであり、地域の文化遺産ともいえるべき存在である。今回の調査により初めて明らかとなった伝統住居の分布は、今後の景観保全計画策定のための基礎データとして極めて重要である。

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