

## OLD ARCH BRIDGES IN HAMADAN PROVINCE

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**Abstract.** In Iran, one of the oldest countries of the world, several arch bridges have been built from the past till now. Despite natural disasters, such as earthquakes and floods, some of these bridges are still used. Hamadan is one of the oldest cities in Iran (the first kingdom's capital city), and has several cultural heritages including old arch bridges, which have been built about 400 years ago.

In this paper, some of the important masonry arch bridges have been described providing available information. These bridges are under the supervision of the Iranian Cultural Heritage Organization, ICHO (Hamadan Province Office). ICHO has carried out several repair works to safeguard these valuable heritages against failure and to preserve them for future generations. The repair programs include underpinning and strengthening the foundations, structural works, and reconstruction of damaged parts. In the oral presentation of this paper, some photos are presented to show these historical bridges.

## **1 INTRODUCTION**

In Iran, one of the oldest countries of the world, several arch bridges have been built from the past till now. Despite natural disasters, such as earthquakes and floods, some of these bridges are still used. Hamadan is one of the oldest cities in Iran, which was the first kingdom's capital city. This province has several cultural heritages (more than 800), including old arch bridges, which have been built about 400 years ago.

Iran has been an important region between the east and the west of the world from the past. Also, the presence of different people living in different parts of the country necessitated construction of roads and bridges. One of the oldest and the most important highway has been "the Silk Road", which was constructed starting from China ending in Europe, and an important part of this road passed through Iran. Rivers were one of the most important obstacles for highway construction in the past. Although the number of big rivers is not high, due to Iran's arid climate, but still there are several seasonal rivers with high floods and wide cross sections. In prehistory time, some initial methods of transportation were used, such as travelling in dry seasons, swimming, construction of wooden bridges, and usage of small boats. But after the establishment of governments, development of commercial and cultural relationships, military aggressions and defenses, construction of suitable bridges on the rivers necessitated.

## **2 A BRIEF HISTORY OF BRIDGE CONSTRUCTION IN IRAN**

The first Iranian government was established more than 25 centuries ago. Only few damaged bridges have been remained from that duration. During the Sasanian kingdom- more than 15 centuries ago- several bridges were constructed, some of them are still in good condition and work properly having had some rehabilitation. Some bridges are related to this period of Iran's history, because in the Islamic period they have been reconstructed on their original foundations and/or piers. But the most important period of bridge construction in Iran was the Safavieh period, the period which road network extended throughout the country widely. The history of bridge construction is the subject of another paper, and could be found briefly elsewhere <sup>1</sup>. In this paper, only historical bridges in Hamadan Province have been described.

## **3 HISTORICAL BRIDGES IN HAMADAN PROVINCE**

There are several historical bridges in Hamadan province, which are mentioned in Table 1. The most important bridges are:

1. Shekasteh (Qarahchai) bridge (in Asad Abad city),
2. Farasfaj bridge (in Toiserkan City),
3. Jahan Abad bridge (in Famenin town),
4. Abshineh bridge (in Hamadan City).

The locations of these major historical bridges are shown in Figure 1.

No.	Bridge's Name	Location	Construction Time (Kingdom)
1	Abshineh	Abshineh village, Hamadan-Malayer Highway	Zandieh
2	Shekasteh	Khosro Abad village, Hamadan-Kermanshah Highway	Safavieh
3	Korzan	Korzan village, Toiserkan- Oshtoran Road	Pahlavi
4	Koorijan	Koorijan village, Hamadan, Tehran Highway	Safavieh
5	Aq Korpi	Amzajerd village, Bahar City	Qajarieh
6	Jouragan	Jouragan village, Hamadan- Tehran Highway	Qajarieh
7	Sorkh Abad	Sorkh Abad, village, North-East of Hamadan	Qajarieh
8	Farasfaj	Farasfaj village, Toiserkan	Safavieh
9	Aroomand	Aroomand village, Hamadan-Asad Abad Highway	Qajarieh
10	Zaramin	Zaramin village, Nahavand	Qajarieh
11	Marvile	Marvile village, Malayer	Pahlavi
12	Haji Baqer	Qaleh Sheikh village, Toiserkan-Kermanshah Highway	Pahlavi
13	Meihamleholia	Meihamleh Olia village, North- East of Hamadan	Pahlavi
14	Jahan Abad	Jahan Abad village, Famenin town	Safavieh
15	Qaleh Nou	Toiserkan	-
6	Toiserkan	Toiserkan	Safavieh
17	Koocheh	Koocheh village, Toiserkan- Kangavar Highway	Safavieh

Table 1 : List of historical bridges located in Hamadan Province<sup>ii</sup>

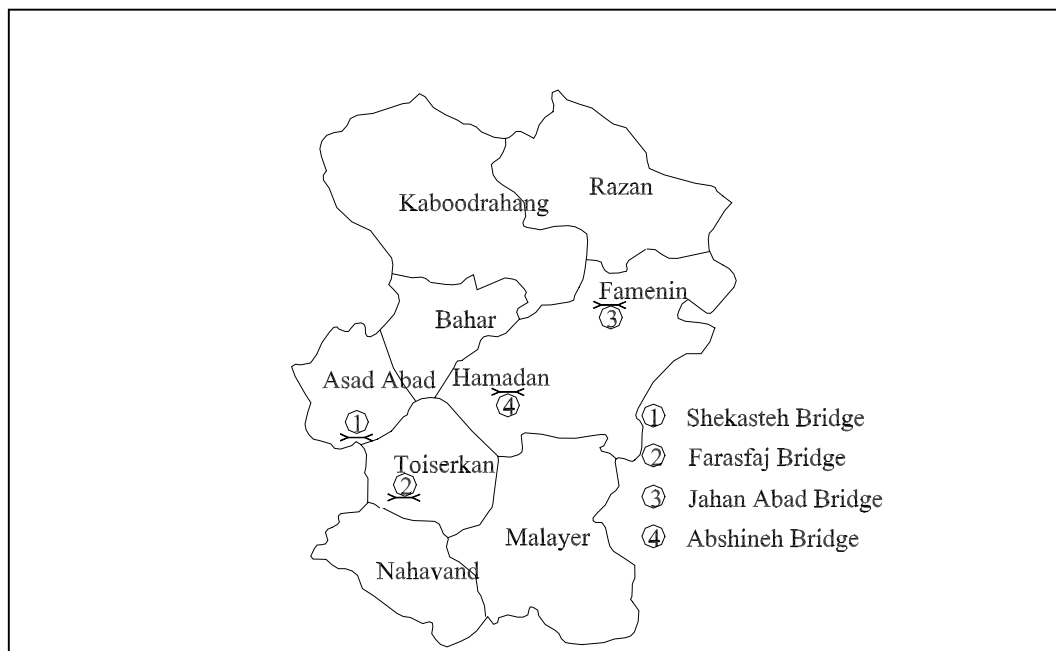


Figure 1: Map of Hamadan Province and locations of historical bridges

### 3.1 Shekasteh (Qarahchai) Bridge

This bridge is located near Khosro Abad village, 20Km South-West of Asad Abad City. Since this bridge was broken some times ago, therefore it has been called Shekasteh Bridge (broken bridge) and the village is sometimes called Shekasteh village. Nowadays this bridge is at the left side of Hamadan – Kermanshah highway, but was used for this important highway in the past. The bridge was constructed over Shahab River and its direction is North-South. It has two main spans (6.20 m each) at the middle and two short spans (4.20 m each) at two sides. The height of the middle spans are 4.86m with 1.20 m thickness, and the side spans are 3.62m with the thickness of 1.03 m. Total length of the bridge is 44m, 5.7m widths, and 6.5m height. The bridge’s deck has a smooth grade from each side towards the center. The bridge foundations were constructed with stone and special old mortar called “Sarooj” mortar. Mortar was made of lime, ash, clay, and water. Then clay bricks and gypsum mortar have been used for construction of the arch sections of the bridge. The shape of the arches are herringbone type, which the crown is sharp. Bridge’s piers have a special semi-conical shape so that the water pressure decreases around the upstream of piers. The diameter (thickness) of each pier is about 4 m. This Bridge has been repaired by the Cultural Heritage Organization recently, and has been recorded in the historical list under No. 1875. The bridge is made during Safavieh Kingdom<sup>i, iii, iv</sup>. The plan, view, and picture of this bridge are shown in Figures 2 and 3.

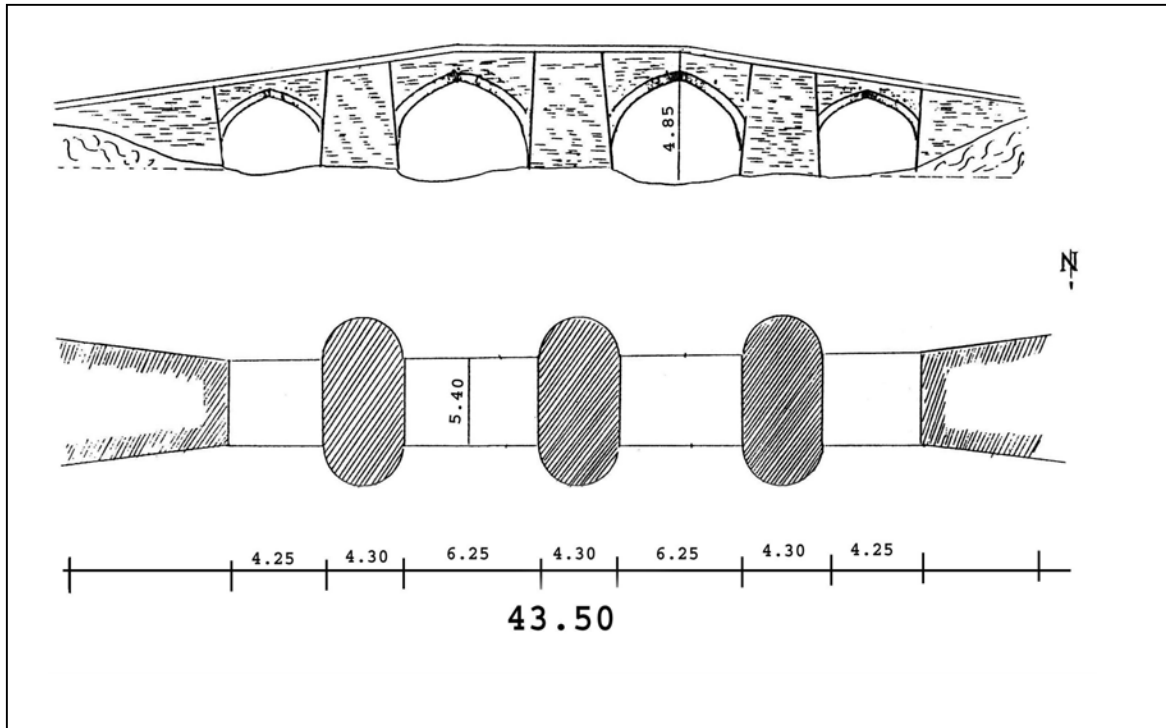


Figure 2: Plan and view of Shekasteh Bridge, Asad Abad

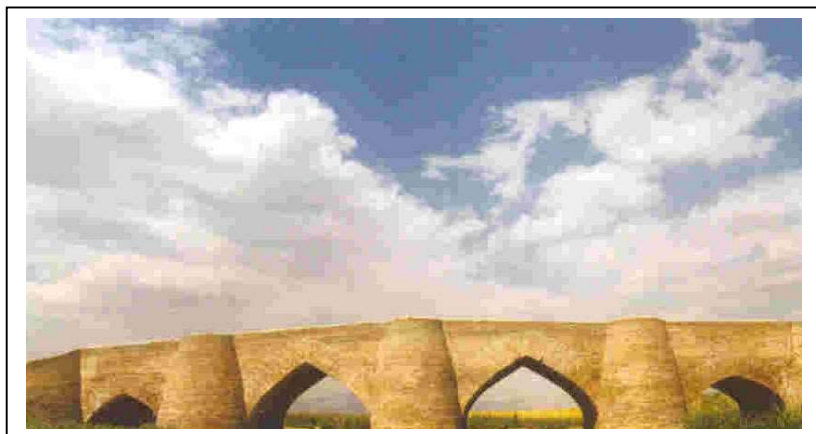


Figure 3: Picture of Shekasteh Bridge, Asad Abad

### 3.2 Farasfaj Bridge

This bridge is located near Farasfaj village, 20Km far from Toiserkan City. Therefore, it is believed that bridge has been constructed during Safavieh Kingdom, about 400 years ago. It has also been mentioned that its history may be relevant to Sasanian Kingdom period, 1400 years ago. The bridge was built over Qelqelrood River. The shape of arches are herringbone type, which the crown is sharp. The bridge's deck has a smooth grade from each side towards the center. The bridge is in the east–west direction with overall length of 60 m with 3 spans. Middle spans are longer than side spans. Above the piers, two small span arches (voids) have been built in order to reduce the pressure on piers and reduction in required materials. These small spans are for big floods as well as to transmit water like a spillway in dams. Therefore, damage due to floods will be reduced due this interesting element of the bridge. The picture of this bridge is shown in Figure 4, which shows shows the small spans as well.

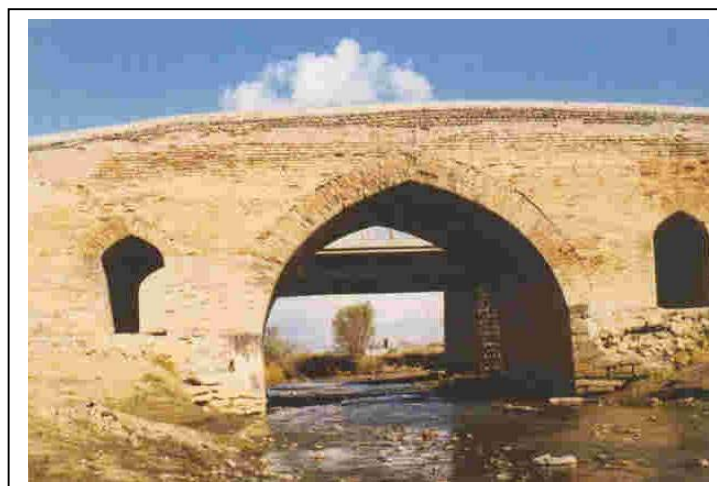


Figure 4: Picture of Frasfaj Bridge, Toiserkan

This bridge was more important in the past, not only for the connection of villages, but also due to an important road that included this bridge, which was for connection of other cities to the west of the country, in particular for pilgrims travelling to religious cities in Iraq. The bridge's foundations are constructed with stone and Sarooj mortar. The bridge's foundations and piers have suitable conditions. This bridge has been repaired by the Cultural Heritage Organization recently, and has been recorded in the historical list under No.1874<sup>i, iii, iv</sup>.

### 3.3 Jahan Abad Bridge

This bridge is located at 6Km south of Famenin, Hamadan and 2Km from Jahan Abad village over Qarahchai River. It has been built during Safavieh period about 400 years ago. The bridge had 5 spans in the past, one of the side spans was damaged, but nowadays it has been repaired. The middle arches are bigger than the side arches and this has caused a smooth grade towards the bridge's center. The shape of arches are herringbone type, which the crown is sharp. The bridge's foundations have been constructed with stone and Sarooj mortar. Then clay bricks and mixed gypsum and soil mortar have been used for construction of the bridge's arch sections. This bridge has been repaired by the Cultural Heritage Organization recently, and has been recorded in the historical list under No. 2287<sup>i, iii, iv</sup>. The plan, view, and picture of this bridge are shown in Figures 5 and 6.

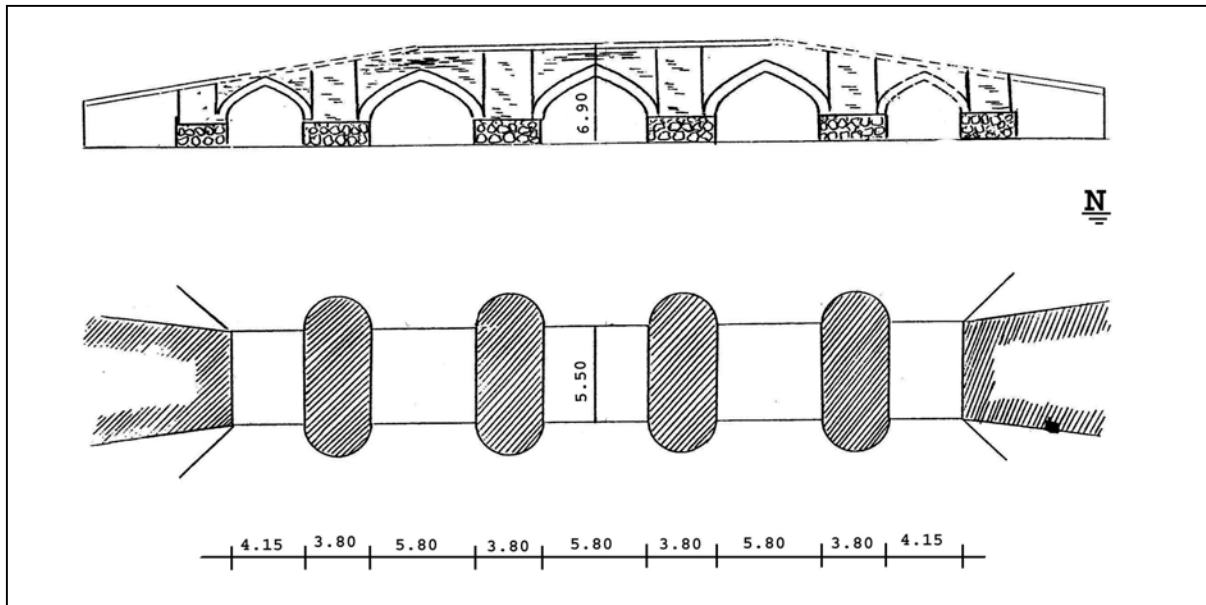


Figure 5: Plan and view of Jahan Abad, Famenin



Figure 6: Picture of Jahan Abad Bridge, Famenin

### 3.4 Abshineh Bridge

This bridge is located at 5Km south-east of Hamadan, near Abshineh village. Now this bridge is at the right side of Hamadan – Malayer highway, and was used for this important highway in the past. The bridge was built over Yalfan (Abshineh) River. It was built during Zandieh period about 250 years ago. The bridge has 4 spans. The middle arches are bigger than side arches and this has caused a smooth grade towards the bridge's center. The shape of the arches are herringbone type, which the crown is sharp. The bridge's foundations have been constructed with stone and Sarooj mortar. Then clay bricks and gypsum mortar have been used for construction the arch sections of the bridge. This Bridge has been repaired during the Qajar and Pahlavi period<sup>iv</sup>. The picture of this bridge is shown in Figure 7.



Figure 7: Picture of Abshineh Bridge, Hamadan

#### 4 CONCLUSIONS

In this paper, some of the important masonry arch bridges have been described with available information. Unfortunately information about these bridges is very limited and the available information does not include Civil Engineering aspects of the bridges in details. More study is required about these bridges and other historical bridges in Hamadan Provinces as well as other Iran's provinces.

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