INTRODUCTION OF HISTORICAL HYDRAULIC STRUCTURES OF KAROON RIVER IN SHUSHTAR DISTRICTS

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ABSTRACT:

Because of good condition of life and situation in Shushtar city and also good climatology, various tribes were abstracted water availability and proper quality of Karun river, beside of fertilization of land are the reasons of different hydraulic structures. These expensive structures are Barrier Bridge and intakes that are related to Haknamaneshian & Sasanian of historical structures on the world. Although some of these structures are destroyed by floods and wars during the times but some of them still are working or repaired to work (Daryoon canal & intake).

In this article not only we introduce the structures but also we discuss about structure goals material operation relation and access of them.

Keywords: historical structures barrier– bridge intake

INTRODUCTION:

Before of farming human used water as drinking and hungering after that human con concentration was happened.

Existence of Karun. Kharkheh, Garahi, Zohreh and flat fertilize land , Khnzestan province was the last place of living for new rock time and later. Because of little rain store and conveyance of water was of first thought by this way differet hydraulic structures are built. The first irrigation of Choghamish hill (Between dezfull & shushtar) are related to six thousand years B.C. destroyed , the oldest one is Choghazabil water refinery about 3250 years ago in time of Onatash imperial of Ilam. Until now mare than 260 hydraulic structures were introduced that are the most number in the world.

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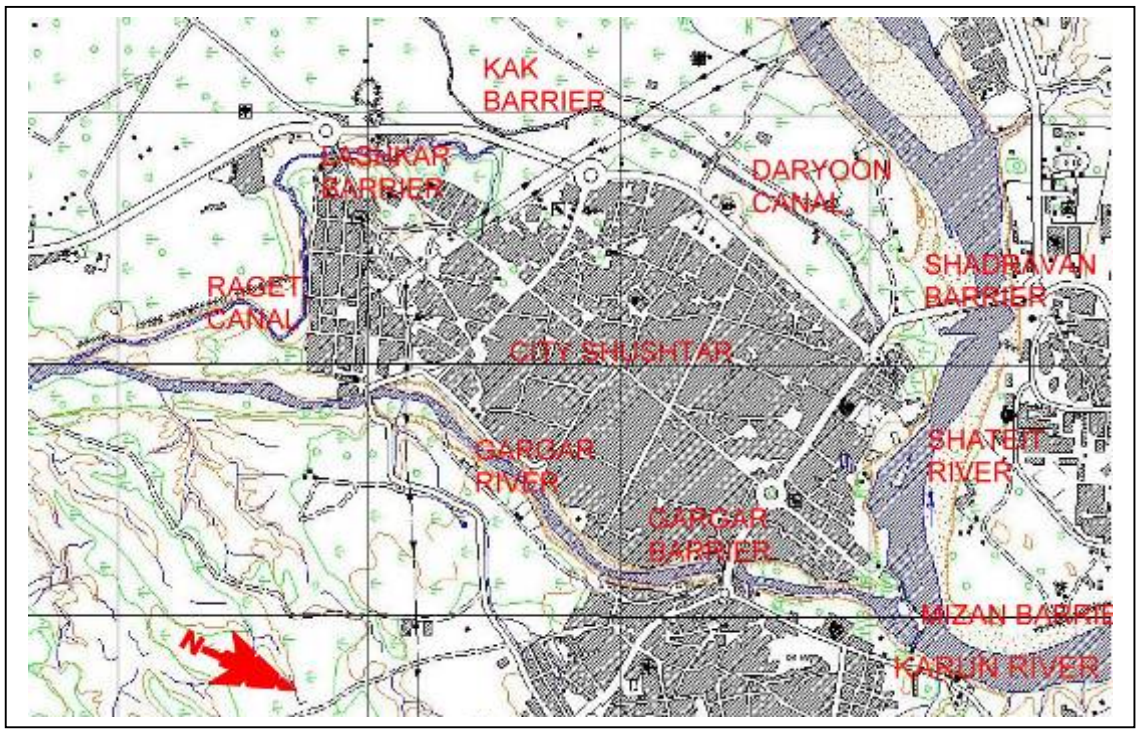
Shushtar hydraulic structures in totally are the oldest one in country without debt they are the biggest centre of hydropower in the world. These structure are 2000 years old and were located cross Karun river between Gotvand to Ahwaz city and some of barrier – bridge canals, underground conduit in this distance are seem.

Shushar city in north 5th of Khuzestan province is the oldest city of Iran.

Karun River at the point of entrain from north of shushtar at the place of Ghasar Takht by historical barrier as mizan is divided to branches as Dodangheh (Gar gar) Four dongheh (Shotat). Near 300 meters of Mizan barrier on Shoshtat another barriers as barrier briage Shadravan was located and near 1000 meters south of mizan over Gargar branch Gar gar barrier- bridge over Gargar branch Gargar barrier- bridge underground tunnels are located.

In this article in attention to numbers historical hydraulic structures because of limitation only a few number are presented.



Map (1) – situation of historical hydraulic structures on Karun river around Shushtar city.

RESEARCH REVIEWING:

Najmolmolk itinerary says that Shushtar wide barrier , Mohammad Alimirza on Gargar river is located dam wide is about 25 zar (zar= 41 in) and hieght is less than 5 zar and 200 zar length that is not straight total cost of dam is about 120.000 tomans. Few times

it was destroyed by digging of masraghan stream in soft texture of Khuzestan soil this stream became bigger to flow more water. In other hand in shotat branch water flowing Lester and damage to agriculture.

Because of that, they built a burrier on Mosrghan intake in this place one branch as Four dongeh.

And other one is two Dongeh. From this book in downstream of Mizan barrier beside of city there was Magham barrier could lift water few Zar (zar= 41 in) for people conveyance that by water wheels to city. Two dongh more than 20 Zar (zar= 41 in) is deeper than city, this is the why they use water wheels.

About 300 meters upstream barrier- bridge of Shushtar under Salacel fort there is two tunnels. These tunnels after one hundred are joined to each other , and create Daryoon canal. Another name of this canal is Minoab or Darabian that built by great Daryosh imperial of Iran. Also about 500 meters downstream of Mizan barrier there is another barriers that were built of bricks and in the front of this dam there is a earth dam because of simplify is a temporary dam.

In Shushter city there is barrier as name of Shapur imperial of Iran it has 1 mile Length and was built by bricks to left water for Shushtar.

Historical investigation of irrigation networks is showing that this networks 300 yeas before Shadrawan brier- bridge it supply water it means that barrier bridge of Shadrawan was built to complete Daryoon stream operation.

HISTORICAL AND HYDRAULIC STRUCTURES :

1- BARRIERS AND BARRIER- BRIDGE

1-1 Mizan barrier :

1-1-1- Barrier introducery and it history:

this barrier is one of the important hydraulic structures in Shushtar evidence shows that it is related to Sasanian times. Migan barriers is loc teal in east west of Shushtar north and near to Seyed Mohamad Mausoleum. In this location, Karun river in direction of east- west divided to east& west branches (map l). This barrier is divided karun river 4 to 6 and 2 to 4. four sections of water cross of Shushat river are famous as four Dongeh and 2 another sections in east direction are famous as Dongeh or Gargar or Masarghan. We have no historical evidence about construction time of this barrier. But it should in same time of Shadravan, Daryoon, Gar gar canal. There is a thought that this barrier has a time duration as Masarghan in Sasanian time. Because of problem regarding to flowing wafer on lands they built Masarghan barrier on Daryoon river barrier divided the river to Shoshat& Gar gar branches.

1-1-1-2 cause of denomination :

Shapour dam , Shapoury barrier, Khaghan barriers , Trazo barrier , Fata Ali Shah Mizan barrier are another names for this barrier.

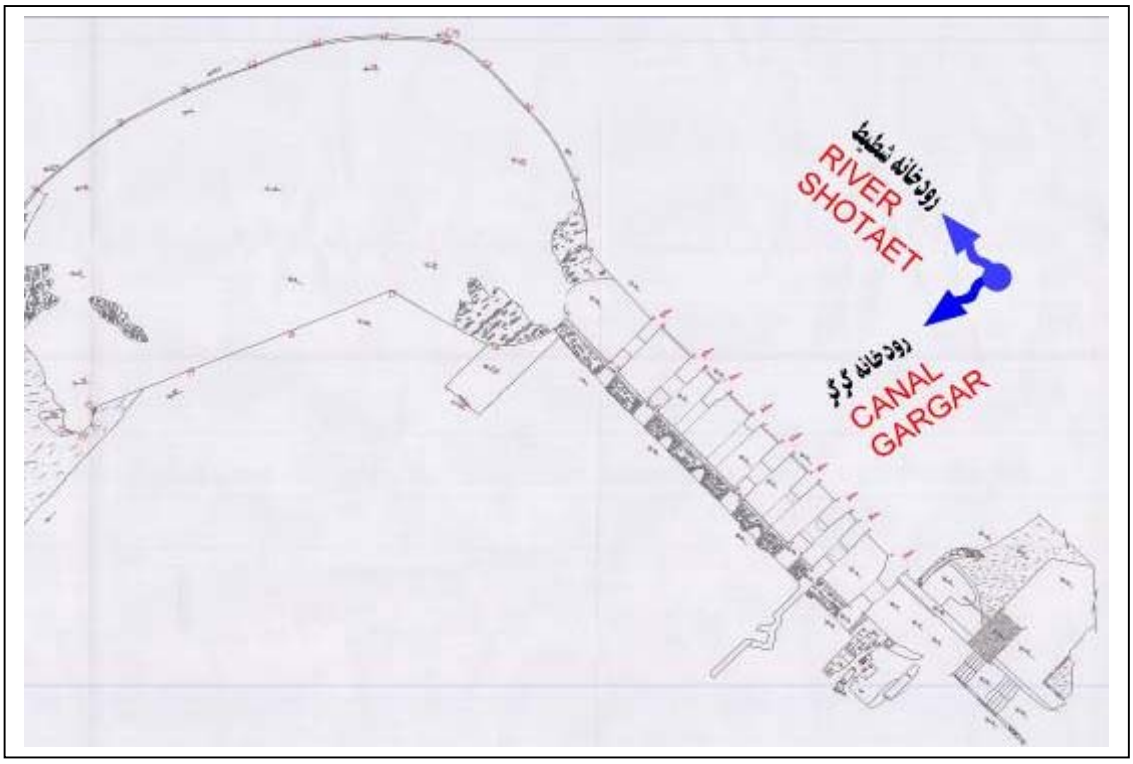
Fig (1) – Arial map of Mizan barrier

1-1-3 Barrier architect:

Mian barrier has 6 conduit 9 open channel, pressure relif & broad weir conduit wide are different, but foundation wide of nine conduit are the same. 4/9& 7 intakes are now exist. Barrier length is 523 meters crest length 323.32 meters, and different elevations of upstream and down stream in 0.45 m, height of buries is 6.5 meters. Mizan barrier materials are sandstone in regular & irregular shape, grove, and primary materials are sandstone in regular& irregular shape, grovel , and primary material of cement.

Table (1) – technical specification of Mizan Open conduit.

X	IX	VIII	VII	VI	V	IV	III	II	I	Gates Number
5.90	2.55	3.10	2.40	2.60	3.20	2.80	3.60	2.90	3.20	Gates width (m)

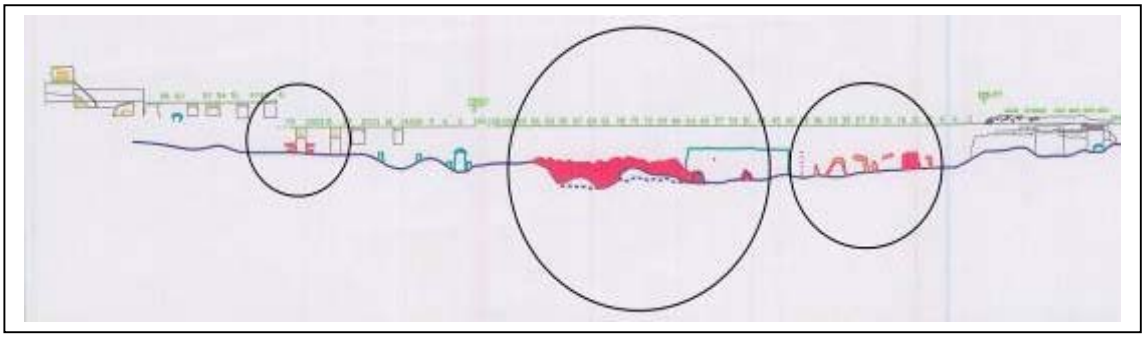


Map (2) – Mizan barrier plan.

1-1-4- Geometry situation investigation & reparation.

There is no information about foundation & plan of Mizan barrier. But some investigation such as incuvation is done. There is none. There is some possibility that foundation is settlement and felt down in river. For stability consulting engineers has presented the following ways:

- repairing the 1, 2 and 8 conduits
- repairing the pressure relief of conduit 9.
- Wall & foundation reconstruction.
- Re construction of equilibrium canal



Map (3) - situation of scouring in Mizan barrier piers

1-2 - Lashkar barrier- bridge

1-2-1- Historical specification.

Lashkar barrier brig is located in south- west of Shushtar in 2300 wetter far away from Daryoon river intake. It is one of historical set of hydraulic structures.

1-2-2- Cause of denomination:

As Lashkar barrier, Askar is famous.

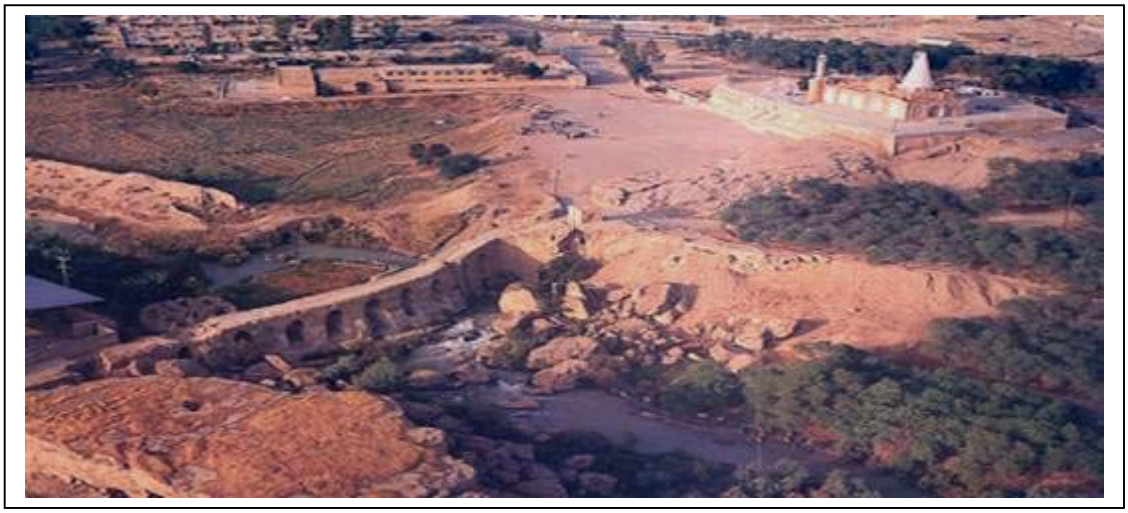
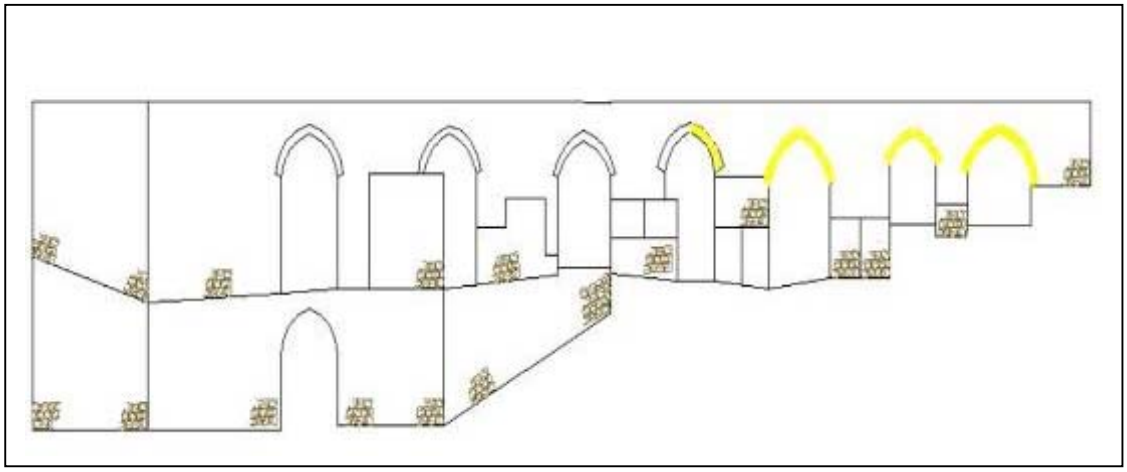


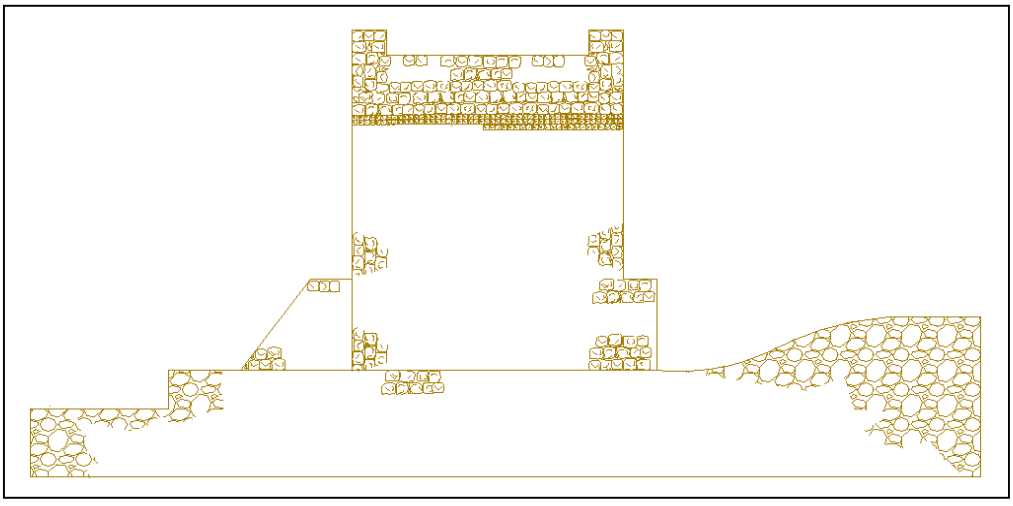
Fig (2) – Lashkar barrier

1-2-3- Barrier architect:

This barrier has 12 intakes bridge length is 124 meters, average height 10 meters, top wide is 4 meters. Wide of each intake is 3.2 meters. Height of intakes from bottom is 4.9 meters.



Map (4) - longitudinal profile of lascar barrier brig.



Map (5) - width profile of lascar barrier brig

1-3- Shadravan barrier- bridge :

1-3-1 - Historical specification:

It is located in east of Shushtar bridge on Shutat river. The construction time is at the time of Shapour l and was built by Rom imperator. It is one of original part of old irrigation of Shushtar.

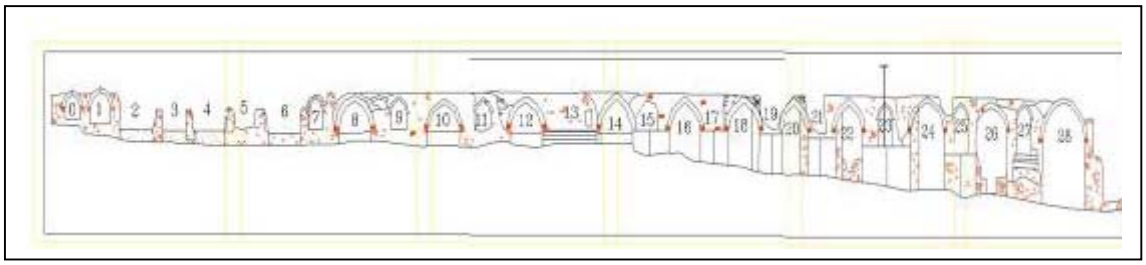
1-3-2- Cause of denomination.

Shadravan bridge , Shapour brig, barrier- brig of Gysar are others names.

Fig (3) – Shadravan barrier- bridge

1-3-3- Barrier architect:

It has 534 meters length, 44 big intakes & 43 small intakes. At the present time only 28 intakes are remained. Telis barrier- bird has 2 convex at upstream& one concave in downstream



Map (6) – longitudinal of barrier- bridge of Shadravan.

1-4- Gar Gar barrier – bridge:

1-4-1- Historical, specification :

It is located at 300 meters downstream Mizan barrier with 1700 years old.

This barrier with migan barrier controls the water surface up to 9.2 meters.

1-4-2- Barrier architect:

It has 3 underground conduit as 3 Koreh, city intake & Bolyti.

Fig (4) – Arial map of Migan barrier

1-4-2-1- Repairing & risk decreasing historical flood damaged to this barrier.

Some considerations for structural protection are:

- Construction a rash between Migan Gar gar barrier.
- repairing & reconstruction of 3 Koreh and city intake.

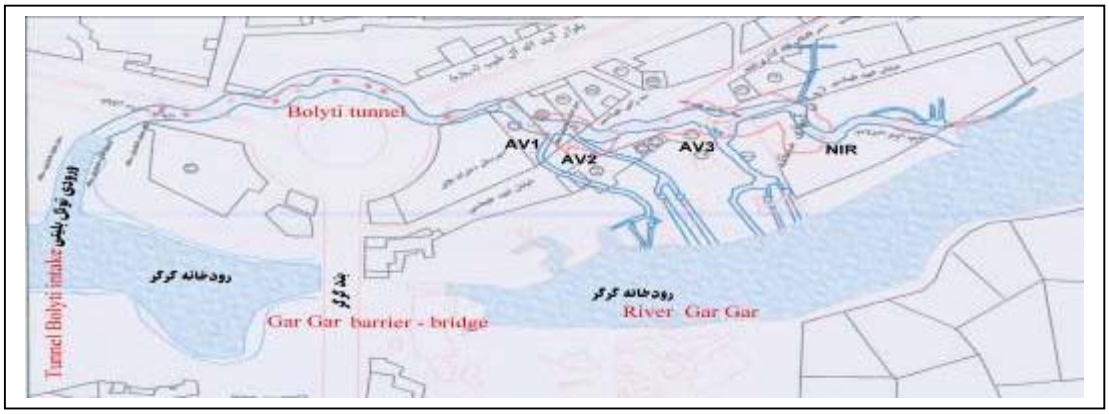
1-4-2-2 Gar gar threeple tunnels:

1-4-2-2-1- Bolyti tunnel :

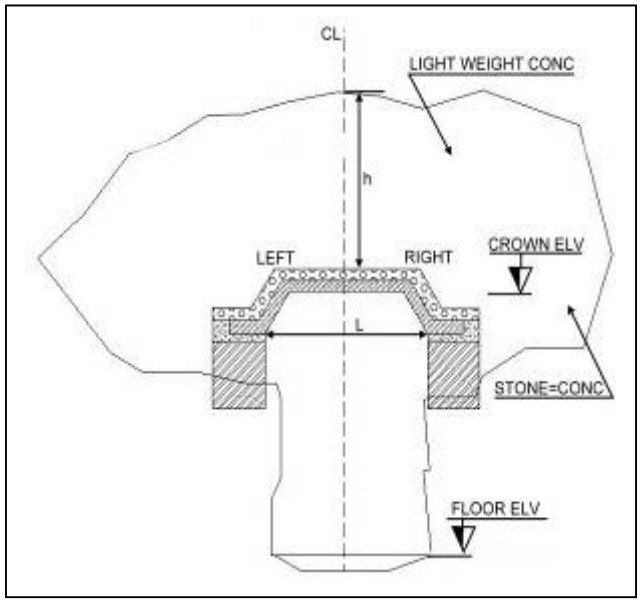
This tunnel has 1700 years old and conveyance the water from upstream of Gar gar barrier to water – mill. Bolyti in miditranian is famous as Mother Goddess.

Table (1) - outlet specification of secondary lateral of Bolyti base on minimum 300 m^3/s

Differential elevation between inlet & outlet of tunnel	Differential elevation River surface with Outlet tunnel	Cross-section (m^2)	Secondary outlet
-0.25	8.45	1.30*2.10	AV1
2.38	8.33	1.05*2.10	AV2
0.95	8.40	0.95*1.90	AV3
-	8.43	0.6*1.90	NIR



Map (7) - situation of Bolyti tunnel with lateral Branches under Shushtar city Bolyti studies.



Map (8) - overflow cross section of Bolyti tunnel in details

Study shows some tension& shear cracks on foundation and walls. There is a large scouring in tunnel invert. KwpA incorporation to cultural heritage organization had done some studies to protect the shape.

1-4-2-2-2- City tunnel intake:

It is one of the tunnels that conveyance water from behind of Gar Gar barrier – bridge to all of water – mill. Because of intake is in front of city they called city tunnel intake. It is located in east- north of gar- gar barrier- Bridge and supply water to city tunnel intake and Haje Handal water mill.

Table 2- city tunnel intake specification

DIFFERENT ELEVATION BETWEEN OUTLET INVERT WITH INLET INVERT	DIFFERENT ELEVATION BETWEEN OUTLET INVERT WITH WATER SURFACE	CROSS-SECTION (M^2)	LENGTH (M)
4.80	4.20	4*4.90	80

1-4-2-2-3 -Three Coreh intake tunnel

In Shushtarian speech for under ground tunnel they used Coreh name. Tunnel has 3 intakes by this means they named three Coreh intake.

Intake of this tunnel in located in east- north of Gar Gar Bridge. in it's direction has a diversion canal for water- mills as named Bokhbodeh outlet of tunnel is famous as loaf it comes from the word related to wavy and high currently water as name lof. The plural of lof is loaf.

Table (3)- three – Coreh technical specification

DIFFERENT ELEVATION BETWEEN OUTLET INVERT WITH INLET INVERT (IN METER).	DIFFERENT ELEVATION BETWEEN OUTLET INVERT WITH WATER SURFACE (METER)	CROSS-SECTION (M^2)	LENGTH (M)
0.70	4.90	3*(1*3)	100

Map (9) - situation of three Coreh tunnel and city intake of Gar- Gar intake

- DAMAGE CAUSES IN GOR – GOR BARRIER TUNNELS

1- Erosion in stones

2- Scouring by floods

3- Lack of aeration

4- Lack of durational reprimand

Fig (5)- Three – Coreh tunnel inlet.

1-5 - Borjeh Ayar barrier – bridge

The time of this barrier is related to Sasanian time. It is located on gar – gar branch and close to Maugham ale tam pal. It has some canal & chambers that looks like cross.

1-5-3 - Cause of denomination

The other names are: Sabaeikash , borjyeh ayar.

1-5-3 - Barrier architect.

Some parts of this barrier are located beside of river two parts of that has 150 meters long beside the river that use it for water diversion as the east of this barrier there are some residual of structures related to Sabaian prey- site.

This bridge has is netter thickness height of wall is 4.s meter & wide of that is 4.5 meters.

It has 20 meters long.

Fig (6)- residual parts of Borjeh ayar stricture.

1-6 - Khak barrier:

1-6-1- Historical specification:

It is related to Sasanian time. This barrier is located in west - south of Shushtar at 1900 meters Downstream of Daryoon intake & 400 meter upstream of (12) lashkar barrier.

1-6-2- cause of denomination:

Because of two large earth columns in both sides is famous as Khak barrier.

1-6-3 barrier architect:

Spite of small body it has nine gates.

Reservoir area is 1000 m^2. Only 40 cm of this structure is visible, now 3.5 meters of this barrier is getting up of the soil. It has 2 sections. Each section, has 5 gates with columns of 1.33 lengths. Each gate has 1.72 meters wide. In ten steps downstream has diversion gate that was destroyed

Fig (7) - Khak barrier of Shushtar

2- CANALS & RIVERS:

2-1- Historical Daryoon Specification:

Daryoon canal after Gar – Gar river is the second man built canal in Shushtar. It is related to Hakhamaneshian time that about 5 hundred years B.C

Hydraulic structures of Daryoon Are Shadravan barrier, intake & tunnel of daryoon ,Mizan barrier ,Lashkar barrier , water- mills with 2000 years old.

2-2- Caugo of Denomination:

Other names are Daryoon stream, daryoon canal dara stream, minad canal.

2-3- Barrier Architect:

Intake of Daryoon is located under Slacel castle at the highest elevation of north plan.

Watering is supplying directly from river.

It has 2.2 - 4 meters width, 2-8 meters highs invert of this tunnel is rectangular with two pass way in both sides.

2-4- Repairing The Stream& Intake Of Daryoon:

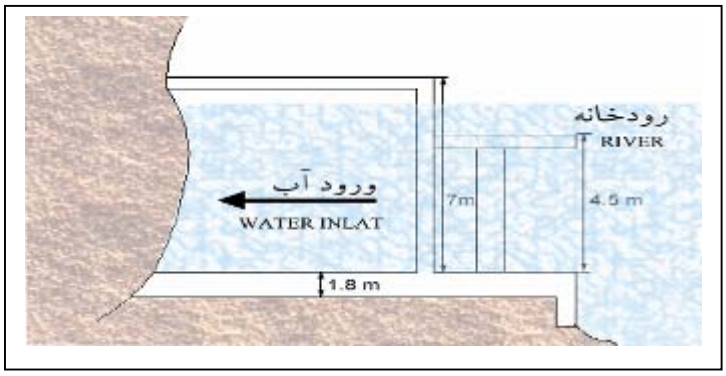
Historical floods were damaged to Shadravan barrier. Minab network with 3600 hectares need to a modern design and intake for this reason it was decided to rebuilt and repairing the intake & tunnel

2-4-1 - Parts specification:

Structure specifications are:

- intake

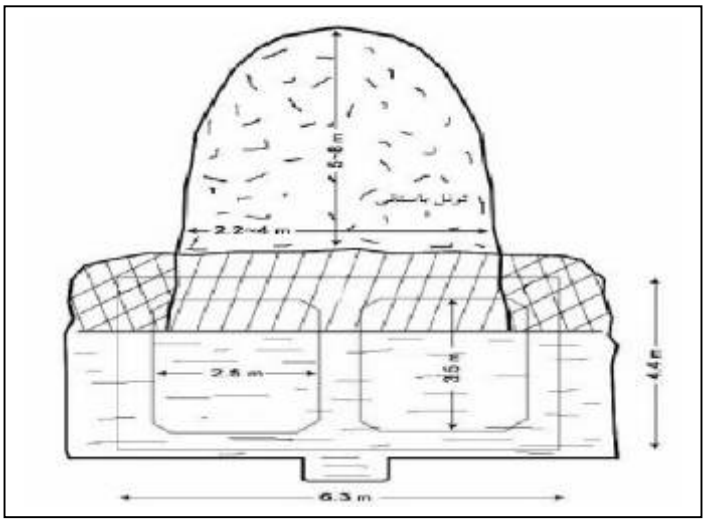
It has 2 intakes with 3.7 * 5.6 meter & another 2 intakes with 2.4 * 3.7 meter that hare trash system it has 40 m per month that is the biggest intake.



Map (10)- longitudinal profile of Daryoon stream

- Tunnel

It convenience water from two box conduit by 3.5 * 2.5 meter. Wide of tunnels 6.3 meter height 4.4 meters and length of that is 169 meters.



Map (11) - cross- section of under pressure tunnel in Bastian tunnel.

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