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Check hydraulic, structural, water mill "Kah Kooh" Sarayan city of South Khorasan

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Abstract: *Using the power of water storage and its conversion into mechanical energy for economic exploitation, the most important achievement of the construction of buildings such as mills for grinding cereals which of these structures, particularly wheat and barley has been used . In this study, the introduction of active mill Kah Kooh of Sarayan in South Khorasan province that is the type of mill chimney has been paid. The present study analyzes this space in terms of water supply and water flow in the headrace channel slope according deals. Also, the water pressure inside the headrace on the amount of time grinding grains and cereals are examined. Finally, according to calculations showed that the headrace how quickly water from 0/84 meters per second to zero and back to 16/32 meters per second will.*
Keywords*: mill chimney, Kah Kooh, headrace, channel slope, water volume, speed, Manning, height.*

INTRODUCTION

With increasing consciousness of men and their need for different products, the manufacture of equipment were needed. One of the industries that emerged in parallel with these developments, mill [9]. SHoshtar mills such structures is unique in the field of water utilities that During the Achaemenian and Sassanian to use more of Karoon made [7]. In the Islamic era in most parts of Iran mills exist so that in the reign of Mohammad Mahdi Davaniqi (second century AD) Rey was divided into ninety-six, Each of the forty-six streets and every street has been hundreds of homes and dozens of mosques. The city also has 6,400 schools, bath 16600, 15000 minaret, 12000 Mill, 1700 Currys, there have been 13,000 caravanserai [3]. Also in the seven century AD Khwaja Rashid al-Din writes that Tasuj village Tabriz function. Bath and many mills there [1]. The word mill in Persian literature and the common language of the people means the same as "Ace" used [2] and the weight of the bald, to say the absolute Asia [8], Two round and flat stones are laid on the underside of the bar, iron ore [6]. Whether the return (hand¬Ace) or water (mill) or wind (Sbad) [8], and the ass is what it is called Khoras [10]. Is a tool for flour, maize and vegetable seeds. From Asia for crushing rock salt, gypsum, are Chinese.

Including hydraulic structures in South Khorasan province can be used to mill Kah Kooh of Sarayan Which today continues to work actively. The mill, and a portion of a chimney is different.

Due to the location of the mills in South Khorasan province architecture, materials used and the type of user, commonly known principles of classical architecture, especially in the design of vaults and arches and coatings does not follow and Their plan was designed based on environmental conditions and shape of the earth, so the diagnosis is based on architectural style, historical period of work, the percentage error is a lot. But consider that in Sarayan in the Safavid era was at its zenith. Most of Sarayan history of the region belong to the Safavid period. Old mills in the region can be attributed to the Safavid period until modern times have also been active.

1.1.mill Kah Kooh

The mill in South Khorasan province, the city of Sarayan and the distance of 5.3 kilometers northeast of the city of Sarayan in the region, " Kah Kooh " is located. In terms of geographical location based (UTM) in length and width 643712/3751703 and height is 1625 meters above sea level.

It has all the parts of a mill and historically related to the Qajar period was. Access to the mill via a paved road to the village Karimooi and Musabi chorus and then a kilometer of asphalt road through a dirt road that leads to the Kah Kooh, is possible. Mill " Kah Kooh " at the beginning of a canyon that leads to the mountain Zabry and Zabry located in the water. According mill in the northeast and southwest with dimensions of 5 × 21 meters with a height of approximately 4 meters over the surrounding built environment (Figure 1). For steep entrance leads to the cubicle of wheat flour. The structure has three domed space, which is connected by a corridor in any of the spaces skylight dome lights embedded in the middle. Entrance with dimensions of 220 × 250 cm from the southeast side of the building is possible. The arched entrance with stone and mud mortar and plaster as a percussionist implemented, built and today is a metal door. After two inlet chamber space such as symmetrical dimensions of 190 × 220 which serves as a lounge area (guards) were left in the oven is embedded in the wall (Fig. 2). The two space about a meter above the floor of the corridor. After the hallway spaces, storage room located to the right of flour has dimensions of 120 × 220 cm. After this space, along entrance, wheat flour cubicle dimensions of 210 × 280 m there. Wheat flour coating chamber which has the dimensions of 20 × 20 × 5 cm brick and brick to cover only the part that is used in the building.

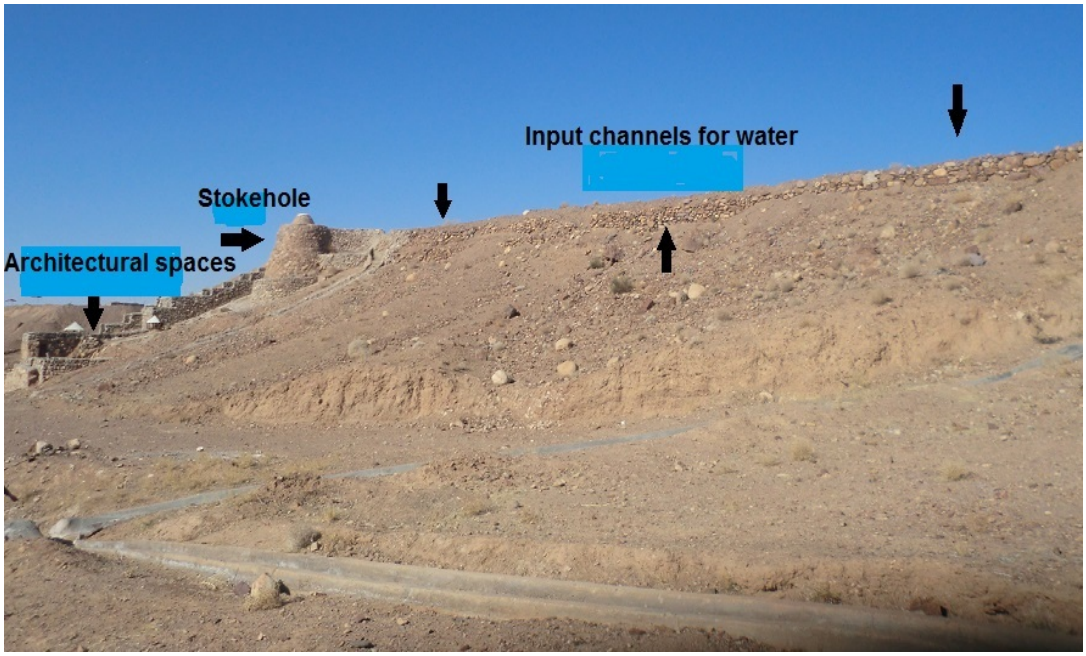

Fig 1: overview of stra Mill Kah Kooh

Fig 2: sentry box of Mill Kah Kooh

Diameter headrace 160 cm and a diameter of 90 cm and depth of 11 meters chimney walls. The main wall chimney built of brick and stone to stabilize the outer core and a cone shape. According to depth of water pressure at the bottom of the chimney and the chimney higher than thicker walls of the chimney is made up of crack lesser [5]. Also on the inside of the chimney stones horizontally so that if the interior of the chimney, is used. Water transfer channel width of 40 cm and depth of 30 cm on the walls of the channel to 56 meters with a width of 4 meters has been created. This wall was built using stones and a gentle slope to the water in the canal water can lead to chimney, has been created (Figure 3).

Fig 3: headrace and Input channels mill kah kooh

Diameter 93 cm stone is high time that the state is 6 cm thick. "Turbine" in the form of a cone with dimensions of 85 × 87 cm this mill and a depth of 80 cm is made of wood. The turbines on a wooden lever to 40/2 meters and a width of 10 cm along the sides of the timber is installed in the wall (Figure 4).

Fig 4: Stability of wheat flour or Pachal

Stone mill "kah kooh" conglomerate which is easily accessible wickets. On the left of the stone mill, which is a corridor from the hallway to the turbine inlet water after being driven out. If the grinding mill or turbine is damaged or need repair from the same corridor used. Used in building materials including bricks, rubble

stone and mortar is lime mortar and plaster.The mortar being more costly because the parts that are directly associated with water is used as a chimney. The corridor, from the rock.

1.2.Materials and Methods

In the review of hydraulic calculations of the water mill to mill "kah kooh" need to input channel, flow and speed of water entering the mill, the amount of water stored in the chimney and the chimney outlet water velocity at the beginning of mill output, is estimated.

1.3. hydrological calculations

1.3.1. input channel to the mill

Fluid flow in a conduit may be made either under pressure or free flow to free flow of water, open channel hydraulics applies. Including a variety of open channels, rectangular channels, trapezoid, triangle and circle are [4]. Surveys to determine the type and characteristics of the input channel to the mill Kah Kooh, showing the restoration of the old channel (Soil - clay) and turn it into a channel with a trapezoidal section. The trapezoidal channels from upstream mill is designed so that each 50 m long, 30 cm height reaches to the mill entrance.(fig 5 and 6)

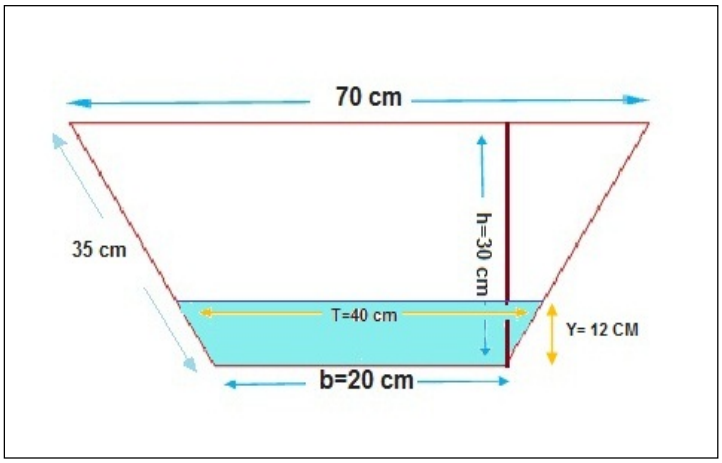

Figure 5: Input to the mill trapezoidal channel

In (Figure 5); b bottom width of the channel, Y depth of water in the channel, and h maximum depth designed for the channel, T width soaked, A cross-flow, z = cotg & Index slopes, P on wet (Groups of water contact with the wall) and R is the hydraulic radius. To determine the speed and volume of water based on the channel to calculate the area and perimeter channels is required around wet (water contact area with glazed) with P and A will be displayed with the channel area. Divided by the area of the wetted perimeter, hydraulic radius obtained by the unit of length.

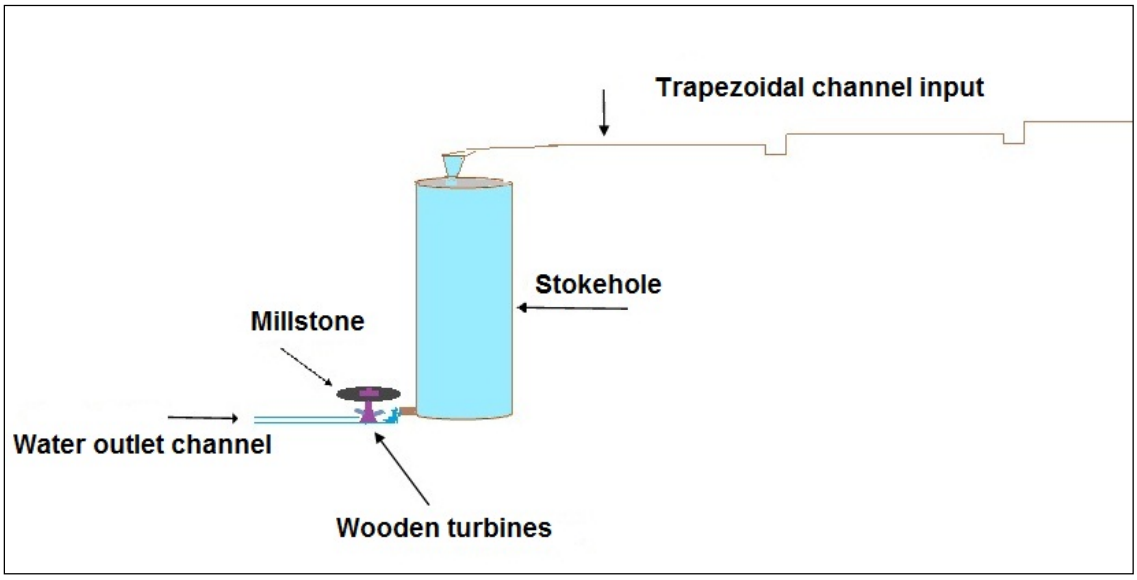

Figure 6 : Plan of mill

2. Estimate the water flow and the speed of the incoming water to the mill

Since the drought has occurred in recent years in kah kooh, not the volume of water that has already been aqueduct upstream of the mill flow; achieved, the volume of water passing through the channel manually calculated and re-volume and velocity of water using the channel characteristics and computing Manning formula is calculated.

2.1. Determine the volume manually

The amount of water per second from a water source (wells, springs, canals, rivers, canals, etc.) flows, flow water, wanted to say and with the letter Q or discharge the source is given. Discharge water flow in cubic meters per second, or liters per second is expressed.

Q = flow rate (ml a door Seconds)

v = volume Container (L)

T = time in seconds container filled

$$Q = V / T \quad (2\text{-}1)$$

With the help of formula (2-1) flow of Canal, 2.2 liters per second, respectively.

2.2 determine the speed of water manually

If Space Time T necessary That in seconds and Space Among Two Point Equal With L The meter is taken into account, Speed Surface Water From Formula (2-2) Hand The Is:

$$V = L / T \quad (2\text{-}2)$$

On The speed of the water by 0/64 meters per second, respectively.

Must Attention Did That Speed current Water a door Two the side Creek fewer And a door Middle More is so To Calculation Speed, Speed Average And Size Trade The Them.

(Vm = kv) Amount k To Depth Water On has it And Approximately 0.8 in Opinion The Fall.

0.8 = k

Speed Surface = V

Speed Average = vm

Finally, the average speed for this channel 0/52 meters per second, respectively.

2.3 Determination of flow and water velocity equations to help Manning

Since the volume of water in recent years, reducing significantly the current rate and can not be an effective channel to move the mill to be considered is tried according to the channel characteristics, the amount of Water flow and the speed of conventional The mill stream, is achieved.

2-3-1 - Manning equation

Manning equation (Manning) empirical equation for open channel flow. This equation was first presented in 1867 by French engineer Philippe Gayyv Klr and then in 1890 by Irish engineer Robert Manning was redesigned and developed. Manning formula, common equivalents in uniform open channel flow analysis that has been extracted from Chezy formula [4]. This equation, a formula (2-3) is:

$$Q = \frac{A}{n} R^{\frac{2}{3}} S^{\frac{1}{2}} \quad (2\text{-}3)$$

Manning formula Q = Water flow in terms of cubic meters per second, A = flow area, R = hydraulic radius in meters, S = slope of the channel bed and n = roughness coefficient roughness coefficient 016/0 to 013/0 concrete channels, to channel 022/0 rock and 025/0 is for earthen canals [4].

Water flow velocity in the channel with the help of Manning equation for Formula (2-4) is:

$$V = \frac{1}{n} R^{\frac{2}{3}} S^{\frac{1}{2}} \quad (2\text{-}4)$$

The trapezoidal channel of Kah Kooh, Channel specifications and calculations based on the Manning equation, according to the table (1) is:

$$R = \frac{by + y^2 z}{b + 2y\sqrt{1 + z^2}} \qquad A = by + y^2 z \qquad p = b + 2y\sqrt{1 + z^2}$$

View channel	A	P	R	$R^{0.66}$	S	$S^{0.5}$	N	V	Q
Calculation	0/35	0/51	0/068	0/168	0/016	0/126	0/025	0/84	0/029

Table 1: Profile Channel Trapezium mill, Kah Kooh along with the calculations

According to Table (2) And by comparing the rate and speed at two viewing modes and the Manning formula, although there are slight differences, but these differences can be due to the recent drought in the region consider that had a significant effect high Aqueduct in Water flow even has led to mill closures. The water speed achieved more than the view mode that can result from changes in channel design in recent years and its slope is slowing.

Parameter	Handy	Manning calculations
Water flow(Q)	2/.2	29
Speed	0/52	0/84

Table 2: Comparison of discharge and velocity in two viewing modes and the Manning formula

3.1. the amount of water stored in chimney

Cylindrical chimney can save a considerable amount of water and the balance at the entrance and exit of the chimney, with the loss of water from the chimney outlet, the water quickly returns multiplied. In Table 3 the chimney Profile:

View chimney	Shape	Radius (r) (Meter)	Height(h) (Meters)	Storage ($\Pi r^2 h$) ($Meter^3$)
Calculation	Cylinder	0/575	13/3	13/80

Table 3: Storage headrace

3.EXPERIMENTAL

3.1. chimney outlet water velocity at the beginning of mill output channel

To calculate the rate of solving simultaneous equations and continuity of energy we use. If the Bernoulli equation, assuming no energy loss between two consecutive write, will have:

$$\frac{p_1}{\gamma}+\frac{V_1^2}{2g}+Z_1=\frac{p_2}{\gamma}+\frac{V_2^2}{2g}+Z_2 \quad (3\text{-}1)$$

Continuity relationship between the two sections 1 and 2 is as follows:

$$Q=A_1V_1=A_2V_2 \quad (3\text{-}2)$$

Considering that Water flow mill input and output is identical and liquid water, and at the entrance and outlet of water in contact with air, and the equation to equation (3-3) becomes:

$$y1+\frac{V_1^2}{2g}+Z_1=y2+\frac{V_2^2}{2g}+Z_2 \quad (3\text{-}3)$$

In equation (3-3), Z_1 and Z_2: floor height of the chimney and the output level to the ground level in meters, V_1 and V_2 speed in school and water velocity in meters per second in the second period, g acceleration of gravity in meters per second, Y_1 and Y_2 water depth in first grade and second grade in terms of water depth in meters.

So what calculations and field data obtained in the table (4) to gain speed at the outlet section was formed.

Parameter	Z_1	Z_2	V_1	V_2	Y_1	Y_2
Calculation	0.6	0	0	16/32	13/3	0.3

Table 4: Estimated Parameter Of Equation To calculate the energy output speed

4.CONCLUSION

According to calculations have shown that the chimney and how quickly water mill output entries from 0/84 meters per second to 16/32 meters per second. And it would increase the power of water to move the stone mill. Also, because Water flow has fallen in recent years has fallen chimney after dewatering volume and channel output speed of 16/32 Which can be reduced slow speed stone mill and turbine, resulting in a smaller amount of wheat flour per unit time is. Another finding of this study is to move the stone mill with water and a small volume of water is relatively slow. Since the friction and wear two stones together produces less heat than metal, the result of burns under a rock flour can be avoided. This affair represents more natural to be this type flour ratio to flour mill by the industrial is.

5. ACKNOWLEDGEMENTS

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