Materials and the Style of Buildings used in Iraq during the Islamic period

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Abstract

The Islamic period in Iraq lasted 1002 years (637-1639 AD). During this period big cities were constructed and old cities were reconstructed. There was development of the materials used and the design. Bricks, grill wage, plaster, gypsum and marble and stones were used. The environmental conditions were taken in the design of the buildings. The walls were thick and basements and badgur were established. This makes it easier to cool or heat the house. Tar was used to protect the buildings from moisture. New style of buildings was established using new engineering innovations. Well-designed arches and domes were noticed during this period. Islamic buildings had special features such as minarets, arches, domes, vaults, gilding, patterns and decorations.

Keywords: mosque minaret, liben wage, tower fence, Umayyad era, Abbasid era, emirate house, dome decorate, mud brick.

1 Introduction

The style of construction and the materials that were used in Iraq passed through different stages during Iraqi history. The history of Iraq can be divides into several stages: The oldest

is what known as the ancient stage (150000 BC- 226 AD).This stage ended at the Islamic age [1]. The Islamic period includes the Rasheden Caliphs Era (637- 661) AD, The Umayyad Era (661- 750) AD, The Abbasid Era (750- 1258) AD, and The Mughal Era (1258- 1639) AD.

The third stage extends from (1639 AD onward). This includes the Ottoman Empire, British occupation and finally the Iraq independence.

The Islamic period is characterized by the establishment of big new cities such as Basra, Kufa, and Wasit (Figure 1). In addition, existing cities like Mosul and Anbar were reconstructed. The political, military, and administrative environment helped to achieve these establishments. The cities were characterized by its collector Mosque, emirate house, the places, and the schools.

All the buildings were characterized by an internal courtyard or garden. The courtyard might have ceiling some times. Another feature was the presence of more than one courtyard, and they act as a filter for dust and acts to moderate the air temperature inside the house.

Generally, the buildings can be classified in o three categories as: buildings surrounded by fence such as palaces and khans, and buildings of a religious nature such as mosques and the shrines, and public

houses, [3]. The Islamic buildings are characterized by two main features. They describe the function for which the building was constructed for, and they did not pay that much attention to the external appearance of the building. The Islamic engineer followed firm steps in their work. They used to prepare the plan drawing and calculated the cost and quantities of material required for the construction [4]. The most important features characterizing the Islamic building were the minarets, the domes, the columns, the decorations, inscriptions and the calligraphy which was use in the inscriptions [5].

Style of buildings, material used for construction and the development through the beginning of the Islamic period to the Ottoman Era will be discussed in this paper.

Figure 1: Map of Iraq [46]

2 Rasheden Caliphs Era (632-661) AD

Islamic conquest of Iraq started 637 AD. At the beginning of the conquest, Basra city was established. The city was actually an army camp to accommodate the soldiers and their families. It was built using canes. Later the camp was developed and re styled. A mosque, emirate house and finance house were built. These buildings were within the center of the city. Surrounding these buildings were

the markets, public bathes and residential houses. Streets were also established and all of them led to the mosque. The mosque was open courtyard surrounded by wall. Later part of the courtyard was covered by ceiling to protect worshipers from hot sun. The material used was mud and liben (This is a mixture of clay, water and barley). It was mixed in a special technique referred as "Bakla": in this technique they dig a trench and they mix the clay with water and barley inside the trench. The mixture is very well compacted and later they build the walls on top of it.

Kufa was the second city to be built at 638 AD. It was built in a similar way to Basra city. The materials used for building were mud and liben. The emirate house was built on the southern side of the mosque over foundations having depth of 90cm. The materials were also similar to those used for building Basra city. Figure 2 shows the plane of mosque and emirate house. Later bricks were used in building but to a limited extent. Wage was used for building houses but limited.

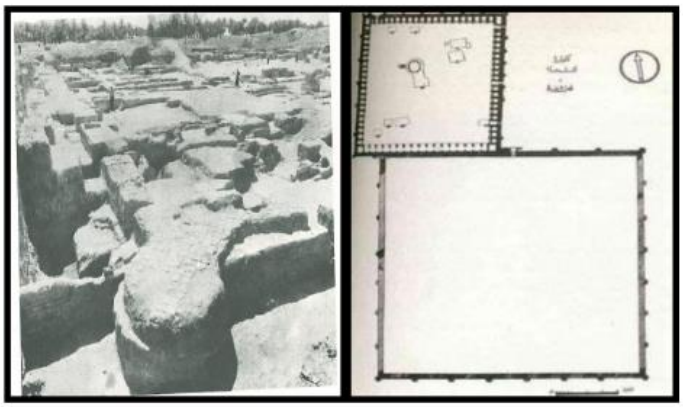

Figure 2: The Planned of the Mosque and the Emirate's House and Photo of Emirate's House Foundations [8]

3 Umayyad Ears (661- 750) AD:

This period marks major development of construction and architectural work. The engineers modified the style of buildings that they saw in conquest countries and mix it with the Islamic style. The weather conditions, availability of construction of building for the environment were taken into firm and the topography and the soil type were taken into consideration. Straight roads were straight about 50 m wide. The center of the city usually has the mosque, emirate house and house of finance. These are surrounded by markets and residential areas. Mosques at that period were considered as governmental house besides its religious purpose. All financial, political and educational transaction was executed at the mosque. In view of this, every city must

have a mosque at that period. Engineers were very keen to build the mosques in such a way to reflect the spirit of religion and it also reflects the engineering development.

Basra city was headquarters of Umayyad Government in Iraq and was on the way connecting Sham (Syria, Jordan, Palestine, and Lebanon) and the Persian Empire. In addition, it was an important port. For these reasons it developed quickly and covered an area of (15*15) km.

A number of merchants lived in Basra and built luxury palaces on the banks of the rivers. The main mosque in the city was reconstructed. They used wage and plaster in its reconstruction, the foundations were used stones and they furnished the ground with read stones. Figure (3) shows the mosque. The house of government was reconstructed in a similar way.

Figure 3: Basra Mosque with its Minaret [13]

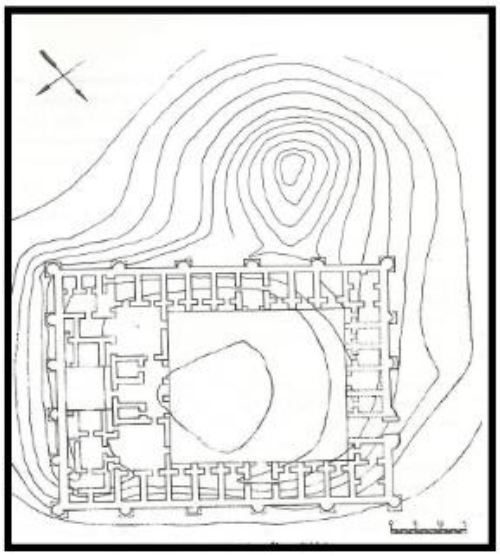

Figure 4 : Plan of Umayyad Palace in Basra [5]

The style of construction used to depend on the structural system and the bearing walls. During these period columns, reinforced pillars, and arches of different types (semi-circular, horseshoe, and spire) were used. The external walls of palaces were 1.20 m thick using liben which is the prevailing material south of Iraq. This mixture is durable and does not shrink like mud. The mortar used was from the same mixture. To protect these walls from rain and moisture, they started to build 18 cm thick outer cover from wage cooked. The lime used for this part was the extinguisher lime (al Nora). This material is resistant to weathering and erosion. In certain occasions they used to mix the extinguisher lime with ash which makes the mixture more

resistant. The internal walls were coated with thin layer of 30mm thickness of the extinguisher lime. Sometimes these walls were decorated with inscriptions. All the houses had more or less the same design. They had central court which is about 1m lower than the other parts of the house. In the middle of the court, they usually build a small pool to store water for daily uses. The court is surrounded by wood columns with inscriptions crowns to prevent rooms from heat of the sun. Houses had basements under the ground to be used during summer due to the hot temperatures. These basements had their roofs shaped like arch to provide strength and durability to bear the loads over them and for thermal insulation. Chimney like structure was built starting at the basement to the top roof and they were called Al Malkuf. The upper outlet was opposite the direction of the wind so that it allows air flow inside the structure. All the rooms were connected to this structure by special openings to allow the ventilation. Teaching and prayer rooms were characterized by a hollow structure referred to as "kowa" to allow light in and also for ventilation. Basra city was characterized by its gardens and public bathes. In one of its suburbs "Shaaba" the remains of an Umayyad palace exist (Figure 4).

Kufa City was expanded and it covered an area of (15*9) km, the

main mosque was reconstructed and expanded as well (Figure 5). It had a quadrate shape of dimensions (110*116*109*116) m. The height of wall was 20 m supported by semicircular towers in same high .The depth of the foundations for the walls were 5.5m. The towers were distributed on the four comers of the mosque. The materials used in the construction were wage and plaster. Roof of prayer house was raised by columns with beautiful crowns with a diameter (O 90-11O) m. It consists of sandstone pieces sculptured and ranked over each other. They were tied together by iron rods which penetrate a lead cylinder. The mosque can accommodate 60,000 persons.

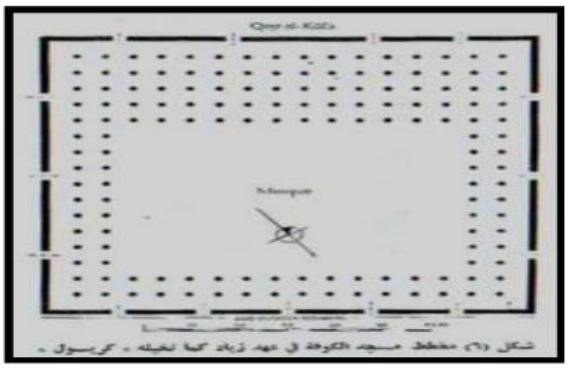

Figure 5 : Planned for Kufa Mosque [15]

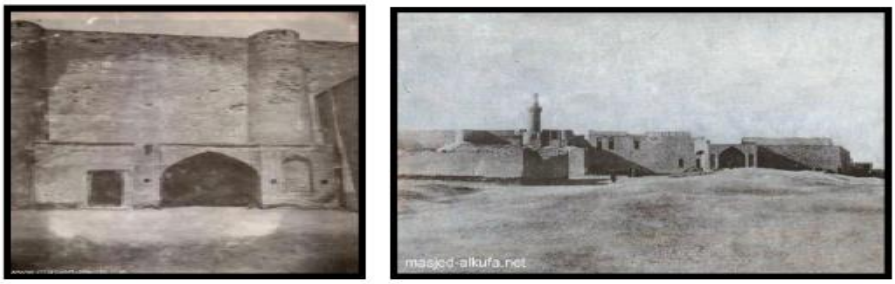

Figure 6 : Photo for Mosque [16]

The emirate house was built in a square shape with dimension (176*176) m (Figure 7). The house was surrounded by two walk The external wall had ribs of 176 m long. The average thickness of wall was 3.6 m. It was supported by semicircle towers from the external side, their diameters about 3.6m. All the ribs had 6 towers apart from the northern rib which contained two towers only. The ribs of the internal wall were 170 m long each .The thickness of the wall was 1.8 m. The materials used in the construction were wage (36*36*9) cm and plaster [13; 16]. The wall contains semicircle towers (3m in diameter) except the northeastern side. The palace was built in a square shape (61*61) m with thick walls (3m) (Figure 8) wage and plaster were used as construction materials. The outer side is of wage painted blue. The palace has a complex design with many interns leading one to other. The entrance width was 1.80 m.

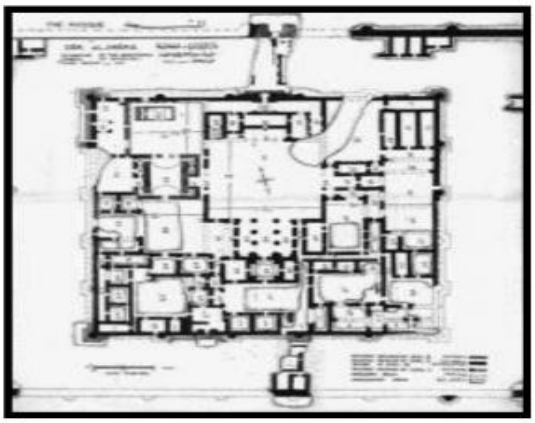

Figure 7: The Planned for Kufa Emirate House [8]

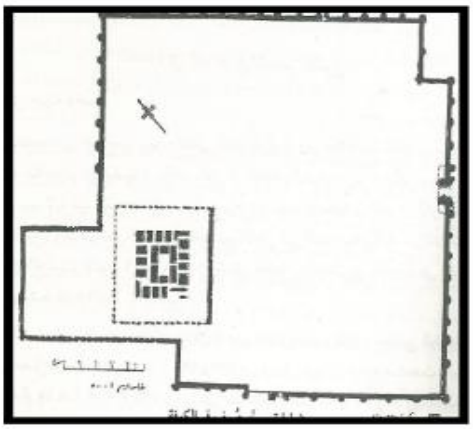

Figure 8 : The Planned for Umayyad Palace in Kufa [6]

Mosul city resembles other cities in its construction. The construction materials for the buildings in Mosul were stones, geometric stones, gravel and wage. In addition, it had a wall surrounding it, which was built with wage. A wide trench was constructed surrounding the wall from the outer side and they used to fill it with water from Tigris during any attack on the city.

Wasit city was established at (701- 703) AD, on the western bank of Tigris, and became the headquarters of Umayyad emirate in Iraq. It was located between Kufa, and Mosul, Ahwaz, Egypt and Basrah. The main features of the city were very similar to other cities in Iraq. The main mosque had the dimensions of (182.88*182.88) m, and its walls 2. 5m thick In the middle it had a rectangular courtyard surrounded by five corridors (Figure 9). Remains of the foundation

showed that at the intersection of the tiles and corridors, columns were constructed from several parts of sandstones. They were connected together by a hole in the middle; through this hole an iron cylinder filled with lead was placed to join the successive sandstones blocks together. The constn1ction materials were wage and plaster . The building was characterized by simplicity and attractive view. The emirate house had the dimensions of (365.76*365.76) m. Square columns were constructed using square wage. Three blocks (madamiq) were used in the foundations of the co11idors linked together at the base. Each part of the house contains 19 corridors. The most important feature in that house was its green Dome. The dome was overboking all palace facilities. It was built by stones. It was seen from a distance of 25 km [15; 6]. The city was surrounded by huge wall from three sides and river Tigris was on it's the fourth side. The walls were 4.5m thick and 2m in height. The walls were supported by towers and they had 6 big entrances (Figure 10). A trench was surrounding the walls from outside. The city had 4 main roads. Each road was 7.32m wide. All Islamic cities have public bathes. They have the same design and are composed of small entrance lead to a room for changing clothes followed by three parallel rooms (coo 1, warm, and hot). All these rooms

were provided with water basin. Water transpo1t pipes were made of clay. Inside the bath, all rooms have domes for lighting and they did not allow the entry of air. The bath ground was furnished with marble, while its building materials were wage, stone and marble to bear water [17]. The city was expanding rapidly because it was the capital and numbers of hotels (khans) were built.

In Nahrown area (near Baghdad nowadays) Umayyad palace was established (Figure 11). It had rectangular shape. In the middle there was a courtyard overlooking the Ewan's. This design was prevalent later. The palace had plaster decorations.

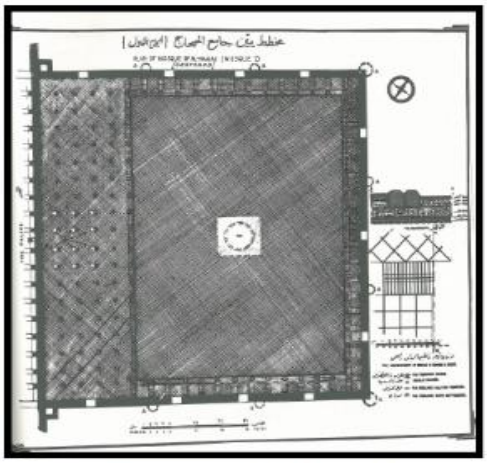

Figure 9: Planned for Wasit Mosque [5]

Figure 10: Photo for Gate of Wasit City [13]

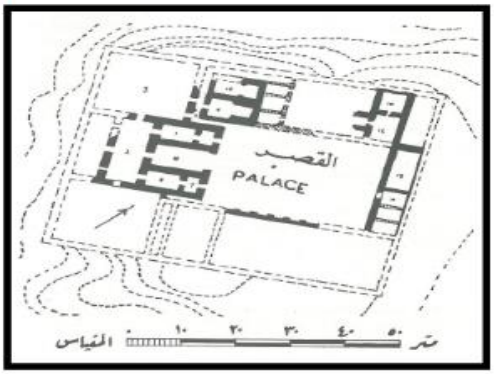

Figure 11: Planned for Umayyad Palace in Nahrawan [18]

4 Abbasid Eras (750 – 1639):

This period marks the transfer of power to Abbasid. They changed the capital city to Baghdad later to Samara. Baghdad was chosen because of its strategic site in the middle part of Iraq. The buildings were characterized by architectural decorations and large dome roofs, arches,

and unique shaped columns [19]. Baghdad was built in 762 AD. It had a circular shape and su!1'ounded by huge solid walls (Figure 12 and 13). The caliph palace was located in the center and a mosque was attached to it. The size of the palace was double the size of the mosque. Around the palace and the mosque were governmental offices. The city was planned as rings and the further away from the center the wider the ring is. Three walls can be noticed. The first wall surrounds the central courtyard and followed by the middle wall. Between these two walls are the residential sites. The area between the middle and external wall was left empty. Big trench su!1'ounded the external wall and it was filled with water from Euphrates and Tigris Rivers by canals. Euphrates canal is referred to as Issa branch while the Tigris canal was referred to as Aldajael branch. To inter the city, four bridges were constructed on the trench leading to four gates. These gates were facing certain destinations so they were refe!1'ed to as: Basrah, Kufa, Sham and Khorasan. The streets were divided Baghdad into four pivotal sections. The widths of the streets were 30.58 m (Figure 13).

The palace had a square shape (365.76*365.76)m (Figure 14). The material used for construction was lebin of two sizes. The first was square in shape "Aljaafari or Aledam" (0.915m*0.915m) weighing

200Kg. The other was rectangular shaped (0.915*0.458) m "munasif' and weighing 100 kg. The first was used in the foundations and the second type was cooked to form wage which was used with plaster to build the palace. The Palace was consisting of Ewan in the front having an area of (27.43*18.29) m. In the front of the Ewan was a board place (18.29*18.29) m, thickness 18.29 m.

Figure 12: The Scheme Model of Baghdad [6]

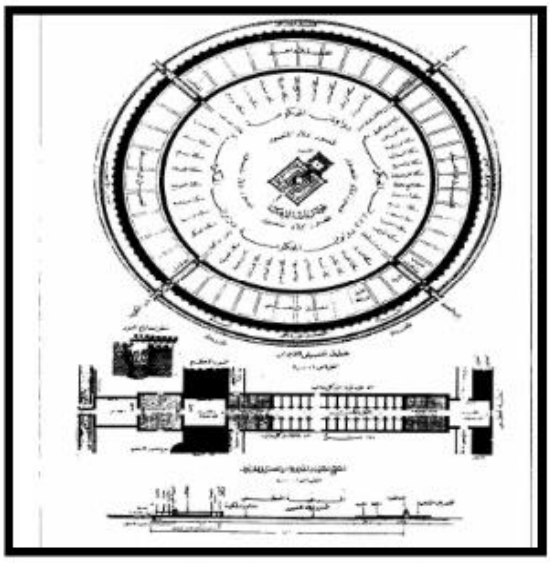

Figure 13: planned of City and Design of One Gate [23]

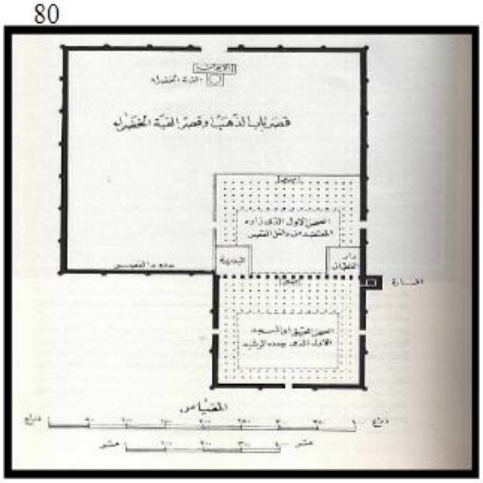

Figure 14 : Plan of Mosque and Gold Door Palace [24]

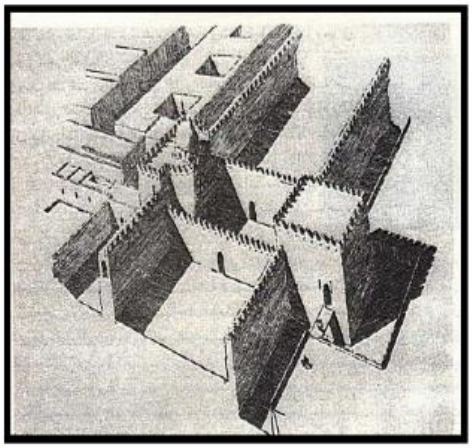

Figure 15:Section Door and Fence of City [24]

Figure 16: Photo of One Door of Baghdad and Part of Fence [26]

Over the board at a height of 40 m, another board of the same dimensions exists and over it a green dome was built. The palace was referred to as Bab Aldhab palace. This is so because it was built with marble and stones that were coating with gold. Over the dome was putting statue of a knight on his horse to determine the direction of the wind. Gold Coatings were used to decorate the walls and columns crowns. Wage, plaster, and stones were used for corridors, vents trimmings and columns build. The mosque was square shaped

(182.88*182.88) m. Jaafari liben was used for the foundations and liben and mud for building (figure 14). The city was surrounded by external wall and another inner great wall. The walls had 4 entrances which were (1972) m apart. A dome was built on each gate so that the caliph can set there. The thickness each wall was (18.29) m [21;22].

The space between the two walls is (170.70) m and it was referred to as "Al feasal" and within that space there were no buildings because it was used for military maneuvering. The exte1nal wall was 17 m in height and it was (18.29) m wide at the bottom. The great inner wall was (30) m height and its width at the bottom was (45) m and decreases toward the top till it reach (12) m. both walls were built using jaafari liben in their foundations and liben and mud for the main wall. Each raw within the wall (162000) Jaafary liben pieces that weight 117 kg were used. This is so because liben can be easily penetrated by catapult. The fence was suppo1ted from the exterior side by 113 rounded towers (28 between Khorasan and Sham and 29 between Basra and Kufa). The height of each tower exceeding the wall by (4.575) m. Behind each gate was built corridor dimension (76.75*18.29) m. They had arches was built from wage and plaster (Figures 15 and 16).the con1dors and water canal surrounding the city were

lined with a cement like material called "Al Sarowge" made of extinguished lime and other material such as ash. This material was durable.

Baghdad was expanding on both sides of the River Tigris. The eastern side "Al Rusafa" was allocated to the army commander's residence and princes. The western side "AL Karkh" was allocated for industrial and marketing activities. Later merchants built huge luxury houses (Figure 17) on this side. The common building material was mud apart from the important governmental buildings where they used wage and plaster and sometimes marble. Within the palaces (e.g., Kwled, Rusafa and Fordwas palaces) silver, gold, wood and glass decorations were used.

Figure 17: The Entrance of Kwled Palace, [26]

Mosques were used for religious, social and educational purposes. They were characterized by diversity in the plans and the height of their minarets (e.g., Alhadhir, and Kamria mosque) Al kulapha mosque (Figure 18) which was built in rectangular shape (area of 31*17.50 m).

It consists of minaret build on square base (3.50*3.50) m, and height 3.50 m, the total height of the minaret was 11.70 m. The materials used in building the mosque were wage and plaster. They used wage glazed in building the minaret.

Thirty-five schools were built in Baghdad and some other cities during the period (1227-1234). The most famous were Nedhamia

and Sharabia School. The biggest school was referred to "lMustansiriya" (figure 19 and 20).It was consider as the first Islamic university at that time.

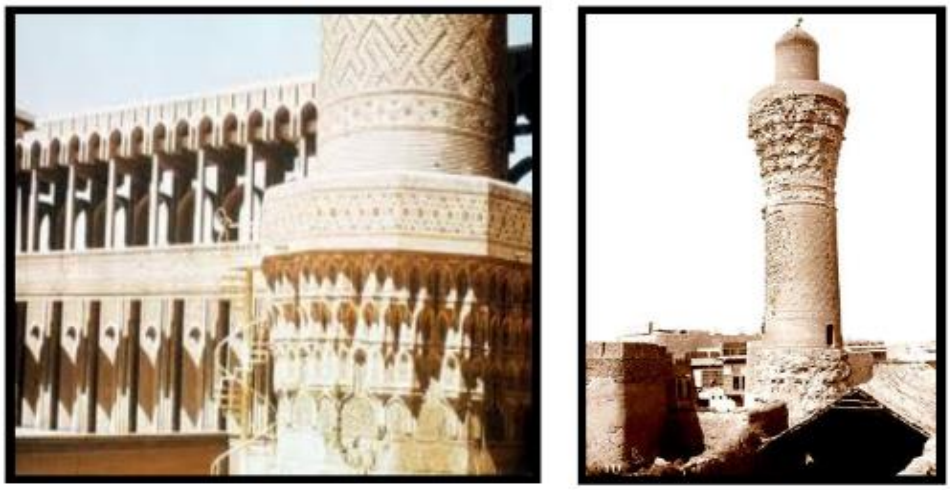

Figure 18: Photo of Caliphs Mosque and Minaret. [27]

Mustansiriya building was rectangular in shape covering an area of (4836) m^2 . The construction area was (3121) m^2 . It consists of middle wide courtyard area of (l710) m^2, surrounded by corridors, in the middle of each side there was big Ewan its width about 6 m, and height l 0 m, on both side of Ewan there were two study halls. Mustansiriya was two floor building containing lecture theaters, halls, Ewans, libra1y, pharmacy, hospital, kitchens, bath rooms, dar alhaddath and dar Al-Quran [28]. The building was ve1y well ventilated

Figure 19: Photos of Mustansiriya [29, 30]

Like all Abbasid buildings the materials used in school building were wage, plaster, and liben. Most famous thing in Mustansiriya was its amazing water watch (Figure 21). It had two Baz birds each one stands up over basin, falling down from their mouths two golden nuts each hour then it opens one of twelve golden doors marking one hour.

Sharabia school is one of three schools were established with the same name in the middle of Abbasid era, in Baghdad, Wasit, and Mecca (Figures 22 and 23). The school is one of the luxuries and unique features that are still fixed on since Abbasid period till now a day.

It was consisted of two flowers, overlook a rectangular courtyard of area 40 m2. All the schools had the same design.

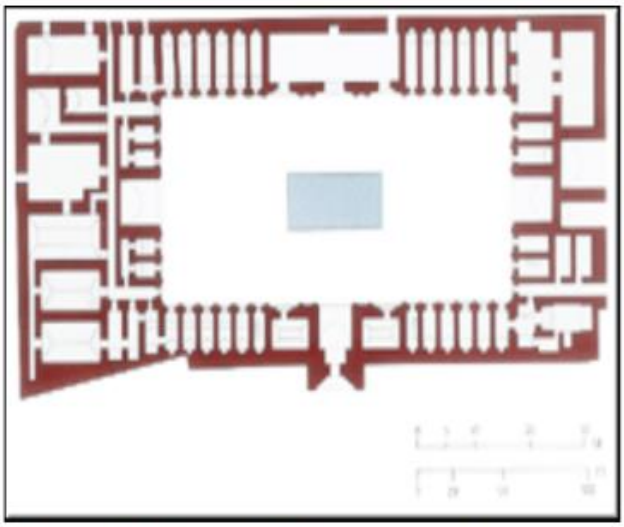

Figure 20: Plan of Mustansiriya for the two floors [32]

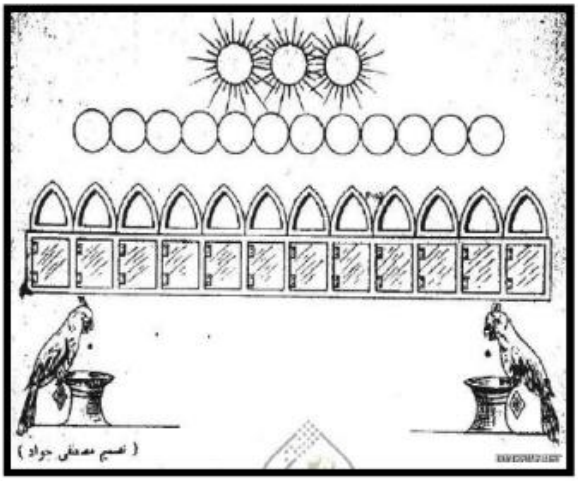

Figure 21: Plan of the Water Clock [31]

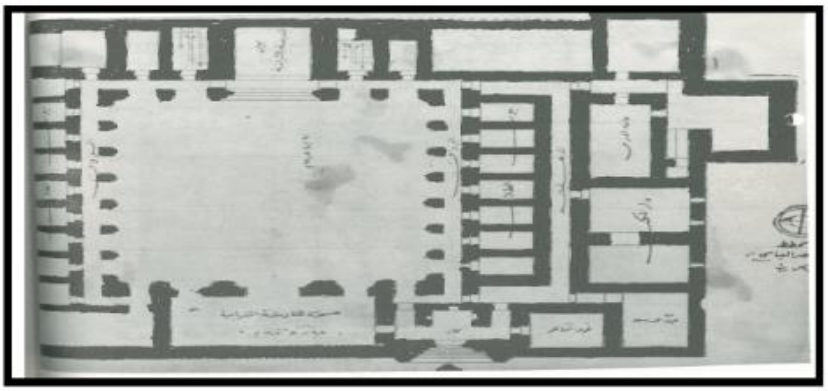

Figure 22: Plan of Sharabai School in Baghdad [18]

Figure 23: Photos of Sharabai School in Baghdad [33]

The School in Wasit is slightly different (Figure 24 and 25). This school was characterized by its decorations.

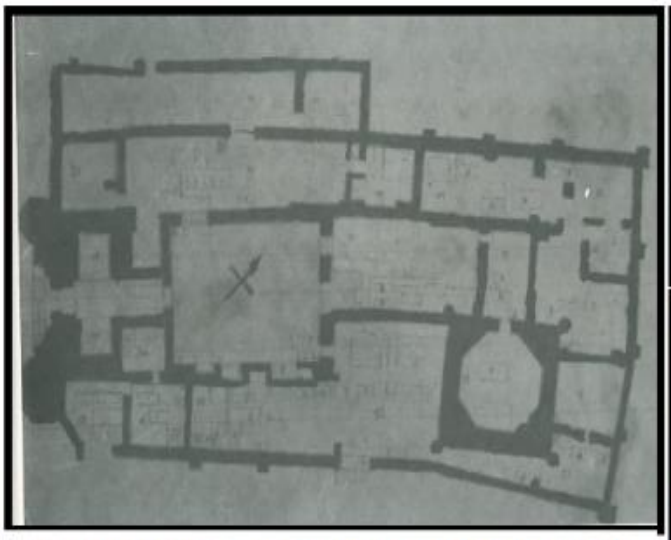

Figure 24: Planned for Sharabia of Wasit [6]

Figure 25: Photo for Sharabia of Wasit [34]

Samarra: This city was established in 836 AD after carful engineering planning and design. It was surrounded by an octagonal fence; the length of each rib was 630 m. Towers were built from the exterior side to protect the fence. Large blocks of liben were used in the foundation of fence. Many palaces were built in Saman-a; the most important was refe11"ed to as Caliph Palace (Figure 26). The length of its frontal view is 700 m and the distance from the main door to the end about 800 m. The palace had three Ewans. The middle was the largest. It was rectangular in shape (17.5*8) m, and it was 12 m height. It had tapered roof trimmings. It also includes a big door (width 3.8 m

and height 7 m). The other two side Ewans were smaller (4.5*4) m. Behind these Ewans were back rooms followed by the Throne hall. The palace has a second floor and basements. The height of the Walls reaches 6 m.

The wall foundations were strengthening by plaster decorations. Two basements or crypts were built inside the palace in the northern and eastern sides. The small crypt was dug to 10 m depth in solid rocks. It had dimensions of (21*21)m. It was connected to three caves. The walls were decorated with carved plaster. The big cave was of square shape (dimensions (180*180) m). Inside this cave was a large and extensive pool (diameter 80 m), connected to Khariz (khariz is tunnel dug underground to collect ground water).

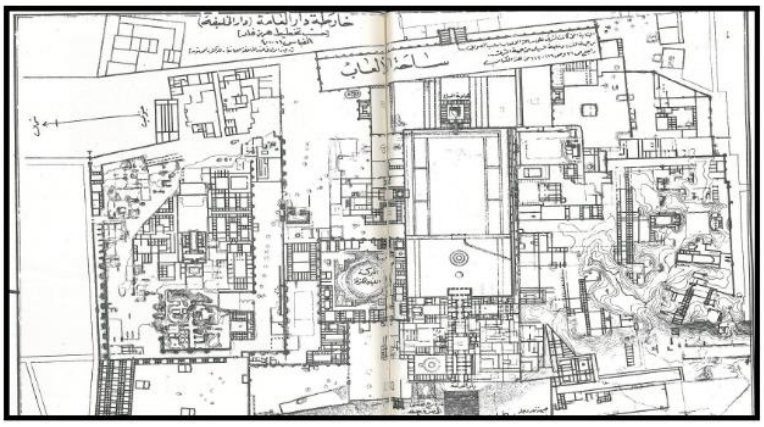

Figure 26: Plane of Dar Alama (Caliph Palace) [6]

The big crypt had many divisions and its upper part contains number of rooms. It is believed that it was used as treasury.

Water distribution network was established within the palace. The main pipes were made of lead, while the secondary pipes were made of blue glass or potte1y. Other palaces include Jawasaq khaqani palace (Figure 27) which is located on the east bank of the Tigris southe1n Dar Alama palace. This palace was ve1y large and contains throne hall, many large T shape halls, family rooms, internal gardens, soalagan (polo) courtyard, and field race. Wage was the material used for the foundations and walls. Marbles were also used for the walls. The lower portions of all the walls were decorated using plaster coating [32; 36].

The total area of the Gypsum palace is (130000) m2 (Figure 28). The palace inside is a square building (140*140) m, surrounded by external wall, its length about 370 m, supported with 100 towers. The towers at the comers had a diameter 3 m, while other towers were smaller in size and prismatic in shape (2*1.40 m). They were located at a distance of 80 cm from the wall. Inside the palace there is a big hall (15.40*15.40 m), the thickness of its walls 2.20 m, and its roof was a big dome.

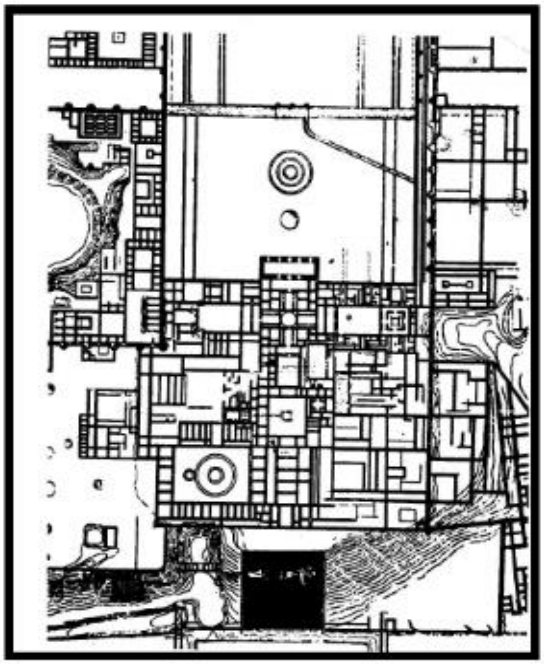

Figure 27: Planned of Jawasaq

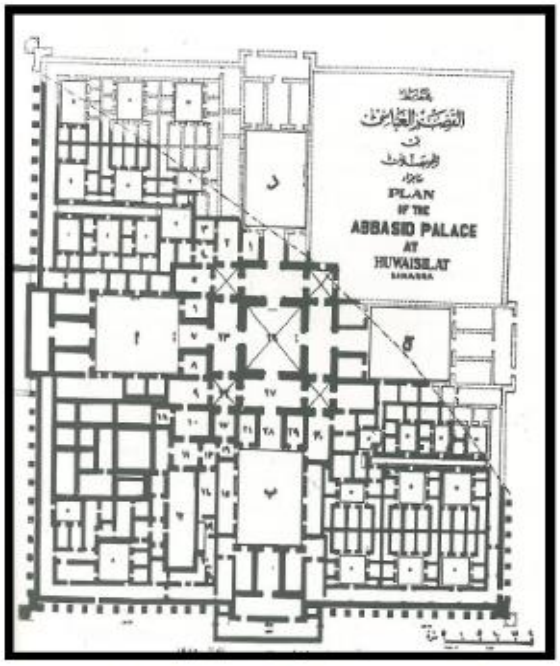

Figure 28: Planned of Gypsum Palace

The big hall is connected to four rectangular halls (16.60*6.60) m. The entrances to these halls were located in the middle of each rib of the square halls and they were 3.60 m wide. These halls are leading to rectangular open Ewan (7.80*6.20) m. The rectangular halls are connected to a rectangular open courtyard dimension (80.22* 18.80) m, leading to rectangular corridor connected with palace entrance with two identical doors. The most impo1tant feature of this palace is the materials used. They were mixed plaster with stones (boulder) looking like concrete. They also used extinguished lime and ash in foundations and the main walls of salons and halls. The offices were built with wage

(25*25*7) cm, and plaster. The grounds of halls, Ewans, and salons furnished with square wage (36*36) cm. Other palace facilities furnished with sand mixed with plaster. Bath's walls were coated with tar over plaster layer. The walls were having gypsum decorations and inscriptions were also coated with tar to prevent moisture effect in gypsum. The fence was built with liben.

Pre-Islamic style of buildings (Hairi style) was used in building Blkuar palace (Figure 29). This includes one big main hall for the caliph with a big door and two side wings halls for caliph's followers with smaller doors. This style became dominant in most materials used in its building large wage (called qiz) and plaster. Asheq (Figure 30) was another palace located on Ashaq River. It has dimension (131*96) m, and it was built with wage and plaster [7]. Al Mutawakkil caliph was order to build the main big mosque in Samarra in 825 AD and it was referred to as "Al Mutawakkil mosque" (Figures 31 and 32). It was rectangular in shape (444*376 m). They were supported by 40-44 towers built by wage and plaster. The comer towers were bigger with a base dimension of (5.45*5.25) m, and the small towers with base dimensions of (3.90*2.25) m. the foundation of the walls were from liben and wage and plasters were used to build the walls. The

mosque itself was constructed in rectangular shape (240*185) m, composed of cou1iyard containing rounded large fountain built using single piece of granite stone. The courtyard is surrounded by prayer house, and two washing places on both sides and rear part.

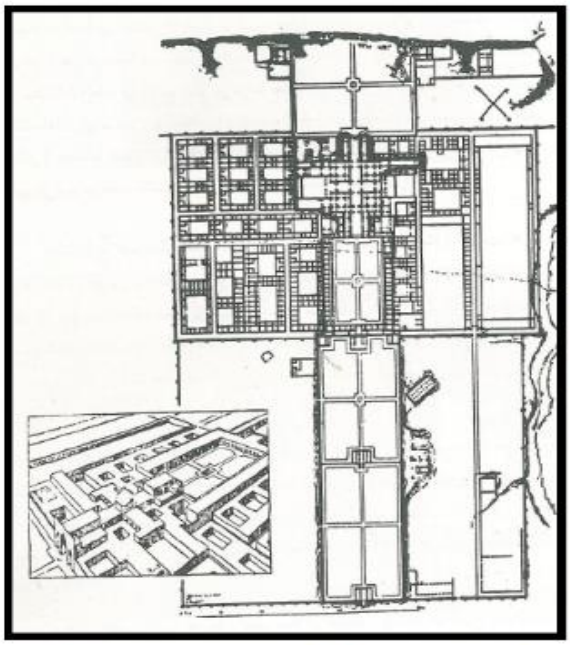

Figure 29 : Blkuar Palace planned

Figure 30: Photo of Al Asheq palace [29]

The walls were 2 m thick and 10 m height. There exist 25 galleries inside the mosque composed of 24 rows of columns. Each row 9 columns made of pink marble and columns base is (2.70*2.70) m. the base of the columns is composed of plaster and wage. They have octagonal shape at the base and then cylindrical shape with marble and plaster crown at the top having decorations. The walls of the mosque were coated by mirrors (glazed mosaics and gilding). The unique feature of this mosque is its minaret which is referred to as "Malwya" (Figures 31 and 32). It was built on two square bases. The lower base dimension (31.80*3

1.80) m, which represent foundations. The upper (30.50*30.50) m was rising from ground surface 4.20 m, decorated with pointed arches and bends some of them covered the spiral stair go up to minaret. Minaret was rising 50 m from the base and spins counter clockwise five times to reach the top by 399 steps of spiral stair of width 2.5m. The area of minerate decreases upward starting from 2.5 m^2 until be 1.90 m^2.At the top, the minerate is cylindrical shape with 6 m height. To reach top, a spiral stair is used built inside the cylinder.

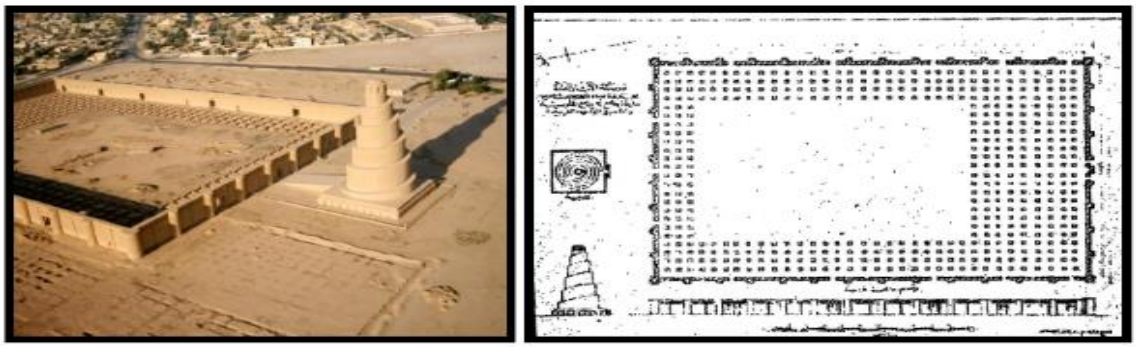

Figure 31: plan Samara mosque with minaret [18]

Figure 32: Photo Samara Mosque and Menirate [38]

References:

[1] E. Al-Taie, N. Al-Ansari, S. Knutson, Progress of building materials and foundation engineering in ancient Iraq, Journal of advanced materials research, vol. 446-449(2012), pp220-241.

[2] *History of Islamic Archiiecture,* University of Alexandria, College of Engineering. www.kfnl.org.sa.

[3] M.0.Russe:*Islamic Monuments in Iraq,* translated by Dr. N.Arision, foreign arts 60-94, 1990.

[4] M. A. Al Mosa\\i *Historical Factorsfor the Establish and Development of Arab- Islamic*

cities, edited by rashed house for publishing, Baghdad, 1982.

[5] Dr. A. H. AlKarbotaly: *Arab-Islamic civilizaiion, Arab Islamic civilization, poliiics, administration, j ustice, war, sociology, economics, education, , culiure and the arts,* Khanji library, Cairo, second edition, 1994.

[6] S. Yuosaf: *History of Iraqi Architecture in Various Eras,* edited by Alrashed house for publishing, Baghdad, 1982.

[7] A R.Al Husanai:*Iraq's Ancient and recently,* third edition, Al Erfan press, Sidon, 1958. [8] www.alnajaf2012.com.,*AlNajqf Alashraf capital of Islamic culture 2012.*

[9] H.H. Sailh:*From Basra History*, www.mesopot.com.

[10] Dr. A. Al Bahnace:*Arab Art Aesthetic*, National Council for Culture,Arts and Letters, Kuwait, 1990.