

The Stone as a Main Building Material

Case Study of Amman- Jordan

Diala Atiyat

Faculty Of Engineering - Architecture Department
University of Jordan
Amman- Jordan
archdiala@yahoo.com

Abstract— This report presents the findings from a research study concern in using the stone material as a main material of Amman city building during past until present. What this paper seeks to do is to study this fantastic material which has improves its varied properties and it's a spatial character by considering it as the oldest material used by man in construction and building. Amman is famous for its extensive use of building stone; refer to the geographic and topographic nature as a city surrounded by seven mountains. The research will start with a historical overview from old ages until present and examples will be mentioned for using it in several civilizations which bass by Amman city. Jordanians architects have a varied uses of stone material and it was depending on the evolution of architectural language and technical development, each one of them has different concept and different way, like Wadah Al-Abedi, Farouk Yaghmour , Rasem badran and Imad Al-Dabbas. The research came out with a sort of conclusion points, which judge the local treatment for using stone material on our Ammanis building.

Keywords— Ammanis building; Stone building; Jordainian architect.

I. INTRODUCTION

City of Amman (the city of mountains, valleys and springs) has embraced community since the stone ages, and followed by a series by several communities interacted with and affected by and influenced by, left behind historical records which has adorned by. like the Roman amphitheater, the Nymphaeum pic (1), Castle and others, in response to developments experienced by Amman, it was a must-have to start development of urban character of their own, so the foothills and valleys of Amman witnessed distinctive architectural works and it had a strong use of stone in construction, and it had crystallized by the unique architectural style in this city. The material of stone is another noble material, it is a weak in field strong in others if its properties been understood correctly, it began as a limitation and ends as an ability, it was a limitation when our information about it was limited and when we understood its potential and characteristics we hired it through the construction of a new sentences, dimensions and characteristic for this material. [1].



pic(1), Nymphaeum, Amman-Built in 191 CE (the researcher, 2015)

A. Issue

Looking all around Amman city makes us noticed that it is famous with its extensive use of building stone; refer to the geographic and topographic nature as a city surrounded by seven mountains was the main artery to provide the city with its need of these stones, which stretched to the governorates of the south Jordan. According to a group of architects have taken up on themselves to produce models of architecture in Amman confirmed that architecture in Jordan influenced by Islamic, Roman's and Greek's architecture heritage.

The local area is known with its availability of many types of stones as a construction material, which was the common denominator for building in the region through several ages, since ancient times, but it was expressed in each era with a different architectural way, and we will discuss that.

B. Methodology

Methodology of this study and access to information as follows,

Historical approach, which represents a collection of information through sources and books and magazines and reports, publications and various documents related to the study.

Data collection: Literature review; books review, papers review, review of previous study, Internet, photographic documentation, analysis of collected data.

II. HISTORICAL OVERVIEW

Stone considered as the oldest material used by Man in construction and building [2]. It has been able to resist the natural factors over thousands of years. It transferred to us the first monument built by first man, and a lot about civilization of the Pharaohs, Greeks and Romans.

Perhaps the specifications of the stone in terms of hardness and durability of gravity and permanence that prompted it to be used in the old and the modern buildings.

A. Old era

Define Neolithic period: 8000-4500 BC. Man used the stone with layers of mud to built stone walls, Amman characterized in this period with stone fortifications and towers that shows military and commercial activity in the region, such as the tower of Rujm al-Malfouf (pic 2) which is still exists until now.



pic(2), Rujm al-malfouf, Amman (the researcher, 2015)

- Greek period

Ptolemy II gave Amman" Philadelphia" name instead of its old name Ammon in 285 BC. M. and he tried to give the look of the city a lot of Greeks appearance, and make in Citadel site a lot of Greek temples, King Tobia built a palace known as an Iraq Alameer still present until now (pic3).which considered as a shift in the style of construction and dealing with the stone as a man's ability to show creativity.



pic(3), Qasr Al-Abd , Amman (the researcher, 2015)

- Roman period

A period of transformation in the style of construction, where it was dealing with construction as an art which shows the power of human creativity, the use of stone came accurately and beautifully to express the civilization and advancement.

Philadelphia was rebuilt days of Roman rule to include the runway and the streets and the theatre.(pic4) In the Byzantine period the technology has evolved where the stone has been treated with its own properties Physical.



pic(4), Roman theatr , Amman (the researcher, 2015)

- Islamic period

Umayyad built palaces of stone and also included many Islamic decorations in it also add the patterned on the stone, in this period the stone had been used in a varied characteristic and multiple colors. In different shapes and a variety of uses.(pic5)



pic(5), Jabal alqalaa, Amman (the researcher, 2015)

B. The modern era

The stone material became a major importance in the process of construction in building with the arrival of craftsmen from neighboring Arab cities like Nablus; Jerusalem .architects could use the stone in elevation apparel using one of two methods:

1-The First one takes the form of regular courses of varying height or equal height the frequently use for this methods is with "Tobza"stone.pic (6) .



pic(6), Jordanian textured patterns stones (the researcher, 2015)

2- The second takes a random style to show the simplicity in construction [3].

III. THE CHARACTERISTICS OF THE JORDANIAN STONE, TYPES AND COLORS

The physical properties of stone are the most important factors that determine their use in construction in order to serve as long as possible, from the basic things that affect on properties of stone: general fitted and smoothness, specific gravity, absorption, modulus of rupture, abrasion resistance and compressive strength.

Jordan quarries characterized with their varied stone colors such as: white, bright white, pink, yellow and dark green the reasons for this diversity in colors refers to several reasons, first: the stone quarries is a natural place, not manufactured and therefore it is not surprising that there is a difference in the colors in the one type of rock second weather factors has an effect on the color of the stone through its water absorption , especially interfaces west and south west elevations of the building, third polluted air by vehicle gases in crowded areas is also a reason for changing on the stone color and we saw that a lot on downtown buildings of Amman.

A. Types of stone

- Natural Stone, Artificial stone
- Natural stone is available almost everywhere in Jordan; they may still available in four sources, mountain stone quarries and desert stone quarries and the free stone in the agricultural areas and the built stone in ancient archeological regions.
- Artificial stone: a type of stone which is factory made from processing concrete, it has the same features details, color, shape and properties of the natural stone. Artificial stone characterized with high quality and the beautiful view, it is begun to use in Amman building in the last decades.

B. Natural stone is consists of three types *Authors and Affiliations*

The Volcanic rock such as Granite and Basalt. Sedimentary rocks such as limestone and sandstone., and Metamorphic rocks like Marble.

Many types of stone, having their names from the region which they extracted from, and the best types of stone in Jordan stone called "surface of Ma'an" it is a solid stone with low water absorption.

Jordan quarries produce different types of stones:

- Stone of Ma'an: the proportion of the city of Ma'an South Jordan, one of the finest and famous qualities it has the advantage of rigidity and a low water absorption.
- Stone of Qatraneh: fair-solid uniform color and absorption ratio is high.
- Stone of Hayyan: fair-solid is used extensively due to its low prices comparing with the rest of the stones. [4].

IV. AMMANIS BUILDING AND USING OF STONE MATERIAL

The evolutions of using stone material in Ammani buildings in evaluate from structural and functional use (old era) to an aesthetic and decorative pursues (modern era).

Stone was the main building material for the traditional houses of Amman. The availability of limestone quarries in and around Amman and the long tradition of building with stone. Made it the most commonly used and appreciated material.

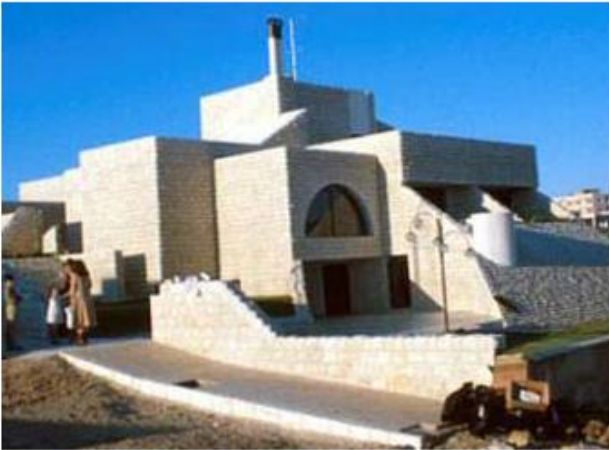
The rebuilding of Amman in the late nineteenth century started with the use of stones collected from the ruins of the antiquities from the citadel and roman theater area of downtown Amman. By the turn of the century skilled stone cutters and master builders had already arrived to Amman from tow directions. The first came from Naples and Jerusalem via salt which, by then, had already established a significant building tradition. The second came from Syria and Lebanon with the arrival of Syrian and Druze master builders. Stone cutters, building techniques, building vocabulary and terminology was mainly influenced by those of Nablus, Jerusalem and salt, while master builders, innovative ideas and individual skills came from Syria and Lebanon. [5].

V. JORDANIAN ARCHITECTS AND THE USE OF STONE

Jordanians architects have a varied uses of stone material and it was depending on the evolution of architectural language and technical development, a group of buildings that used stone material in a diversity and modernity way have chosen in this research and a number of Jordanians architects names who have contributed the personification of evolution that lived throughout stone material in Amman will be mentioned.

1) Rasem badran :

The Jordanian architect Rasem Badran designed and built a series of villa-type houses in Amman in the 1970's and 80's, by using the stone material. He has claimed that his architectural work is an "attempt to mediate between the past traditions and present practices for a solution that is not archaic", And he confirm the use of local materials which is available in the region where the design exists, for example he managed to use the stone material on the main elevations in a variety proportions and measurements which gives a unique architectural language for the building and suit the place around. Pic (9)



pic(9), Villa by Rasem Badran, Amman (www. Greatbuildings.com , 2015)

2) Wadah Al- Abedi :

Wadah Alabedi considered from the most Jordanians architects dealings with stone material, and he has a magnificent ability to came out with a variety composition of it In one of his designs in a residential villa, we find that the overall composition based on the cube sculpture concept, Using a variety of stone forms like Tobzh courses which is reflecting the sense of organic in the overall composition of the building. Pic (7)



pic(7), Villa by Wadah Alabedi, Amman (www. Greatbuildings.com , 2015)

3) Farouk Yaghmour

Text He described the stone as a beautiful and fun material, and the way we should use it for must evolve with the development of our life style, free from direct transport. He used a variety colors and type of stones on his work such as black and white and pink stone in the distribution of stone courses of buildings elevations.pic (8)

Farouk confirm that the use of stone material in our modern life became fake, where the stone material became like a tinny shell garmenting on the exterior elevation of buildings, where the stone does not exceed the thickness of 5 cm, he describe using of stone material nowadays became artificial and lost its credibility with the disappearance of the original professional stone hammered men. Also we see a lot of example for use a variety colors of stone in building elevation like Ali's Maher for one of his villa designs.pic (11).



pic(8), Villa by Farouk Wigmore, Amman (www. Greatbuildings.com , 2015)

4) Imad Al-Dabbas:

Architects did not deny the need to introduce a modern building materials such as glass, metal sheet within the thoughtful design beside the original material (stone), taking into account the development of Arabic architecture,.

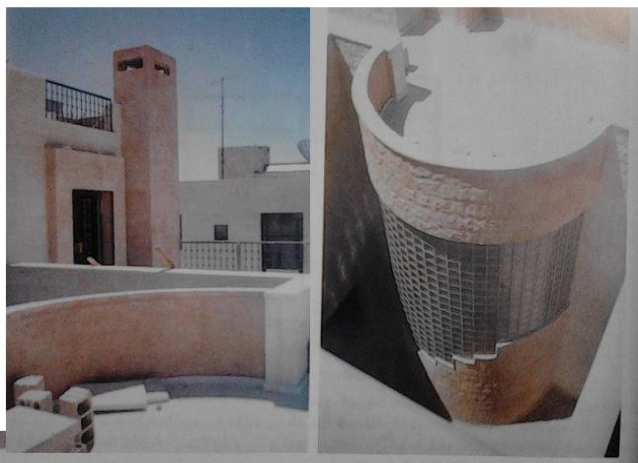
Imad al-Dabbas merge the stone material with modern materials in a sustainable way using advanced technologies in a streamlined and beautiful way. By his designs he gave a new concept for using stone and gave a new character for Ammanis stone buildings. Pic (10).



pic(9), Office building by Imad al-dabbas, Amman
(www. Greatbuildings.com , 2015)

VI. CONTEMPORARY BUILDING IN A TRADITIONAL MATERIAL

Stone structures have existed for as long as history can recall. It is the longest lasting building material available, and is usually readily available. There are many types of stone throughout the world all with differing attributes that make them better or worse for particular uses. Stone is a very dense material so it gives a lot of protection too, its main draw-back as a material is its weight and awkwardness. Building material is any material which is used for a construction purpose. Many naturally occurring substances, such as clay, sand, wood and stones, even twigs and leaves have been used to construct buildings. Apart from naturally occurring materials, many man-made products are in use, some more and some less synthetic. The manufacture of building materials is an established industry in many countries and the use of these materials is typically segmented into specific specialty trades, such as carpentry, plumbing, roofing and insulation work. They provide the make-up of habitats and structures including homes.



pic(9), Villa by Ali Maher, Amman (Abaza, 2008)

Material is a method of architectural embodiment of an important and fundamental way for the architectural space to take across its final form. There are conditions for the use of specific material by the function for the space. Including conditions, visual and audio conditions and of course the biological climatic conditions, by its resistance to weathering and natural factors, for that it is important to choose the right material in the right place. [6].

VII. JORDANIAN LAWS, THE USE OF STONE MATERIAL

Each Greater Amman Municipality laws,

Jordanian capital laws Impose in a lot of areas "stone" on the exterior walls of building & establishment, which is brought to the capital, Amman, a special scene & a unique site, and here is the statement of the articles which is concern with stone material of building:

Article 20 – A - May not use any reflective material to light in the building and the external interfaces lead to discomfort neighbors or pose a risk to public safety. B - allows the use of any color to paint or paint or coloring interfaces Overseas construction to no more than (20%) of the area of these interfaces to be the rest of the colors of the interfaces-colored natural stone or white and if desired the owner to use the other and an area of more than (20 %) of the area of the external interfaces construction it shall obtain the prior approval of the Commission.

Article 52 –The exterior walls of first and second class buildings required using of stone or mud mortar or any other stronger material. [7].

VIII. CONCLUSION

Using stone as a construction materials in a good deal gives us an outstanding forms and deals ,of which led to admiring it and this led to misunderstanding and mixing of threads together and turning it to devote to this admiration through embalming those forms that have succeeded through the material and which response to the challenges posed by, There is no benefit from hiring a stone outside its potential for concrete forms nor interest in carrying the concrete to be shaped like the beauty of the stone forms.

stone material have proved itself as a basic material of Ammanis building over time, we didn't stop using it, because architects evolve using it as a material readily available in the local environment and suitable to it were it has a practical treating for the natural ventilation, and it is also so effective especially in warm areas because the surface of the stone with its light color reflects the heat and direct solar radiation.

REFERENCES

- [1] Ali Abu Ghanimeh, Jordanian architects varied uses of stone, dr. arch.ali abu ghanimeh & arch. Abdalla ghosheh. Conference of the materials and construction Egypt 2002. (in Arabic)

- [2] Raif Muhanna ,Contemporary building in a traditional material Raif Muhanna, Rafea Nuhanna and Ziad Muhanna.1993 (in Arabic).
- [3] Ihsan Fathi ,An analytical study of the architectural styles of the role of the first in the city of Amman, Jordan, Dr. Ihsan Fathi, Conference of the preserve the heritage buildings Jordan 1994.
- [4] yahia al-zou'bi ,the traditional natural building materials (stone) it's application in Jordan, prof. dr. yahia al-zou'bi. & arch.soud al-shiab , Conference of the materials and construction Egypt 2002.
- [5] Dornie, D. New stone architecture. Lurence king publishing Ltd , London, 2003.
- [6] M. Al Momani ,H. Ali Sick Building Syndrome in Apartment Buildings in Jordan Jordan Journal of Civil Engineering, Volume 2, No. 4, 2008
- [7] System of building permits in Amman / issued under Article 37 of the Law on the organization of cities, villages and buildings No. 31 of 2009.