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MATHEMATICAL & SPATIAL RELATIONSHIP BETWEEN DOME AND AL-MOUSALA IN CONGREGATIONAL MOSQUES (AN ANALYTICAL STUDY OF BASIC DIMENSION OF CENTRAL DOME PATTERN)

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ABSTRACT

Islamic architecture has a clear impact for systems and the relationships of Mathematical and Geometrical proportions , which reflected in their buildings. The research will deal with an important aspect that linked in two mains elements in the Congregational Mosques. The first is a house of prayer (Al-mousala) as the main and most importantly space in the mosque, and the second is a dome as structural and decorative element, who was significantly associated with Congregational Mosques later. This study is one of very few studies which have investigated the kind of the Mathematical& Geometrical proportions relationship, also the spatial linking of these two elements with each other's. Through the statistical analysis that links the relationship between their different dimensions and the positioning kind of the main dome on a house of prayer (Al-mousala). For this purpose the resaerch has been selected two sets of samples. The first models include a different regions of Islamic Congregational Mosques represent different patterns of Congregational Mosques as a sample of general Islamic architecture while the second comprises a number of Congregational Mosques in Mosul city, a representative of the local architecture.

Keywords: Central dome, Al-mousala, Congregational mosques, Mathematic, Islamic architecture, Ottman architecture, Mousl mosques.

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1. INTRODUCTION

Mosque is the Islamic term was not known before the advent of Islam. The mosque is every place that we can worship the Allah. Mosque high place among architectural installations may not be an exaggeration to say that the mosque architecture is the foundation upon which the other buildings. though the buildings of mosque begun simple far from complexity as the first mosque was a square piece of land surrounded by a fence and it was the roof afford columns of trunks of palm trees or movable columns from other buildings, as in the Great Mosque in Sana'a

about (6 AH) and the Mosque of Basra (14 AH) and the Mosque of Kufa (17 AH) and the Mosque of Amr Ibn Aas (21 AH). the planning of Prophet's Mosque has delat al-qibla and sahen with others arcades become a main source to successive generations of architects in the east and west of the Islamic world with addition of some amendments which were taken from the local style in each region until appeared the Olaiwana planning with appearance of the school, which consists of an open courtyard surrounded by four Iwans facing each other where this style together become as an nucleus to build mosques from the fourth century AH / tenth century. Then appeared the third style , which consists of two part the first prayer house which upon it a huge dome surrounded by half-domes , the second is an open courtyard surrounded by corridors this style appeared since the second half of the seventh century AH / third century AD [1].

2. THE DOME

The oldest domed building found in the late Uruk and the beginning of the era GONODA in the Royal Cemetery in Ur (Sumerian era around the third millennium BC) [2]. originated domes in ancient Egypt and Iraq ancient, it has materials in Iraq by using bricks in construction , after that its moved to Greek architecture then to all the world .

the Dome covers a square area based on four walls, then dome moved to the Romanian architecture in temple Alkol Seyou in Rome, and it moved to Christian architecture as a dome above structure , also was a model of the churches was contains a number of domes above the nave. After that it moved to the Islamic architecture, Dome of the Rock in Jerusalem-Sharif is considered as the most important dome in Islamic architecture.

2.1. The History of Dome in Islamic Architecture

The first Islamic domes is the Rock Dome in Jerusalem, Figure (1), it return to the era of the Umayyad (661-750 AD), built by Caliph Abdul Malik bin Marwan year 72 AH, with octagon shape. the rib length 20.95 m, and a height of 31.5 m, the dome is composed of two layers, the upper wooden covered with sheets of lead and doctrine copper plates in above (Ibn Al-Atheer,1375 AH,P86) , then appeared several environmental and functional factors led to use of this element but in a small scale , did not indicates the high of ceiling almousla for a number of reasons, including providing currency and materials needed for this type of construction and increase space capacity without columns and usefulness in reference to the site of al- imam or al-Khatib in Congregational mosques . The oldest example of the Iraqi domes still exists is the Dome of Ukhaydir palace dating back to the first half of the second century which are found in its corners Hnaya pluteaceae, while the al- salibiea dome in Samarra is oldest dome of a grave at the time of the Abbasid al-Mustansir 246 AH. while The Dome of Aleppo is the oldest dome in the belad alsham, which date back to the year 336 AH [3].

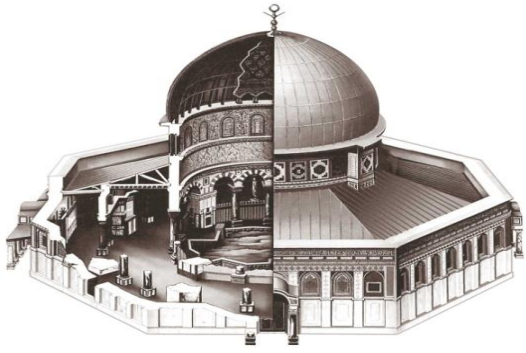


Figure-1. Perspective section in the Dome of the Rock

2.2. Types & Forms of Domes

2.2.1. The Conical Domes

This type of domes are used since the mid-fifth century and even the Ottoman period in The shrines , In it the dome rises high to indicate the status of the deceased and its importance. this type of domes build by gypsum and enveloped from the outside by stone. Al- salibiea dome is the most famous of these domes (the tomb of a Muslim) (Figure 3) in Samarra, which is domes of the Abbasid period, it is the first shrine in Islam, and includes the remains of the caliphs: (al montaser, almuhtadi &almutaz).

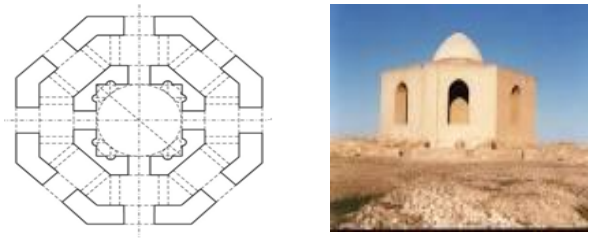


Figure-2. plan and perspective to the salibiea dome

2.2.2. String Domes

This type of domes made from gypsum , and often be fragile so it covered by second dome to protect it from environmental conditions. It has half structure curvature be structure from crisscross tendons, begin from indented base and contain twenty four part intersect. the curved tendons is to change from the square or ribbed base to apse base by a series of cubic or prismatic mocarnasat with different shapes. like the dome of Al-Nouri mosque, and usually built by white gypsum around the dome center to form a star has Several heads [4].

2.2.3. Half Circular Domes

Domes built as a half circular in Egypt and Syria in one direction in the Fatimid period and two direction in the sixth century and then added plaster ornament in their bases during the Ayyubid period and increased the height neck of dome in Almamalik period .

2.3. Different Types of Dome Forms

There are different types of domes in Egypt except half circular, elliptical , ribbed and wooden as the Dome of Sheikh Abdullah in Cairo, which carrying in highest a small ribbed dome , while in the countries of the Maghreb have prevailed dome spherical half without foreign decorations, while I took forms domes in Persia elliptical shape covered by Al-qachani

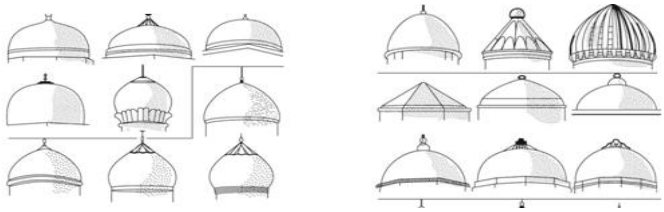


Figure-3. A variety form domes in the Islamic world

2.4. The Construction of the Dome and it Relates to the Al- Mousala

The dome loads transmitted to the ground by supports solid stone and various forms including square, circular octagonal or other forms. Often contain cavities like niches or other details. The Dome that has a ring section settle either on a square rule or octagonal According to the structural system used in the transfer of weight to the land where the almusala under it . there are three structural systems for the transition from the square to the dome circle which are as follows [5].

2.4.1. Al-haniat Corner

The second innovation for the transition from a square plan to Octagon then to the ring it is al-hinea corner It is the cone suppression has head vertical angle is placed on his side that divided the vertical corner angle. meaning that its base half a circular has been placed in head level and it ribs half cone are placed in a horizontal plane, so that applies in every corner of the its two straights sides on the two angle ribs of the square region will be covered by a dome, but the domes, which convert the square plan to the octagon or circle by the corners heniat it have found in the palaces of the Sassanids, and found examples of corner heniat units in al-Ukhaydir Palace including the dome of main entrance, and appeared in the al- amaa door in al-aljosag Khaqani palace in Samarra, .the examples of henaya corner domes al- hakim Mosque and the Dome of the seven girls mosque Figure 4 illustrates these elements [6].

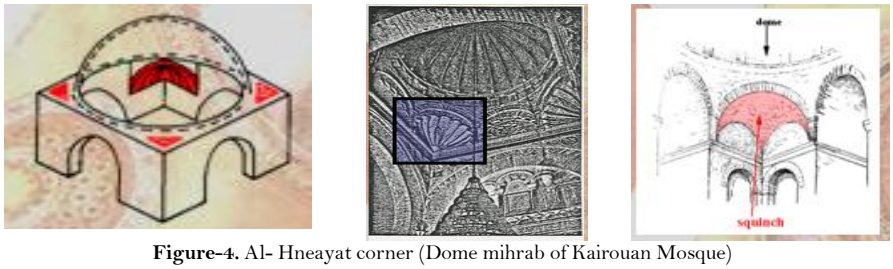


Figure-4. Al- Hneayat corner (Dome mihrab of Kairouan Mosque)

2.4.2. Spherical Triangles

The spherical triangles was Used as an element in stone domes in Jordan and spread its use depending on the expansion in the use of domes and semi- domes, thanks in it innovation to Arabs, they have been used to move from square plan to round plan to support the lower edges of the domes. it have been used a lot in the colonies of the Byzantine Empire , this structure construction allows to rise the dome with lightness and save costs, opposite most of the old ways that have been used in the Pantheon. considered the dome of the "Aea Sophia" mosque is the first example of this, And continued in the Islamic era where it found a dome of Amra palace bath and in al- sarh bath . the diameter of the spherical triangles either be equal to the diameter of dome, In this case the triangles look like part of the dome, or can be the diameter of spherical triangles are not same the diameter of Dome even it can work the dome from half sphere completely, Figure 4 illustrates these elements [7].

Figure-5. Spherical triangles (Blue Mosque in Istanbul)

2.4.3. Al Mogrnasat

Al mogrnasat considered developer type from the Hanaya corner form , it invented, as a construction element to transfer the plan of the dome from square to circle plan , where it was the first appearance of it in Persia in the cemetery Junbada doorin gorgan in Iran. it have been mushroomed rapidly with the end of atheist century, and the first model consist of from two direction as a first stages of the evolution of Al mogrnasat, and consists of two direction, the first one is include three Kosrat and second include one, so Al mogrnasat have been used as a constructed element and found in the domes of the Fatimid in Mashhad al-Jaafari and Atkp and Mrs. paper also found in the monastery of the martyrs the presence in this dome represent manifestation of the spread of the Fatimid architectural elements in contemporary Christian architecture [6]. Figure 6 illustrates these elements.

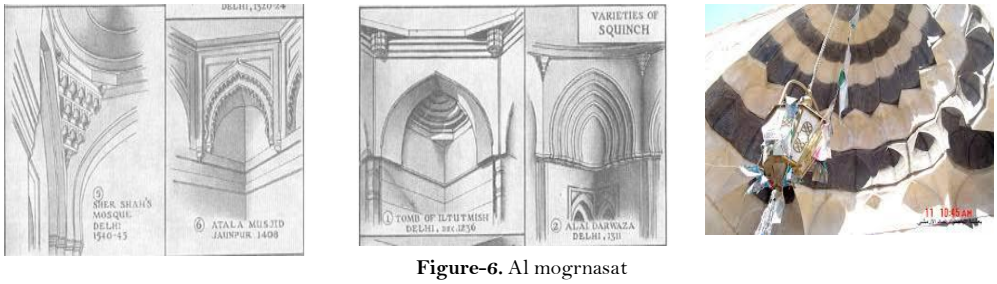


Figure-6. Al mogrnasat

2.5. The Dome Use in Islamic Architecture and its Relationship to the Al- Mousala

The dome used in various Islamic buildings, especially mosques addition to its use in schools, palaces and baths as well as the use in the conical dome particularly in roofing shrines and scenes. Islamic architecture distinguished by using an unlimited number of domes in mosques and put it in different locations of the mosque. This domes take its titles of their location within mosque or Al- mousala as a following is of these sites. [8]

2.5.1. Al- Mihrab Dome

In this case, one dome in the mosque located above the mihrab and on the axis direction of al-qibla, it has been commonly used in all the mosques of the Islamic world as in the Al-Aqsa mosque of in Figure (7)

Figure-7. Al-Aqsa mosque

2.5.2. The Lobby Dome

The Mosque contains the second Dome at the end of mihrab tile in the edge of al- saucer called the Dome of the lobby, where Use this method in the mosques of the Maghreb and Egypt, it a duplicate of the al-mihrab Dome for prayers in sides of mosque, like in the Al-Al-azhar mosque, [9] and in the Zitouna Mosque of Kairouan. As in Figure (8).

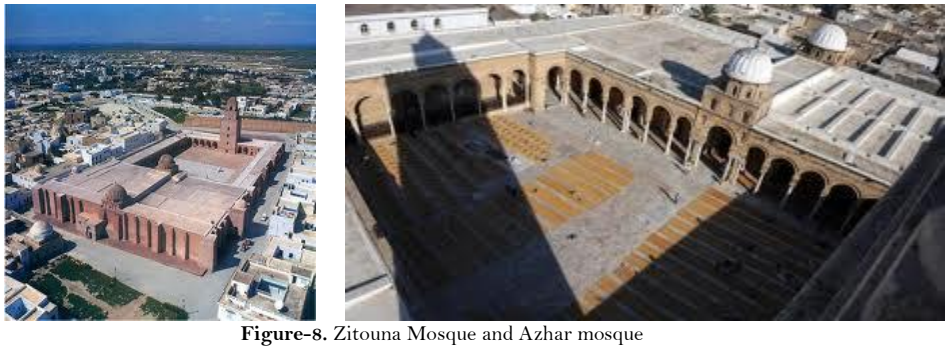


Figure-8. Zitouna Mosque and Azhar mosque

2.5.3. The Central Dome

In addition to structural solution the central dome in Islamic architecture represented the large dome of the sky as they are in many Islamic mosques as the Ottoman mosques is a good example of this type of mosques like Selimiye and Sulaymaniyah mosque as in Figure (9).

Figure-9. Sulaymaniyah mosque and Selimiye mosque

3. HOUSE OF PRAYER (AL- MOUSALA)

The Islamic fuqh shows the Prophet sunat give basic mosque components. The Prophet's Mosque select the basic components of a mosque (the fence, saucer, a house of prayer or (AL-mousala) , canopy, corridor, the position of the muezzin), and so has identified the prophetic elements of the mosques pattern of that have affected to the different patterns in the shape and style of expression [10].

3.1. Legitimacy Laws for the Design House of Prayer Space (Campus) and the Election of its Shape

The House of Prayer (AL- mousala) is the primary design element in the mosque, it was to the noble sayings of prophet greatest impact in determining the AL- mousala shape and it's the primary and secondary elements and has placed several concepts and foundations to design the space and shape of the house of prayer (AL- mousala) as following:

1. Straight and Wide

The Prophet Mohammed Peace be upon him said "settlement their rows from the perfect of the prayer " (Bukhari and Muslim) [10] that's means the virtue of the first row in prayer and that the increase row length will increase the number of believers therefore necessary the shape of AL- mousala to have rectangle. the long rib facing the al-qibla wall.so that from better left the shape like as circle and octagon where decreasing rows toward the direction of al-qibla [11].

2. Lighting and Visual Link with the Outside Space

Based on the words of the Prophet, peace be upon him (beware of paying attention in prayer, the pay attention in prayer is fault.

So, the windowing within the internal space will affect categorically on its function during the prayer, so prefers the lack of windows in the level of view worshipers, particularly in the qibla wall or the side walls, so as not to distract worshipers during prayer or hear the sermon. It is here determined by the visual extension of the internal space to be from the top and not of aspects, nature of activity prayer preference for non-contact on the horizontal plane between the inner space and outer space, and be a visual extension of the upper contact is the closest to the internal space [11].

3. Functional Flexibility

The inner space of the mosque dedicated to pray and that only require place vector to al-qibla. The multi functionality of the mosque since Mosque of the Prophet, peace be upon him did not change anything in its architectural program. al- mousala or house of prayer is remained a flexible space that can fit and flexibility fully with any other function is the place to prayer and it's the same place to receive where science students were sitting front and around the teacher ,and a court hall where the judge sits is in front of the audience [11].

4. HUMANE ISLAMIC ARCHITECTURE

Islamic architecture characterized a number of humanity characteristics and principles in its buildings that recorded by researchers in Islamic architecture and these principles

4.1. Human Scale

Islamic architecture respects human scale. The "God" prefer the human creature that generosity from the rest of the creatures and regarded him as a supreme value. Ibn Qutaiba was the first to talk about human scale in Islamic architecture," represent the house jerseys " Where tailored shirt by owner size, the house also built by static scale, the foundation purpose of architecture is to achieve serenity and confidence to those who hold this architecture, whether public or private, the basic principle is the rights and needs and ambitions [12]. Islamic architecture characterized by simplicity and respect for human scale, the first mosques prevailed starting from the Prophet's Mosque and the mosques of Basra and Kufa expressive of human thought and the Muslim believer away from the luxury and richness of Greek temples or gothic churches first mosques crossed honestly Islamic values for monumental that have emerged in the last centuries. As Graber suggests that Islamic culture is not (object oriented) object-oriented, but find meaning in the act and sound (al-athan) more than sight [13].

4.2. Directionality and Axial

Directionality has two dimensions (intellectual, ideological) and (kinesthetic, visual). Directionality one of the most important Islamic architecture features, where all the faithful have directional to the Kaaba and this trend means to achieve unity of purpose as directional reflected

in the mosque through a clear line movement from the entrance to the mihrab. Where we see in each expansion of the mosque the place of entrance change to keep the directionality of the mosque and the movement from entrance to the Al-mihrab. In addition to the presence of decorative elements on the internal inter face of the campus reflects the direction of direction as well as in the dome of Al- mihrab to indicate the directionality.

5. STRUCTURAL ELEMENTS IN THE PRAYER HOUSE (AL- MOUSALA)

5.1. Masts and Columns

The roof of Prophet's Mosque carries on the trunks of palm trees, and preferably reduce the number and size this trunks to not being cut the ranks of worshipers and hinder follow-Khatib during a Friday sermon [14].

5.2. Al- Mousala Roof

Roof of the Prophet's Mosque has low level and this suna has remained for centuries. The Arab style was the lowest in rise in addition to the Andalusian-style no more than a few meters high in al- masala. With the emergence of ions were dashed this suna especially in east of Islamic world after twelfth century, for example, rising house of prayer in the mosque of Isfahan reached 35 meters high, while the rise of(al- mousala) in the Ottoman-style mosques like Sulaimaniyah more than 50-meter [14].

5.3. The Dome

That the construction of a dome in the mosques did not raise the objection of Muslim Scholars of different sects as the niche and minarets which was rejected by some scholars of the nation [14]. The domes began Small size, in the first centuries appropriate and proportionate to mosque scale, then evolved dramatically to become the size of the dome more than the size of a house of prayer in mosques as models Seljouqe and Ottoman mosques, especially after the second century AD.

6. PREVIOUS STUDIES

This Study Contributes in the Existing Literature as the Following

6.1. Hassan [11] The (The Properties of Design Thinking in the İnternal Space of the Mosque)

The Study had been aimed mainly to clarify the characteristics of architectural thought to the process of designing the internal space of the mosque and its various elements, the study mainly relied on the analytical method, with these elements rating in four basic elements. Simplicity without complicated, the functionality not formality, and compatibility do not contrast. the most important findings of the study, that thinking in the design of the internal space of the mosque is

the process of restricted in certain controls and the problem of design has been distinguished by simplicity, not complex, the study do not care to the relationship between the dome and the House of Prayer (al- mousala). [11]

6.2. Al- Jubouri and Samaan [15] (The Study of Geometric Properties in Islamic Architecture)

The study aimed to analyze the shape bases in the architecture of mosques and dealt with two elements (dome and the House of Prayer al- mousala) by studying and analysis of the correlation of each of it with the rest mosque parts. the study focused in some engineering characteristics that bind these two elements with each other without focusing on the nature of the mathematical relationship between them [15].

6.3. A Ardalan and Laleh [16]

The study addressed the mosques in the Muslim world by detail, the study has been divided Islamic world into eight distinct regions have been isolated from researcher eight components of the mosques elements, namely, (the yard, al- mousala, the entrance, the mihrab, the dome, the corridors, the terrace, places of ablution) in this the study had been isolated these elements from buildings that have been altered by the Muslims to mosques by adding these items to those buildings. the study do not care to the relationship between the dome and the House of Prayer (al- mousala) [16].

6.4. Al-Umari and Hafsa [14] (The impact of Islamic Religion in the Formation of Buildings Urbanism)

The study dealt with in one of the chapters (Chapter 5) The provisions of the design of the mosque focused on perceptions of typical design space to (prayer house (al- mousala)) and the provisions of the construction of the dome in the Islamic mosques .The study in this chapter had been develop a set of influential restrictions to the election of the appropriate form for this space based on a set of legal provisions in most of them derived from the Hadith The study pointed to the dome is as a complement element to the roof of a house of prayer (al- mousala) . However the aims of study is not looking of at the relationship between the dome and house of prayer or the nature of the mathematical relationship between them [14].

6.5. Al-Maliki and Kbila [17] (Geometry and Mathematics in the Arab-Islamic Architecture)

The study(the geometry and mathematics) dealt with the phenomenon of proportionality in Arab-Islamic architecture „ as a phenomenon evident in the different civilizations, the study define three types of proportions (mathematical, and geometrical and to harmonization) in Architecture from the approved rules in Islamic architecture. The study provided theoretical

framework to promote its goal (make contemporary architecture aligned with the cultural heritage). through the vocabulary addressed by trying to provide a theoretical reference depend on it the design decisions on it , that handles Architects contemporaries to create a contemporary Arab architecture has the same expressive characteristics to Islamic architecture through a thorough understanding of the concept of draw inspiration from the inherited architecture, The first chapter of the study focused on the concept of (mathematics and geometry in architecture engineering , The second chapter cared to examine architecture and proportionality explaining confiscation and determine their impact in determining the intent or spontaneity in proportionality and devoted the third chapter for the study of Islamic architecture, focusing on the production of the Abbasid architecture) for the period specified in the study, while the fourth chapter specialist to analytical and practical study, The study Despite the comprehensiveness and coverage of several aspects but it did not studied mathematical relationship between the elements of the dome and the house of prayer (al- mousala), in the Congregational Mosques, but he can be considered the goal of the current search a tributary into the general aim of the study.

From this Previous studies and the research it has identified the research problem as follows (what is the specify the nature of the mathematical relationship between the dome and the house of prayer in Congregational Mosques).

This study is one of very few studies which have investigated in this research problem.

7. SEARCH GOAL

This study uses new estimation methodology aims to crystallization a part of the specificity of Islamic architecture by providing scientific and accurate identification of the nature of mathematical relationship between the dome and the House of Prayer (Al- mousala) in the congregational Mosques

Identify specific reach and certified proportion to the size of the dome to the size of a house of prayer (Al- mousala).

Identify the dimensions of one of the research variables by knowing the dimensions of the other, through reaching of a mathematical formula linking the variables of research. A contemporary architects can be adopted this formula to create a congregational mosques have the same expressive characteristics of Islamic architecture through a thorough understanding of the concept of inspiration from the legacy architecture.

The paper contributes the first logical analysis to the mathematical relationship between the dome and the house of prayer in Congregational Mosques.

8. RESEARCH HYPOTHESIS AND REQUIREMENTS PRACTICAL STUDY

To achieve the objective of this research has been the development of a hypothesis include the following.

There is a clear relationship between the size of the dome and the size of a house of prayer in the congregational Mosques and the strength of this relationship varying according to the mosques patterns.

Variation the relationship associated with between the positioning of the dome for the house of prayer (Al- mousala), according to the pattern of Mosques

9. PRACTICAL STUDY

9.1. Define the Variables

Topical variables knew this relationship by two variables each representing a qualitatively compared to occupy their possible values

The first variable represents "domes number" within the house of prayer (Al- mousala) and identified the following values. No Dome, one Dome, two domes (of equal size, is of equal size), more than two domes (of equal size, is of equal size)

The second variable is the position of domes within the house of prayer (Al- mousala) and identified the following values. Centralized, decentralized (above the mihrab, at the back, in both, on the porch of direction, domes scattered, matrix above the sanctuary) Al- Jubouri and Samaan [15]

Mathematical variables included the relationship between size of the dome and size of prayer house (Al- mousala) it has been calculate through available dimensions for these two variables to the mosques falling within the research sample.

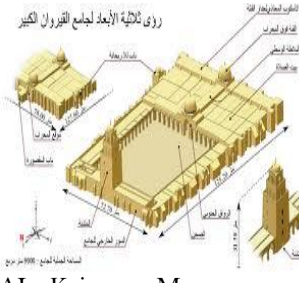
9.2. Sample Selection Search

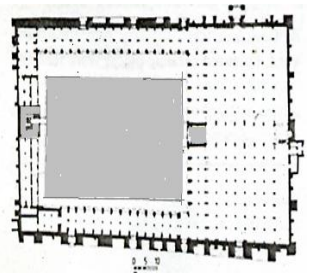
In order to test this hypothesis necessitated study and analysis of a sample of an elected mosques, university buildings in various Islamic regions with a focus on mosques buildings in the local architecture. The following considerations into account when electing the study process models This study documents must be a high degree of accuracy in documented elected architectural models , which is a very important factor as it was elected buildings mosques University, which has a high degree of accuracy and descriptive documentation attached models record and schemes minutes. Try to choose models for different Congregational Mosques and Islamic models covering most regions and for a period of time characterized by widespread urban development. On this basis, has been elected the following Congregational Mosques models as a sample and study the process as shown in Table (1) and Figure 10 shows the horizontal plans of these buildings.

Table-1. List of models as a sample and study

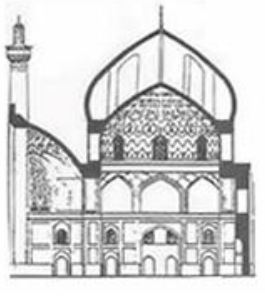
No	architectural project	site	Style	year of achievement	Reference
1	AL- Kairouan Mosque	Tunisia	multi-columns (Arabic)	836 AD	. [18]
2	Umayyad Mosque	Damascus	multi-columns (Arabic(	705-715 AD	. [18]
3	Zitouna mosque	Tunisia	multi-columns (Arabic)	731 AD	. [18]
4	shaah Isfahan mosque	Iran(	four iwan (Sjawqa)	1072-1092 AD	[19]
5	Al- shareefe mosque	Turkey	multi-units (Ottoman)	1437-1447 AD	. [18]
6	Süleymaniye Mosque	Turkey	central dome (Ottoman)	1550-1557 AD	[20]
7	Selimiye mosque	Turkey	central dome (Ottoman)	1569-1574 AD	[20]
8	Shah Zada mosque	Turkey	central dome (Ottoman)	1454-1458m	[21]
9	Sultan Ahmed Mosque	Turkey	central dome (Ottoman)	1616 AD	[20]
10	Prophet Grgise mosque	Iraq	central dome	1158 AD	office construction engineering.1983
11	Mujahid AL-din mosque	Iraq	central dome	1133 AD	office construction engineering.1983
12	Al-agwat mosque	Iraq	central dome	1702 AD	office construction engineering.1983
13	Alrabaah mosque	Iraq	central dome	1694 AD	[22]
14	Khuzam mosque	Iraq	central dome	1576 AD	researcher
15	Jamshid mosque	Iraq	central dome	1560 AD	office construction engineering.1983
16	Basha Mosque	Iraq	central dome	1755 AD	office construction engineering.1983

Source: The researcher

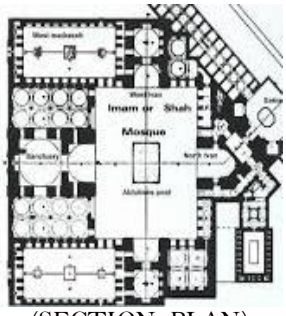




AL- Kairouan Mosque
Umayyad Mosque



shaah Isfahan



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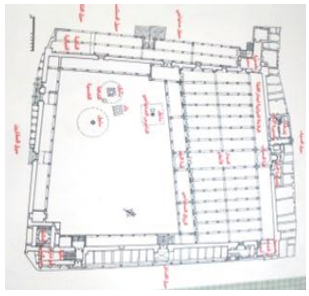
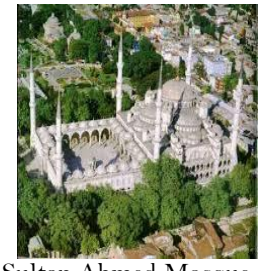


Zitouna mosque



Sultan Ahmed Mosque

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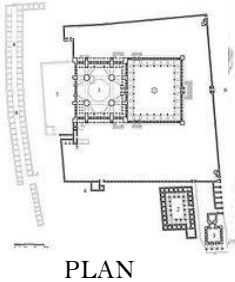

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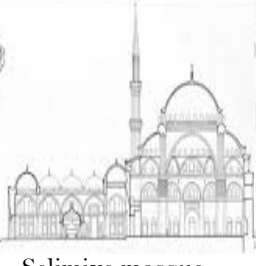

Selimiye mosque

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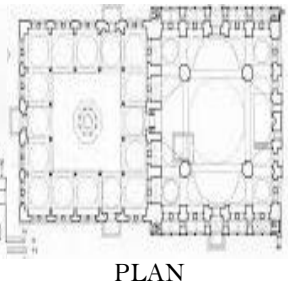

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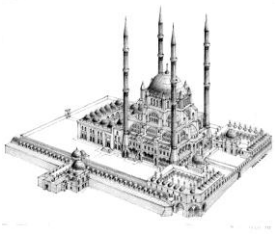
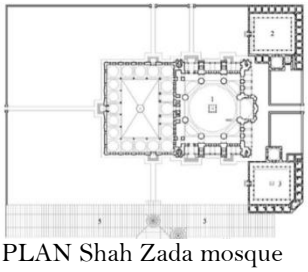
PLAN Al- shareefe mosque





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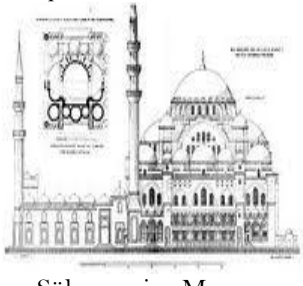
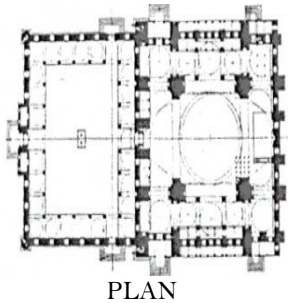


Süleymaniye Mosque



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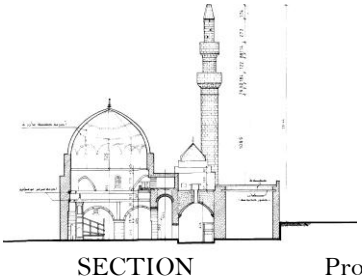

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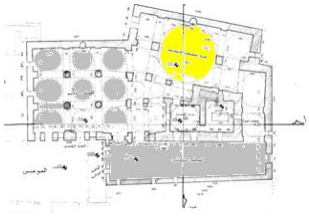
Prophet Grgise mosque



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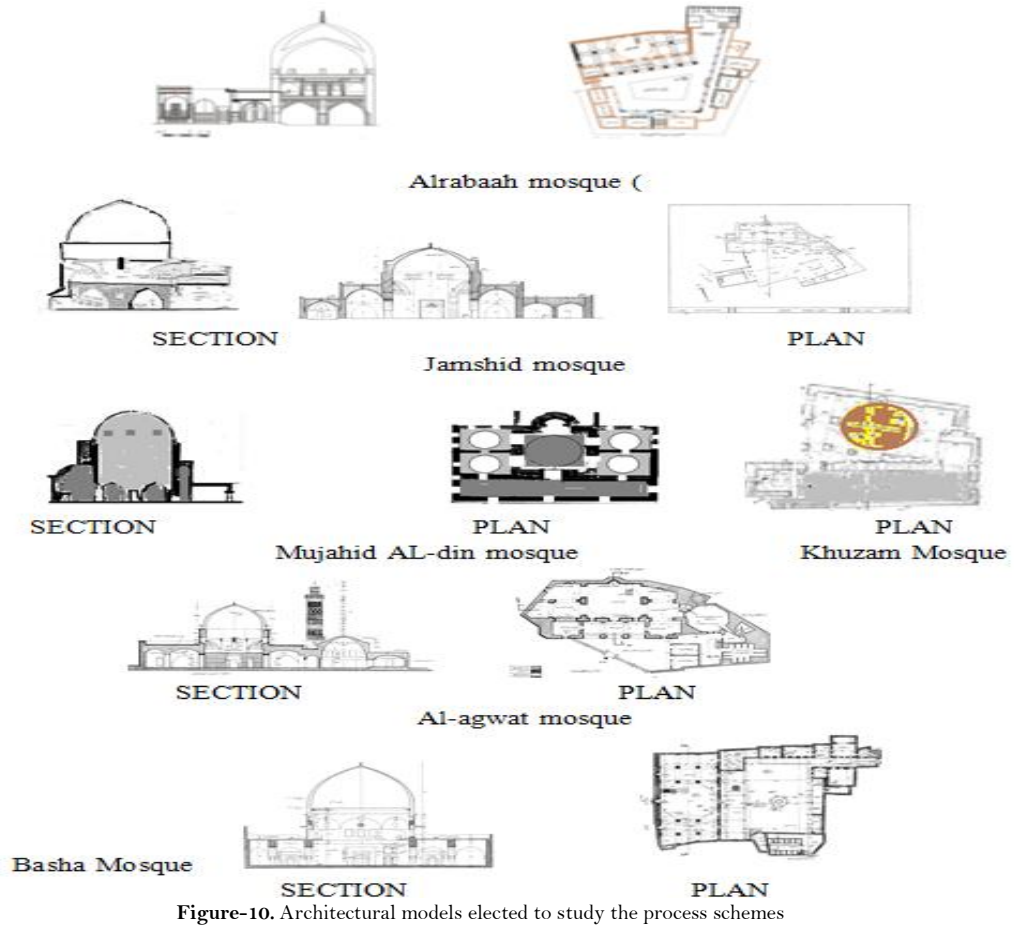

Figure-10. Architectural models elected to study the process schemes

10. RESULTS

10.1 Results Related to the Position of the Dome above the Prayer House

10.1.1 Results Relationship the Domes Number Above House of Prayer

The results did not indicate the similarity between the mosques patterns in the research sample for this relationship. While the central dome pattern distinguished only one dome above the house of prayer. While we find in the four iwan pattern distinguished more than two dome above the house of prayer. While the multi-column pattern ranged between only one dome above the house of prayer, as in the Umayyad Mosque or two domes as in Kairouan mosque and al-zetwona mosque.

10.1.2. The Results of Domes Location above the House of Prayer

The results pointed to the similarity between the central dome pattern with four iwan pattern in the position of main dome dominant in the center above the house of prayer center and their different with multiple-column pattern. also we find a difference in the position of the number domes in the same style of the mosque for the last while, we find repositioning the Dome

of the one above the entrance in some mosques as Umayyad mosque, we find others mosques belonging to the same pattern in which positioned domes, one above the entrance while the other above the mihrab, as in al- zetwona mosque, and Table (2) build the above results.

Table-2. Relationship (local) between dome and almousla

Relationship (local) between dome and almousla															
Position in almousla							No. of dome								
other	Un centeral					centeral	more		Two dome		One dome	No one	style	Architectural project	
Row above haram	In sides	Irregular domes	both	Above mehrab	Above entrance		Not equal	Equal size	Not equal	Equal size					
			●							●			Milt column	AL- Kairouan Mosque	1
						●					●		Milt column	Umayyad Mosque	2
			●							●			Milt column	Zitouna mosque	3
						●	●						Four iwan	shaah Isfahan mosque	4
							●						Central dome	Al- shareefe mosque	5
						●	●						Milt unite	Süleymaniye Mosque	6
						●	●						Central dome	Selimiye mosque	7
						●					●		Central dome	Shah Zada mosque	8
						●	●						Central dome	Sultan Ahmed Mosque	9
						●					●		Central dome	Prophet Grgise mosque	10
						●					●		Central dome	Mujahid AL-din mosque	11
						●					●		Central dome	Al-agwat mosque	12
						●					●		Central dome	Alrabaah mosque	13
						●					●		Central dome	Khuzam mosque	14
						●					●		Central dome	Jamshid mosque	15
						●					●		Central dome	Basha Mosque	16

Source: The researcher

10.2. The Results of the Mathematical Relationship between the Dimensions of the Dome and the House of Prayer (Al-Mousla)

For the purpose of accuracy in calculating the size of the domes being different shapes, mosques included in the sample has been used to represent the house of prayer and the main dome of each mosque by an (Autocad) program and then calculate the size of the dome and the size of a house of prayer for each collector.

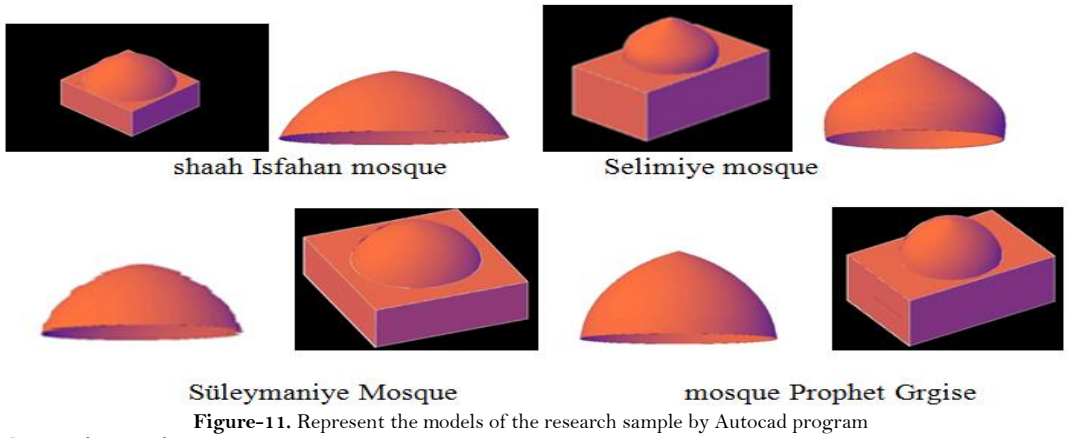

Figure-11. Represent the models of the research sample by Autocad program

Source: The researcher

Table-3. Shows the specific of search data, which represent dimensions the physical of the Dome and its counterpart in the House of Prayer (Al-mousla)

No.	Architectural project	Style	Al-mousla dimension house of prayer				Dome dimension in		
			Length m	Width m	High m	Size M3	Diameter m	High m	Size M3
1	AL- Kairouan Mosque	Milt column	70	38	20	48000	12	9	769.5
2	Umayyad Mosque	Milt column	139	37	26	133718	16	19	1889
3	Zitouna mosque	Milt column	59	29	14	23954	12	16	536
4	shaah Isfahan mosque	Four iwan	66	40	27	71280	20	23	14407
5	Al- shareefe mosque	Central dome	66.5	43.5	14	40498	24.1	12	3613.8
6	Süleymaniye Mosque	Milt unite	69	63	22	95634	25.72	18.8	21540
7	Selimiye mosque	Central dome	60	45	25	67500	31.5	23	235662
8	Shah Zada mosque	Central dome	43	34	19	35131	18.42	18	6139
9	Sultan Ahmed Mosque	Central dome	72	64	25	70225	23.5	25	2850
10	Prophet Grgise mosque	Central dome	21	10	9	1890	9.5	7.25	385
11	Mujahid AL-din mosque	Central dome	25	10	8.5	2125	13.6	8.9	470
12	Al-agwat mosque	Central dome	24	12	7	2016	9.6	4.5	448
13	Alrabaah mosque	Central dome	23	11	7	2070	19	7	1100.8
14	Khuzam mosque	Central dome	15	7	5.5	577.5	5	4	144.25
15	Jamshid mosque	Central dome	17.4	9.5	7.25	1189	3.78	3.75	297.25
16	Basha Mosque	Central dome	29.3	14.5	10.85	4562	11	10.5	1120.5

Source: The researcher

The statistical analysis of research data set in Table (3) by SPSS software showed the following results.

10.2.1. Results of Relationship between Dome Size and Size of a House of Prayer (Al-Mousla)

- The relationship between size of the dome and size house of prayer(Al-mousla) for the sample as a whole is non-linear relationship and can be calculated the size of dome from the size of a house of prayer(Al-mousla) by the following equation.

The weak correlation coefficient and also shows in Table (4)

Table-4. Correlation of relationship between size of the dome and size house of prayer as a whole

Dependent	Mth	Rsq	d.f.	F	Sigf	B0	B1	B2	B3
VAR0004	LIN	.868	12	78.96	.000	3.6583	.001		
VAR0004	LOG	.862	12	74.99	.000	-7.3876	2.1715		
VAR0004	QUA	.927	11	69.61	0.00	2.8816	.0028	-2.E-07	
VAR0004	CUB	.959	10	77.85.61	.000	1.9254	.0061	-1.E-06	
VAR0004	COM	.755	12	36.91	0.00	3.495	1.0002		
VAR0004	POM	.94	12	188.24	0.00	.5579	.3494		
VAR0004	.	.341	12	6.21	.028	1.9041	-24.161		
VAR0004	GRO	.775	12	36.91	.00	1.2514	.0002		
VAR0004	EXP	.755	12	36.91	.00	3.4952	.0002		

Source: The researcher

- The relationship of the dome size with house of prayer(Al-mousla) size in mosques central dome style for all mosques belonging to this style , was linear but it is not clear and the following equation enables us to calculate the size of the dome by the size of the House of Prayer(Al-mousla) with incorporeal weak degree .

For more analysis separate the mosques of this style into two groups, one representing mosques of local architecture and the other outside the scope of local architecture as the following results.

1.The relationship between size dome to the size of the house of prayer(Al-mousla) in mosques pattern central dome (local architecture) and a clear and distinct from the rest of relationship patterns,. The following equation enables us to calculate the size of the dome by the size of the House of Prayer. with high correlation coefficient equal 0784 figures were , and as that shown in Table (5) and chart (1)

$$Z = (58.144+0.24\ X$$

Where X represents the size of house of prayer (Al-mousla)

Z size of dome

Table-5. Relationship between size the dome to the size of the house of prayer in mosques pattern central dome (local architecture)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	58.144	201,375	.791	.289	.784
VAR00001	.247	.085		2891	.034

Source: The researcher

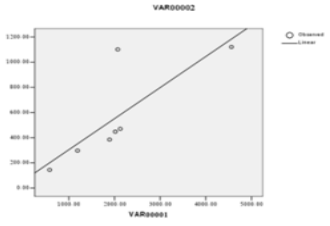

Chart-1.

2.The relationship between size dome to the size of the house of prayer(Al-mousla) in mosques pattern central dome (out of local architecture) accepted with correlation coefficient equal 0.462 , The following equation enables us to calculate the size of the dome by the size of the House of Prayer and as that shown in Table (6) and chart (2) .

$Z = 32.8 + 0.18\ x$

Where X represents the size of house of prayer (Al-mousla)

Z size of dome

Table-6. Relationship between the size of dome to the size of the house of prayer in mosques pattern central dome

Coefficients-a.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	32.842	39.033	.248	.841	.462
AR000012	.695	1.567		.443	.688

a Dependent Variable: VAR000011

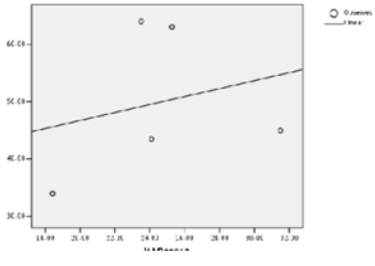

Chart-2.

10.2.2. Results the Relationship between High of Dome and Rising House of Prayer (Al-Mousla)

● The relationship between height of the dome and rising house of prayer(Al-mousla) to the sample as a whole the level of non-linear relationship , calculated the high of dome by the rising of house of prayer(Al-mousls) by the following equation as it is shown in Table (7).

$$H = 11.129 - 5.63EX + 0.31E\ 0.2\ X$$

Where X represents the high of house of prayer (Al-mousla)

H height of dome

Table-7. Correlation of relationship between height of the dome and rising house of prayer as a whole

Dependent	Mth	Rsq	d.f.	F	Sigf	B0	B1	B2	B3
VAR00005	LIN	.277	12	4.61	.053	5.2879	.4094		
VAR00005	LOG	.256	12	4.13	.062	-1.943	5.2042		
VAR00005	QUA	.316	11	2.54	.125	11.1295	-5.634	.0313	
VAR00005	CUB	.501	10	3.34	.063	013.947	6.13525	-,4819	.0115
VAR00005	COM	.343	12	6.26	.028	4.0008	1.05070		
VAR00005	POM	.386	12	7.53	.016	1.639	.6937		
VAR00005	.	.438	12	9.37	.010	2.9816	-7.8115		
VAR00005	GRO	.343	12	6.26	.028	-1.5392	.0495		
VAR00005	EXP	.343	12	6.26	.028	6.662	.0495		

Source: The researcher

● The relationship between height of the dome and rise of house of prayer(Al-mousla) to the sample as a central dome style is non-linear relationship , calculated the high of dome by the rising of house of prayer(Al-mousla) by the following equation as it is shown in Table (8).

Table-8. Correlation of relationship between height of the dome and rising house of prayer as a central dome style

Dependent	Mth	Rsq	d.f.	F	Sigf	B0	B1	B2	B3
VAR00013	LIN	.833	8	39.9	.000	1.4635	.6560		
VAR00013	LOG	.847	8	44.25	.000	011.043	8.70062		
VAR00013	QUA	.843	7	18.78	.002	01.2477	1.1085	-.0144	
VAR00013	CUB	.894	6	16.89	.002	-13.48	4.734	-.3218	,0073
VAR00013	COM	.657	8	15.34	.004	3.308	1.0744		
VAR00013	POM	.700	8	28.43	.001	.6982	1.028		
VAR00013	.	.841	8	42.2	.000	3.2503	-10.884		
VAR00013	GRO	.657	8	15.34	.004	1.1964	.0717		
VAR00013	EXP	.657	8	15.34	.004	3.3083	.0717		

Source: The researcher

● The relationship between height of the dome and rise of house of prayer(Al-mousla) to the remainder of sample is non-linear relationship , calculated the high of dome by the rising of house of prayer(Al-mousla) by the following equation as it is shown in Table (9).

$$H= 50{,}57-5.15X2-0.152X3$$

Where X represents the high of house of prayer (Al-mousla)

H height of dome

The results of the relationship between Diameter of dome and width of house of prayer (Al-mousla). The relationship between diameter of the dome and width of house of prayer (Al-mousla) to the sample as a whole the level of non-linear relationship.

Table-9. Correlation of relationship between height of the dome and rising house of prayer

Dependent	Mth	Rsq	d.f.	F	Sigf	B0	B1	B2	B3
VAR00015	LIN	.253	2	,68	.497	21.8846	-.4622		
VAR00015	LOG	.389	2	1.27	.378	35.1832	-7.7462		
VAR00015	QUA	.997	1	187.14	.52	.50.5733	-5.1530	.1525	
VAR00015	CUB	.997	1	187.14	.52	.50.5733	-5.1530	.1525	
VAR00015	COM	.188	2	.40	.593	20.5091	.9718		
VAR00015	POM	.288	2	.81	.464	50.7157	-.5091		
VAR00015	.	.387	2	1.26	.376	2.0164	6.9694		
VAR00015	GRO	.166	2	.40	.593	3.0209	-.0286		
VAR00015	EXP	.166	2	.40	.593	20.5091	-0286		

Source: The researcher

The relationship between diameters of dome to the width of the house of prayer (Al-mousla) in mosques central dome style is a clear and distinct from the rest of relationship styles,.

The following equation enables us to calculate the diameter of the dome from the width of (House of Prayer). With high correlation coefficient equal 0.638 but deviated from that AL-Selimiye mosque figures were, and as that shown in Table (10) and chart (3)

$$R = (x-3.996) / 1.882$$

Where X represents the width of house of prayer (Al-mousla)

R reduce of dom

Table-10. Relationship between Diameter of dome and width of house of prayer) in mosques central dome style

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-3.966	8.170	.792	-.485	.638
	VAR000013	.1,882	.459		4.097	.002

A Dependent Variable: VAR000010

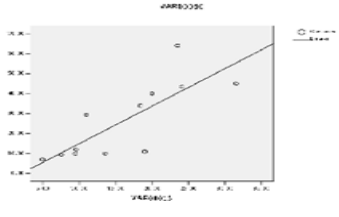

Chart-3.

11. CONCLUSIONS

11.1. The Conclusions Associated in the Position the Dome above the House of Prayer (Al-Mousla)

In the mosques types (Seljuk and Ottoman) (central dome and four iwan) clear similarity in of the number of domes above the house of prayer and places of repositioning those domes over the prayer house (Al-mousla) and disagreement with the Arab type, possibly due to the local Architecture effect it prevailing in those areas.

11.2. Conclusions Related in the Mathematical Relationship between the Dimensions of the Dome and the Dimensions of the House Prayer (Al-Mousla)

The results confirmed the hypothesis of research relating to the existence of a clear mathematical relationship between the dimensions of the dome and the dimensions of the house of prayer (diameter dome / width a house of prayer, the size of the dome / size of house of prayer) in the mosque, the Congregational Mosques, however, this relationship was confined in the mosques of the Ottoman style only , whether that it built in their original environment (the Ottoman Empire) or in neighboring countries environment (Mosul), which indicates the originality the proportions in the Ottoman architecture without effect it in local architecture prevailing. on the other hand there are indicates to the natural effect to this architecture on the rest of its neighboring countries, especially neighborhood countries, the fact that architecture is a symbol of the Islamic caliphate, and depending on the results of ratio of the dome rise to the rise of house of prayer . the research distinguish between from the mosques of the Ottoman type (style central dome) two kinds, the first has a global attributes, as a edifice , which is mosques built in the Islamic Caliphate site, this is the fact that architecture is a mirror that reflects the state's power and prestige of hand and the great attention given by the Ottoman Empire for building mosques on the other hand, and another variety of mosques in Mosul has attributes local that reflect the humanitarian nature of Islamic architecture. And thus it can be identified two kind of mosques style central dome based on the mathematical dimensions of the house of prayer or the dome. The first is represents the Ottoman mosques (the central dome style) of a global nature, which has achieved an acceptable relationship between the geometrical dimensions to the variables of the research. The second is the Ottoman mosques (central dome style) have a local nature and which has a strong mathematical relationship between the basic geometric dimensions of the variables Search.

The previous classification refers clearly to the apparent disparity in the conditions and possibilities for the emergence of these two types:

The first is dominant within the urban fabric helps in making the mosque as a dominant element within the fabric. thus the mosque built within wide and open spaces as well as the used construction materials available helped to open of standard dimensions, and this case to reach its peak in the Selimiye Mosque which explains deviance in Dimensions dome of

Selimiye from those in the sample While the second kind harmonious within the organic fabric , local environmental. constructed by simple materials , so the basic dimensions of geometric harmonious with the surrounding fabric and proportionate to the humanitarian character of Islamic architecture.

- The Search gives to (architectural designer) possibility to calculate the diameter and the size of the dome depending on width and size of the House of Prayer(Al-mousla) , in mosques (central dome style) that want to design newly or those need to be rehabilitated, by based on the mathematical equation mentioned above, can be to the specialists to use that equation to validate elemental ratios (dome and the house of prayer (Al-mousla)) in the mosque when re-restored.
- By knowing the size and diameter dome from size and display house of prayer (Al-mousla)from the previous equations can be to the professionals specifically architects, definition of the mosque dome shape as (semi-circular or semi-circular or semi-circular shaped) by changing the height of the dome while retaining dimensional basis.
- Characterized by the Dome of the Selimiye Mosque from the rest of the Ottoman mosques in the size and height of the dome which confirms the edifice form of the mosque on one hand and the relentless pursuit of architect Sinan to exceeded the dimensions dome of Mosque Hagia Sofia from other side.

12. RECOMMENDATIONS

Studied the mathematical relationship between the other elements in the Congregational Mosques like the dome and the minaret and others.

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Contributors/Acknowledgement: All authors contributed equally to the conception and design of the study.

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