CHAPTER 6
THE FUTURE
The evolution of our design revolves around the concept of a State Mosque as a centre, a focal point for the urban expansion to the west of Baghdad.

In this sense a State Mosque will be a multi-functioning centre reflecting at once:
- The essence of Islam.
- The status of a national symbol.
- A focal point for a renaissance of the arts and crafts in Iraq and the Islamic world.
- A centre of public amenities.

This is to be a complex to reflect the status of Baghdad in the year 2000, a complex with the flexibility to absorb and grow with the changing requirements of public and cultural amenities.

The programme requirements for a State Mosque have been fulfilled in the design concept. Additionally we would propose the following amenities that would eventually reflect the status of the mosque as a true centre of the renaissance of Baghdad.

Public facilities such as an orphanage centre, a handicapped institute, courts of justice could be housed in the immediate surroundings of the mosque as important civic institutions.

The public amenities area could be developed as a meeting place where bazaars, teashops, coffee houses, hammams, bookshops could thrive introducing the atmosphere of the souqs which traditionally surrounded great mosques.

The cultural synthesis can evolve generation by generation. The wall bay units of the outer boundary wall and the lower wall bay of the sahan riwaqs are vestibules to house contemporary and traditional Iraqi artworks.

They can be repositories for the art and craftwork of other Islamic nations reviving again the golden era of Baghdad as a world centre of art and culture.

The public park to the north of the site could be developed as a public open space, emphasising an avenue of approach to the main gateway for pedestrians. This open space will be used for fairs and fetes celebrating the great festivals of the Islamic year.

The area to the south of the mosque across the canal would be developed as another public park to provide a monumental setting worthy of the mosque. A bus station can be developed off the main feeder road and pedestrian links made to the mosque across bridges that could span the canal.

In line with the revitalization of the canal into an urban green belt it is proposed to widen the canal to form a lake to the south of the mosque forming a giant reflection pool. Here channels of filtered water will link with the major water axes of the mosque complex.
Pavilions linked by canal walks could be developed to house permanent exhibitions of Abassid boats and historical river transport. These could be developed in harmony with public boating facilities on the canal.

The shelter belt of palm trees which provide a sense of enclosure to the site shelter orchards and picnic grounds where families may gather on feast days and holidays.

The multi-use nature and functions we have proposed have been carefully zoned so as not to intrude on the serenity and sanctity of the mosque and the Sahans which form the still point - the hub around which revolves the multifarious activities of life.

Here in essence is our concept for a State Mosque complex - respecting the past while looking forward to the future, reflecting the status and dignity of Baghdad and the Iraqi people and acting as a true centre of Islam.

Here form and function reflect the concept of Unity through diversity which is at the core of Islam.
CHAPTER 7
STRUCTURAL CONCEPT
The structural engineering design will complement the architectural concept with the use of traditional and well-tried structural systems and materials. However, emphasis will be placed in the use of these materials and methods of design and construction, on using the best of modern technology to create a structure that will be enhanced by time and attain an historic and symbolic status.

The architectural concept of volumetric expression within the main prayer hall leads naturally to the use of reinforced concrete as the basic structural material. This main hall and all other ancillary areas will be constructed as an in-situ reinforced concrete framework, rigid in all three directions. Such a rigid frame system is capable of withstanding environmental forces such as wind and imposed dead and live loads as well as the limited earthquake forces to which the structure may be exposed. Bearing in mind the long design life anticipated for these loadings will be taken into account in determining the design factors. Consideration will be given during the preliminary design stage, to the maximum use of pre-fabrication, particularly for floors and roofs, in order to gain the greatest benefits from the repetition of members by way of increased speed of construction and quality of finish of exposed concrete members.

Such an important monumental structure must be built to last. Therefore, the materials of construction need to be carefully selected from those which have shown stability and durability with time and yet are products of modern manufacturing processes.

Reinforced concrete will be used for the main framing system, e.g. substructures, walls, columns, beams and slabs, for all parts of the complex in addition to its use in the main prayer hall. Consideration will be given in the early stages of development of the design to the use of specially treated reinforcement including galvanised or epoxy coated bars or the use of stainless steel bars in particularly vulnerable members. The concrete will be specified to be made with strong and durable stone aggregates free from friable and deleterious materials. If such special reinforcement is used, particularly in areas additionally protected with stone cladding, reinforced concrete could be expected to have a very long life even though the initial cost would be high.

One of the principal expressions of the architectural philosophy of the State Mosque complex is in the large number of domes expressed as volumes over the entire roof area. The surface of these domes will be clad in reconstructed sculpted stonework to withstand the extremes of Iraqi weather. These domes form three groups:-

Firstly, the main dome 93m in diameter.
Secondly, 20 number subsidiary domes, 24m in diameter.
Thirdly, 22 number subsidiary domes 3m in diameter.

التصميم الإنشائي سيكون مثالاً للاستخدام العملي للمسجد وذلك من خلال استعمال المواد والطرق المعمارية ذات القدرات الفارقة العائمة والتي سيعتمد عليها.

مع الاستعانة بدقة تصميم تغلق مساحة segmentation ًشيء سيمثل تاريخ وثقافة.

نسبة جمع صالات الإضاءة ستتعلم استعمال الخرسانة المسلحة وانهيار البناء

ويضيفن حياتهما في الاتجاهات الثلاثة وفي محتوى احتفالي وفي حالة اللزمنة

وحتى انعكاسات الأصوات التي دفعت ذلك قد يتعارض المسداد مع الأخذ بإعتبار

طول معمر البناء الذي سيظهر معرفة في لغة هذا العناصر.

في المرحله الأولى لنظام البناء الاهماء يستعمل وحدات البنائية

السابقة المرتبة وخاصة في الأرمينيات وأي سطح وذلك للاسراع في البناء واحصل

على الجودة المطلوبة.

ycle هذا البني الذي هو رمز لحضاره وتقدم العراق، يجب بناؤه ليزكي عليه

 مدى الدور، وعلى جميع الجوانب الفنية في اختيار مواد البناء الذي استعملت

وثبتت جودتها وقابليتها منذ القدم.

الهيكل العام لا جزء من الخرسانة المختلفة سيكون من الخرسانة المسلحة والمألوف قد

يغذي بصرة خاصة على الاهتمامات الحديثة لزيادة ما طلبتها أو تستعملها

للحديد المفقود في 32 اجزاء من المرح Хот 32 اجزاء، أو ما يسمى به الصندوق المفتوح

مجنون احتفالات وخلال من الاشكال وزيادة الخرسانة المصحة التي ضمت

تون مساحة بالجزر. أيضاً أضاف من معادلة البلاط وتحسين بعض، 

تجميل التغيير الرئيسي الذي يعتمد عليها في أظهار الروح المعمارية للمسجد

في العقاب ودعا الهواء على سطح المسجد كله.

استعمل هذه الإلهام ستكون مسألة بالجزر المفصلة تحت الحروف في الأجواء,

الحجة للفضاء العراق، وهذه الإلهام ستكون في ثلاثة نماذج:

11- الأقمشة الرئيسية وقطرها 3 متر
12- الأقمشة الصغيرة وقطرها 1.5 متر
13- الأقمشة صغيرة أخرى وقطرها 1.3 متراً.
Domes may be constructed either of stainless steel, aluminium alloy or specially treated steel sections forming spatial reticulated structures. Reinforced concrete may also be used for the construction of domes but has disadvantages, especially for large span domes, which include:

i) The dead weight is very high requiring massive supporting frames. A preliminary calculation shows that the 90m diameter main dome would weigh about 8700 tonnes in reinforced concrete without any finishes whereas the framework in steelwork would weigh about 1000 tonnes and In aluminium alloy about 400 tonnes.

ii) Extensive falsework and formworks of complicated geometry is required. For large span domes, the cost of formwork may exceed the cost of the concrete and reinforcing steel.

iii) Construction time is significantly extended.

On the other hand, a steel or aluminium framework for domes has the following advantages:

i) They are light but strong and, when properly protected are durable. The strength/weight ratio is many times higher than that of concrete, aluminium alloy offering the highest ratio. Consequently, a much lower weight is required.

ii) The framework is easier to prefabricate in large sections at ground level in workshop conditions.

iii) The erection of the framework does not involve extensive and complicated falsework thus cuts the construction time to a minimum. A possible erection procedure for the type of dome construction recommended below for the main dome construction recommended below for the main dome is illustrated in Fig. 2.

There are a number of different forms of metallic framework systems used for domes. Single layer gridwork domes can be grouped into Geodetic, Triodetic and Lamella systems. These domes are more prone to buckling, especially under un-symetrical loading unless adequate precautions are taken to stiffen the most vulnerable points. Considerable benefits have been gained in larger span and more heavily loaded domes by the use of a number of layers of double grid work giving more rigidity but introducing a larger number of joints and member types increasing the complexity of erection. Further advantages can be gained particularly in simplifying erection and speedy construction by the use of ribbed space truss construction.

The proposed system to be used on the main dome is of the ribbed space truss family and is more fully described below. However, the final choice of material and system for the dome construction will be made with full agreement of the client and the architect during the preliminary design phase. However our current proposals can be summarised as follows:

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Main Dome

The main dome is 93m in diameter and 45m high from the top of the supporting ring beam which is, in turn, 40m above the prayer hall floor level. In selecting an appropriate structural system for this dome, consideration has been given to architectural finishes, construction technique, loadings, environmental conditions, available construction facilities, services requirements, durability of materials, its future maintenance etc.

It is envisaged that the dome structure would be a framework constructed of either specially protected steel, stainless steel or aluminium, the choice being made during the initial design work after exhaustive evaluation studies have been completed. As shown in Fig. 1 the framework comprises 20 main ribs, triangular in cross-section and a further 20 secondary plane truss ribs. The main ribs are connected together with 10 ring members thus producing a three dimensional spatial structure.

Further subdivision of the panels on the dome surface is achieved by providing both longitudinal and ring members consisting of rolled sections also providing support for the outer cladding and inside finishes. The proposed structural system is a well-tried and accepted method of dome construction and has been used to construct large domes all over the world. The 93.5m steel dome for the exhibition hall in Bucharest, Rumania, and the 90m aluminium dome over the sports hall in Benghazi, Libya, may be cited as examples.

Subsidiary Domes

Considering the size of the 25m diameter domes and their position, at about 40m above the prayer hall floor, a metallic framework form of construction and has been used to construct large domes all over the world. The 93.5m steel dome for the exhibition hall in Bucharest, Rumania, and the 80m aluminium alloy dome over the sports hall in Benghazi, Libya, may be cited as examples.

The 7m diameter domes will almost certainly be constructed of reinforced concrete. Concrete domes of this size may be precast at ground level and subsequently lifted into place but this would be studied during the initial design period.
Construction Methods

The construction methods will largely depend upon the resources available to the successful contractor and which will be reflected in the tender. However, assumptions regarding construction techniques must be made by the engineer, at the design stage, to ensure that the design concept allows the use of the most advantageous of these to be reflected in contractors tenders to the client’s financial advantage. We envisage that the tall columns and framing beams of the main prayer hall, being in situ concrete, will probably be constructed using climbing floors or slip-formed in groups for maximum speed. The floors of the underground car park and the grand Sahel may be constructed using precast units with in situ topping. The ring beams for the main domes will be cast in situ whereas the metal framework of the dome will be prefabricated at the ground level and lifted in place as previously described to give a stable framework for fixing of insulation, inside and outside cladding and finishes.

For the general roof structure investigations will be made at the preliminary design stage, to ensure that the design concept allows the use of the most suitable materials. We envisage that the tall columns and framing beams of the structure will largely depend upon the resources available to the contractor. The rolled steel members would be incorporated into the permanent concrete work and pricing of the various construction methods will reflect the prices of the materials.

Foundation systems will have to be determined following a site investigation comprising trial pits, deep boreholes, sampling and laboratory testing. However sufficient is known about the general soil conditions in Baghdad to enable us to determine the Foundation system systems for the main domes. The ring beams for the main domes will be cast in situ in-situ topping. The ring beams for the main domes will be cast in situ whereas the metal framework of the dome will be prefabricated at the ground level and lifted in place as previously described to give a stable framework for fixing of insulation, inside and outside cladding and finishes. The rolled steel members would be incorporated into the permanent concrete work and pricing of the various construction methods will reflect the prices of the materials.

Traffic analysis and the likely demand for traffic on the new highway along the Tigris River and in the adjacent areas will be considered in the preliminary design stage, to ensure that the design concept allows the use of the most suitable materials. We envisage that the tall columns and framing beams of the structure will largely depend upon the resources available to the contractor. The rolled steel members would be incorporated into the permanent concrete work and pricing of the various construction methods will reflect the prices of the materials.

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