



**2010 On Site Review Report**

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*by May Shaer*

## **Rehabilitation of Al-Qaraouiyine Mosque**

*Fez, Morocco*



**Architect**

*Mohammed Fikri Benabdallah*

**Client**

*Ministère des Habous et des Affaires Islamiques*

**Design**

*2004 - 2005*

**Completed**

*2005 - 2007*



# **Rehabilitation of Al-Qaraouiyine Mosque**

*Fez, Morocco*

## **I. Introduction**

The mosque of al-Qaraouiyine is located at the heart of the Medina of Fez. It was originally built in the ninth century, but underwent several phases of enlargement and expansion during the subsequent historical periods. Its architectural character is similar to that found throughout the Maghreb region, reflecting a building tradition that takes as its inspiration the monuments of al-Andalus. Al-Qaraouiyine also hosts a university that is considered to be the oldest in the world, and was once a major centre of learning.

The al-Qaraouiyine mosque does not only represent an integral part of the urban fabric of the city of Fez, but also plays a vital role in the spiritual, social and cultural life of the community. Its significance, therefore, includes its architectural, religious, social, educational and cultural values.

The rehabilitation project, initiated in 2004 and completed in 2007, aimed to restore and rehabilitate the mosque, to reverse the physical deterioration of its fabric through the years. It also aimed at reviving the traditional cultural and academic role of al-Qaraouiyine, in addition to its spiritual one.

## **II. Contextual Information**

### **A. *Historical Background***

The al-Qaraouiyine Mosque was originally built in AD 859 by Fatima Al-Fihriya, whose family was originally from Kairouan in Tunisia, and migrated to Fez at the beginning of the ninth century. It is the first mosque known to have been founded by a woman. Fatima's sister, Mariam, built the Andalusian mosque along the other side of the river that passes through the city of Fez. The old city of Fez (Fez al-Bali) developed around these two mosques: Adwat Al-Qaraouiyine along the western bank of the river, and Adwat Al-Andalus along the eastern bank of the river.

Al-Qaraouiyine is considered to have hosted the world's first and oldest university. During the Middle Ages, it produced numerous scholars whose work exerted an influence on the Muslim world, and played a part in cultural relations between the Islamic world and Europe.

### **B. *Local Architectural Character***

The al-Qaraouiyine Mosque is an example of the architectural tradition in the Maghreb region during the Islamic period. The origins of Maghreb art are said to lie in Syria, and particularly the Great Mosque of Damascus; this is evident here with respect to the transverse gable and the proportions of the mosque.

Typical of the Maghreb architectural tradition is the horseshoe arch, the intricate vaulting of muqarnas, and the square minaret. In fact, the minaret, which was built in AD 956 is considered to be the prototype of square minarets constructed in the Maghreb region. The origin of many of the forms and the intricate decorative motifs is al-Andalus. The courtyard with its two flanking Sa'dian-period pavilions, connected to each other by a water channel intercepted in the middle by a central fountain, is reminiscent of the Alhambra mosque in Granada.

In terms of building materials, fired brick and sometimes stone was used in Fez, along with a lime-based (and sometimes gypsum-based) mortar. All such material were locally produced. Stuccowork, decorative wooden carving and tiling have also been traditionally crafted. All of these materials and techniques were employed at al-Qaraouiyyine.

### **C. *Climatic Conditions***

The climate of Fez varies between summer and winter. In winter, temperatures can reach a low of 3° or 4°C, while the average summer high is about 34°C. The average monthly rainfall is between 2 and about 100 mm, while yearly precipitation can reach over 600 mm.

An important feature to note is that the prayer hall of the al-Qaraouiyyine Mosque is open to the courtyard, while its upper parts and roof are connected at certain points with nearby buildings.

### **D. *Site and Surroundings***

Fez is believed to have been founded by Moulay Idriss II at around AD 808, and later on became the capital of the Idrissid Dynasty (AD 788-956). The al-Qaraouiyyine mosque is located in the old city (the Medina) in the area that was known as Adwat al-Qaraouiyyine, the area that grew around the al-Qaraouiyyine mosque. The city expanded and developed significantly during the rule of the Almoravid (1061-1147) and Almoahad (1147-1269) dynasties. The two parts of the Medina were then unified and it became a center of cultural and spiritual influence during the Middle Ages.

During the Merinid rule (1269-1465), the Fez Jdid (New Fez) was developed, and included the palace and administrative headquarters, a large number of madrasas, fondouks and workshops. During the Sa'dian Dynasty (1554-1658), fortifications were built, while with the advent of the Alaouite dynasty (from 1658), focus was on military architecture and the establishment of cultural facilities.

Today the mosque of al-Qaraouiyyine is located at the heart of the old Medina, which has been a UNESCO World Heritage Site since 1981. It is an integral part of the city's fabric and is adjacent to several other significant historical buildings including the Medersa Attarine, Medersa Mesbahiya, and Fondouk Titouaniyyine.

The al-Qaraouiyyine mosque is along one of the six thematic tourist routes that were established by ADER (Agence pour la Dédensification et la Réhabilitation de la Médina de Fes) for the Medina renovation project, which is financed by the Moroccan government and the local

government of Fez, in addition to funding through World Bank loans. The thematic routes are guided by signage and a guide book with an accompanying map. The al-Qaraouiyine mosque is included along the 'Monuments and Souks' route, and is the 12<sup>th</sup> stop along that route. Visitors to the city can recognise it by the sign posted at its entrance, providing a brief historical overview of the mosque. However, the mosque is not open to tourist visitation.

This part of old Fez has been subject to major restoration activities, mainly carried out by ADER (Agence pour la Dédensification et la Réhabilitation de la Médina de Fes). Several restoration projects have been carried out in the vicinity of the al-Qaraouiyine Mosque, including the close-by Medersa Attarine.

#### ***E. Topography of the Project Site***

The city of Fez has a mountainous terrain with a river cutting through it, which is fed by sixty springs. The site of the mosque is along a slope with an inclination going down from the western side towards the east. Hence, surface drainage from the higher western side of the mosque passes around the mosque's precinct towards the eastern side and flows down the slope.

### **III. Programme**

#### ***A. History of Inception of the Project***

On 17 January 2004, King Mohammad VI led the prayer at the al-Qaraouiyine mosque, and upon noticing the state of deterioration and damage to the mosque he gave directives for the immediate restoration of the historical building and its old minbar (al-Minbar al-Atiq). The ministry responsible for religious affairs (Ministère des Habous et des Affaires Islamiques), as the custodian of all Islamic religious places, immediately took on the task and began the procedures for carrying out a restoration and rehabilitation project.

#### ***B. How Were the Architects and Specialists Chosen?***

The Ministère des Habous et des Affaires Islamiques began in 2004 to seek an architectural firm to work on developing the project. It contacted some firms, and carried out several consultations regarding the firms' views about implementing the project while also considering their previously executed projects. The Ministry eventually decided to contract the architectural office of Mohammed Fikri Benabdallah, which is based in Rabat, to act as the consultancy firm. With regards to the contractor for the project, a tender was prepared, after which the Ministry contracted the company ABHAT as the main contracting company. ABHAT, in turn brought in specialised craftsmen from Fez and the surrounding areas to work on the execution of the work. For the old minbar, SOTCOB, a specialist company, was contracted for the restoration of the wooden element.

### **C. *General Programme Objectives***

The project falls within an overall programme set by the Ministère des Habous et des Affaires Islamiques for restoring and rehabilitating mosques throughout the country.

An overarching objective of this particular restoration project was the ultimate revival of the cultural and educational role that al-Qaraouiyyine had played in the past.

The restoration programme at the mosque aimed at addressing the damage that the building and its elements had incurred, as well as mitigating the factors that had negatively impacted the site. Thus, in addition to carrying out restoration activities at the building and its decorative elements, structural strengthening was carried out when necessary and water seepage and drainage issues were also addressed. The programme set by the Ministry also included the restoration of the old wood and ivory minbar.

In the course of conducting the restoration work, archaeological remains were discovered by accident. Hence an emergency programme for excavation, documentation, study and reburial was established immediately upon the discovery of the remains.

### **D. *Functional Requirements***

Al-Qaraouiyyine is not only a place where Muslims pray, but also a major centre for learning in Fez. It has a number of teaching chairs and students can either enroll in regular courses of study, or in independent classes. In addition to religious instruction, subjects include mathematics, languages and astronomy.

After the completion of the restoration project, the mosque started accepting female students once again, in particular for instruction in literacy, preaching and guidance.

## **IV. Description**

### **A. *Building Data***

The whole area of the al-Qaraouiyyine mosque is 7,200 m<sup>2</sup>. It has a total of 18 entrances spread along its four sides. The main entryway along its north western end opens to the mosque's courtyard, which in turn leads to the prayer hall. The main prayer hall, which measures 83 x 44.2 metres, has 10 transverse aisles parallel to the qibla wall, with square pillars supporting horse-shoe shaped arches. The courtyard has four aisles along its two ends, constituting annexes to the prayer hall. The site also includes al-Jami' al-Janan'iz (funerary mosque) and Borj Enafara, which is a tower located along the western side.

The mosque has had a long history of evolution. It was originally 30 metres in length, with an initial surface area of 1,248 m<sup>2</sup> and a courtyard (*sahn*). It was expanded in AD 956 with an enlargement to the prayer hall and replacement of the minaret with a new one constructed at the western end of the courtyard, which is still standing today. The minaret also served as a reference for other mosques in Fez for the recital of the calls to prayer. The Bayt al-Mouwaqit,

located on an upper floor and accessed from the minaret, is the place where prayer times are established.

In AD 1135 the mosque was enlarged by the Almoravid ruler Sultan Ali Ibn Yusuf, to a total area of about 3,000 m<sup>2</sup>; a series of cupolas with carved muqarnas were also added at this time. During the twelfth and thirteenth centuries, at the time of the Almoahad dynasty, further decorative stuccowork was added and new rooms were built.

The mosque was further expanded from the thirteenth to fifteenth centuries under the Marinids, and in the sixteenth century the two pavilions along the two ends of the sahn were constructed by the Sa'dians.

The present Almoravid minbar dates from AD 1144 and is made of precious wood and inlaid ivory. It is thought to have been brought from Cordoba.

## ***B. Evolution of Design Concepts***

The framework of the project did not require any new design concepts to be addressed. Nevertheless, there was a process put in place for arriving at the appropriate intervention decisions.

The methodology of work involved a series of steps that are usually followed in the execution of conservation projects. It included the gathering of historical documentation about the site, followed by a photographic and survey recording, after which an assessment of the condition of the building and its elements was carried out. This included evaluating previous interventions. The assessment was conducted along with scientific investigation, in-situ and in specialized laboratories. Afterwards, the intervention options were established and the decisions regarding the methods of executing the restoration work were taken.

A study was made with the aim of analyzing the existing state of conservation and the damages that the interior and exterior plasters had incurred. It included conducting in-situ measurements of humidity levels and the degree of adhesion of the plaster. It was found that humidity levels had reached a height of about 2 metres, and were especially high during the winter. Humidity had affected the whole structure uniformly. On some pillars, the humidity level had reached its saturation rate. This humidity is either the result of capillary action from the ground or due to heavy rainfall. Hence, humidity and a defective drainage system were found to be the main causes of deterioration of plaster coverings.

Additionally, there were some significant cracks, especially along Borj Enafara that seemed to present a significant threat to its stability. Upon inspection of the soil and foundations, it was found that the soil was in good condition and there was no settling. However, in some areas it seemed structural reinforcement would be necessary.

The discovery of some archaeological remains during the execution of work in November 2005 created a major issue for the conservation project. The remains included ancient walls with decorative geometric motifs painted in ochre on white plaster. According to the archaeologists who were in charge of the excavation, some of the archaeological features

uncovered were unique in Morocco. Subsequently, all concerned parties agreed to carry out a systematic archaeological excavation covering an area of about 291 m<sup>2</sup>. Several strata representing different historical periods were discovered, the first of which apparently precedes the first construction phase of the mosque, while the second precedes the main enlargement of the mosque that was carried out in AD 956.

In recognition of the significance of the excavated remains and their potential for enriching the historical knowledge of Fez, options were considered for the best solution for the excavation. The three options considered were: to keep the excavated portion and present it in situ, to transfer the whole excavated remains to a museum, or to rebury the excavated remains by implementing a reversible method. The first option was found to be rather complicated in execution, especially with regards to securing the structure while also considering the short timeframe for reopening the mosque. The second option did not seem to ensure the appropriate conservation of the structures, and therefore the third option was chosen.

Hence, the findings were documented and inventoried, while archaeological pieces and fragments were collected and transferred for further analysis and study. The excavation itself was reburied by first placing a layer of geo-textile after which the excavation was filled with the excavated soil.

### **C. *Structure, Materials, Technology***

The al-Qaraouiyine mosque is mainly constructed of fired brick masonry, in addition to the use of marble in some parts, and a mortar which is lime or gypsum based. Exterior wall plastering is composed of lime and sand, while interior plastering consists of a base of gypsum and possibly lime. The decorative stucco is made up of a gypsum based mixture. The gabled roof is mainly clad with green tiles, while the floors are mainly laid out with ceramic tiles.

In the early 1950s, extensive restoration work was carried out by Henry Terrace and his team. All their interventions were made to the structure itself, including the rebuilding of the gabled roof with reinforced concrete, after which it was clad with the characteristic green roof tiles.

The courtyard (*sahn*) seems to have undergone a number of changes. It used to have an exposed water channel that connected the central fountain with the two pavilions, one on either end of the court. This water channel had been closed off as a result of restoration work at some point in the past. Previous work also involved placing floor layers on top of one another, which eventually resulted in a blue and white patterned courtyard that existed when the restoration project began.

While studying old photographs as part of the documentation process, the preservation team found an image that showed the courtyard at a certain point in the past. As the image was considered to be closer to the original design, the team decided to remove the layers of flooring, bring back the channel system and replace the blue and white patterned tiles with a more compatible arrangement. A principle of the restoration project was to revert as much as possible to the original situation, which included removing previous inappropriate interventions where feasible.



The pavilions were considered to be in relatively good condition in terms of their decorative elements, and therefore minimal interventions were required. Their foundations were strengthened, and the foundations of the tower, Borj Enafara, were also reinforced in accordance with seismic codes.

Where necessary, stucco and wooden elements were cleaned and conserved. In several areas, during the cleaning process during which more recently added layers were removed, the original surfaces were found. These sometimes had colored paint remains, and efforts were made to preserve them. Conservation work was also carried out on the tiles, the marble capitals and the chandeliers.

The project team decided to use compatible and traditionally used materials and techniques as much as possible. For the interior plasterwork a gypsum based mixture with the addition of lime was used, while for the exterior, a lime based plaster mix was used. The execution was done in two layers, a base layer and an upper finishing layer.

In an effort to mitigate the danger imposed by water and humidity, the restoration team implemented a water drainage system for the site: one installed for the court, and another built all around the exterior of the mosque.

With regards to the roof, the preservationists found that the removal of the reinforced concrete structure that was built nearly 60 years ago might cause further damage to the mosque, especially to the vaulting under the gables. Hence they decided to keep that concrete structure, remove the vegetation that had grown through the years and fix the drainage system. A damp-proofing layer was added on top of the concrete roof, over which the roof tiles were reinstated. Initially all of the green tiles were removed, checked, when necessary replaced, and then reassembled again. About 30% of the tiles were replaced.

#### ***D. Origin of Technology, Materials, Labour Force, Professionals***

All the project personnel were Moroccan. It is possibly the first time in Morocco that a project with such significance and scale completely employed local capacities, whether in conducting the studies and analyses, or in the execution. Even when high technology 3-D laser scanning was used in the survey for recording the domes, the work was carried out by Moroccan specialists.

As for the restoration work itself, local materials and traditional techniques were used as much as possible.

### **V. Construction Schedule and Costs**

#### ***A. History of Project Design and Implementation***

The project was commissioned in September of 2004. The preparation of the study, analysis and planning for the interventions (design phase) was done between October 2004 and August 2005. The implementation took place between September 2005 and September 2007.

**B. *Total Costs and Main Source of Financing***

The total cost of the project for restoring the al-Qaraouiyine mosque and its Minbar al-Atiq was 31,200,000 million DHA (4,000,000 USD). The project was financed in its totality by the Ministry (Ministère des Habous et des Affaires Islamiques).

**C. *Comparative Costs, Qualitative Analysis of Costs***

When the overall cost of the project is compared with other projects of a similar size, extent of work done and number of professionals involved, it does not seem to be a huge amount of money. According to the architect who executed the project, another restoration project that he had implemented in Fez in 1998, covering an area of about 600m<sup>2</sup>, had a total cost of about 25 million DHA.

Conservation projects are usually quite complex, requiring a lot of scientific analysis, followed by very precise execution. To be noted is the fact that the restoration and rehabilitation of the mosque has improved its conditions for users and hence been of great significance and service to the community.

**D. *Maintenance Costs***

Preservation projects generally plan for conservation and maintenance work to be an ongoing process at the historic site. In the case of the al-Qaraouiyine mosque the Ministère des Habous et des Affaires Islamiques is able to allocate a budget to carry out building maintenance as required, but no specific allocation has yet been established.

**E. *Ongoing Costs and “Life Performance” of Building***

It seems that many of the ongoing costs are related to electricity. However, improved lighting was very necessary as teaching and reading takes place significantly inside the mosque.

**VI. *Technical Assessment***

**A. *Functional Assessment***

Upon completion of the restoration and rehabilitation project, the condition of the al-Qaraouiyine mosque has apparently improved. It seems to serve its functions well, as a place of prayer and as a place of teaching.

**B. *Climate Performance***

A new sound system was installed that ensures a homogeneous sound throughout the mosque during prayers or sermons. A specific design was chosen for the speakers so that they would not be overly conspicuous. They have a white-ish colour and a slender design, and, are attached externally to the pillars. The whole electrical wiring system was also changed and a new electricity room was set up. A technician was trained on-site to manage this system.

In the past, there had been complaints about the presence of insects that disturbed the users of the mosque. The project thus included pest control which is said to eliminate their presence for about ten years.

**C. *Response to Treatment of Water and Rainfall***

Water drainage is a major issue throughout the city of Fez. As I have previously mentioned, the restoration project included the setting up of a drainage system for the courtyard and the immediate surroundings. However, water remains an ongoing problem and its effects on the plaster of the pillars that are exposed to rainfall, for example, cannot be avoided. However, there are also some humidity issues related to the interior pillars which could reflect an underground water problem. In order to solve it, a holistic approach would probably be required for eliminating all problems arising from underground water drainage, one that addresses rising damp that is common across the city. Additionally, issues related to the adjacent buildings should also be resolved.

**D. *Choice of Materials, Level of Technology***

In line with conservation standards, the project mainly uses traditional and compatible materials and techniques for the conservation work. This includes traditional mortar mixes, fired brick, traditional tiling, etc. Where necessary, the structure has been reinforced, lighting improved, and a new drainage system implemented.

**E. *Response to, and Planning for, Emergency Situations***

Structural reinforcement of the foundations was found to be necessary in limited areas in order to provide resistance in the event of seismic activity.

**F. *Aging and Maintenance Problems***

As mentioned previously, the issue of humidity induced by capillary action or rainfall is recurrent. Therefore, continuous maintenance is necessary for the wall plaster. Additionally, it is necessary to remove all vegetation that grows on the roof as a result of rainfall. Other than that, the building seems to be kept in a relatively good state.

**G. *Impact of the Project on the Site***

The project complements the current movement in Fez to conserve and restore the ancient Medina. The nearby Medersa Attarin has been recently restored and attention is very much focused on conserving and presenting the area near al-Qaraouiyyine. It is hoped that a project for restoring the Medersa Mesbahiya will be initiated, since it is in a deteriorated state and has a negative impact on the al-Qaraouiyyine mosque. The upper floor of the medersa projects over the street that passes in front of it, and hence it is connected with the mosque at its upper level. Water seeping through the Medersa's roof and walls, causes an increase in the humidity of the walls of al-Qaraouiyyine, causing deterioration of the plaster surfaces.

## **H. *Durability and Long-term Viability of the Project***

It seems that the project has long term viability if monitoring and maintenance is carried out regularly. The restoration and rehabilitation of the mosque has ensured its sustainability as a place for learning in Fez.

## **I. *Interior Design and Furnishing***

The project included the restoration of al-Minbar al-Atiq (the old minbar) as part of its overall programme.

The restoration work on the minbar was carried out in situ. Prior to setting up a plan for the intervention, studies were conducted to assess its state of preservation. Three options for the conservation of the Minbar were considered: a) total restoration; b) transfer to a museum and replacement with a replica; or c) conducting conservation work, with minimal intervention, but assuring that its continuous use would not cause adverse effects. The last option was chosen and the old Minbar remains in-situ.

The minbar has its own room behind the qibla wall. When needed, the doorway of that room is opened and the minbar is rolled out along a rail and stands perpendicular to the qibla wall. A new rail was built for the minbar as part of the project (the original one has also been kept), and the wooden structure was reinforced. Other interventions included cleaning and carrying out minimum restoration work.

## **VII. Users**

### **A. *Description of those who Benefit from the Project***

Users are primarily Muslim men and women, who come to pray, learn, or to seek a quiet refuge from the bustling city. They are mainly from the local community in Fez, which has a low-income population. Other users include Muslims from Morocco and the rest of the world. Non-Muslims are generally not allowed entry to the mosque, as is the rule throughout Morocco, with the exception of the Mosque of Hassan II in Casablanca.

### **B. *Response to Project by Clients, Users, Community***

The client, namely the Ministère des Habous et des Affaires Islamiques is pleased with the project and the results achieved. The local community, including those who come to pray, to study or to teach feel that the mosque conditions have greatly improved and feel encouraged to visit the mosque more often.

## **VIII. Persons Involved**

The project, in its conceptualisation and execution, employed teams of professionals from Morocco without relying on foreign expertise. In that regard, the architectural firm, the

contractors, the specialised consultancy offices and the group of specialised craftsmen, were all Moroccan. Several of the professionals, craftsmen and labour were specifically from Fez. It seems that all of the parties involved worked as a harmonious coordinated team.

The Ministère des Habous et des Affaires Islamiques of Morocco, as represented by Abdelaziz Derouiche, was fully behind the project and was involved in all steps of the work. In the implementation of each phase of study and in the execution, professionals from within the country were consulted. Abdelaziz Touri was the general scientific consultant of the project.

The architectural firm of Mohammed Fikri Benabdallah, took over the consultancy work for preparing the studies, the planning and the supervision of the project. Alae Bouayad was the architect directly responsible for the project. The specialised office of Hassan Ameziane (CO.E.CO) was responsible for the overall material and structural studies, and CTIBA, represented by Mohamed el-Kortbi, was consulted for the studies carried out on the wooden features. The photogrammetry and survey were conducted by Salim Benmlih, technical director of GeoData. Testing and analysis was done by the laboratories SOCOTEC and L.P.E.E.

The contracting company chosen to execute the work was ABHAT, headed by Rachid Amrani. ABHAT, which was involved in all aspects of the building restoration work, had a team of highly specialised craftsmen in plaster, tile and wood conservation work. These craftsmen are Lehssen el-Yadri, Ahmed Azaki, Abdallah Assoudou, Moulay Ali Al-Ouadrhiri and Ahmed Boukhlakhel. Specialised contracting companies were hired for specific works: SORALEC for the lighting and electricity, SOFRATEV for the sound system, and SOTCOB for the minbar.

The expertise for the archaeological excavations was provided by the Ministry of Culture. The specialists who worked on the excavation included Ahmed Ettahiri, Abdeslam Zizouni and Montassir Laoukili.

## **IX. Bibliography**

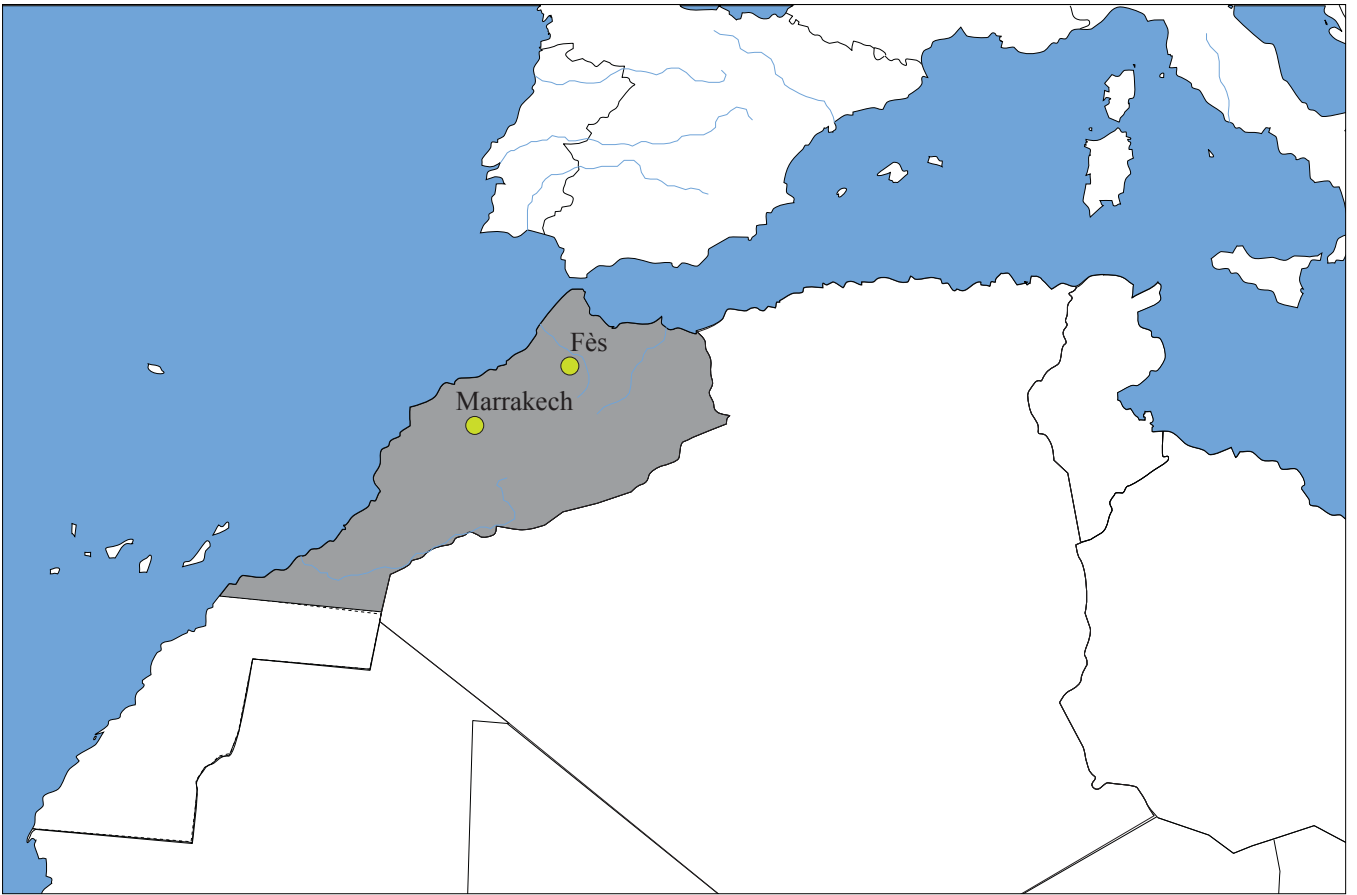
Vestiges archéologiques sous la mosquée Al Karawiyine. *AM Architecture du Maroc*: 103-106. September - October 2007.

Another article about the rehabilitation project was published in a specialised magazine; no print or copy of the article was available.

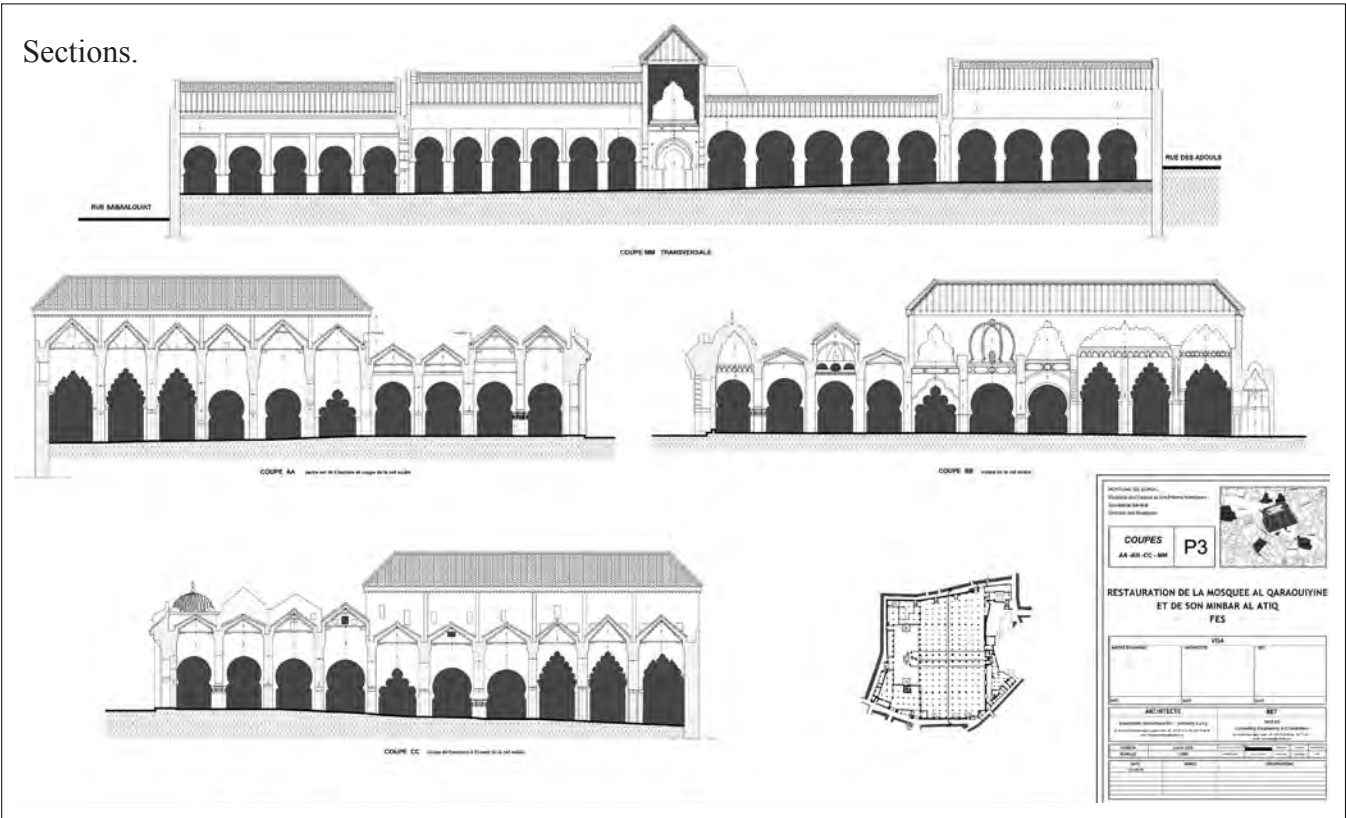
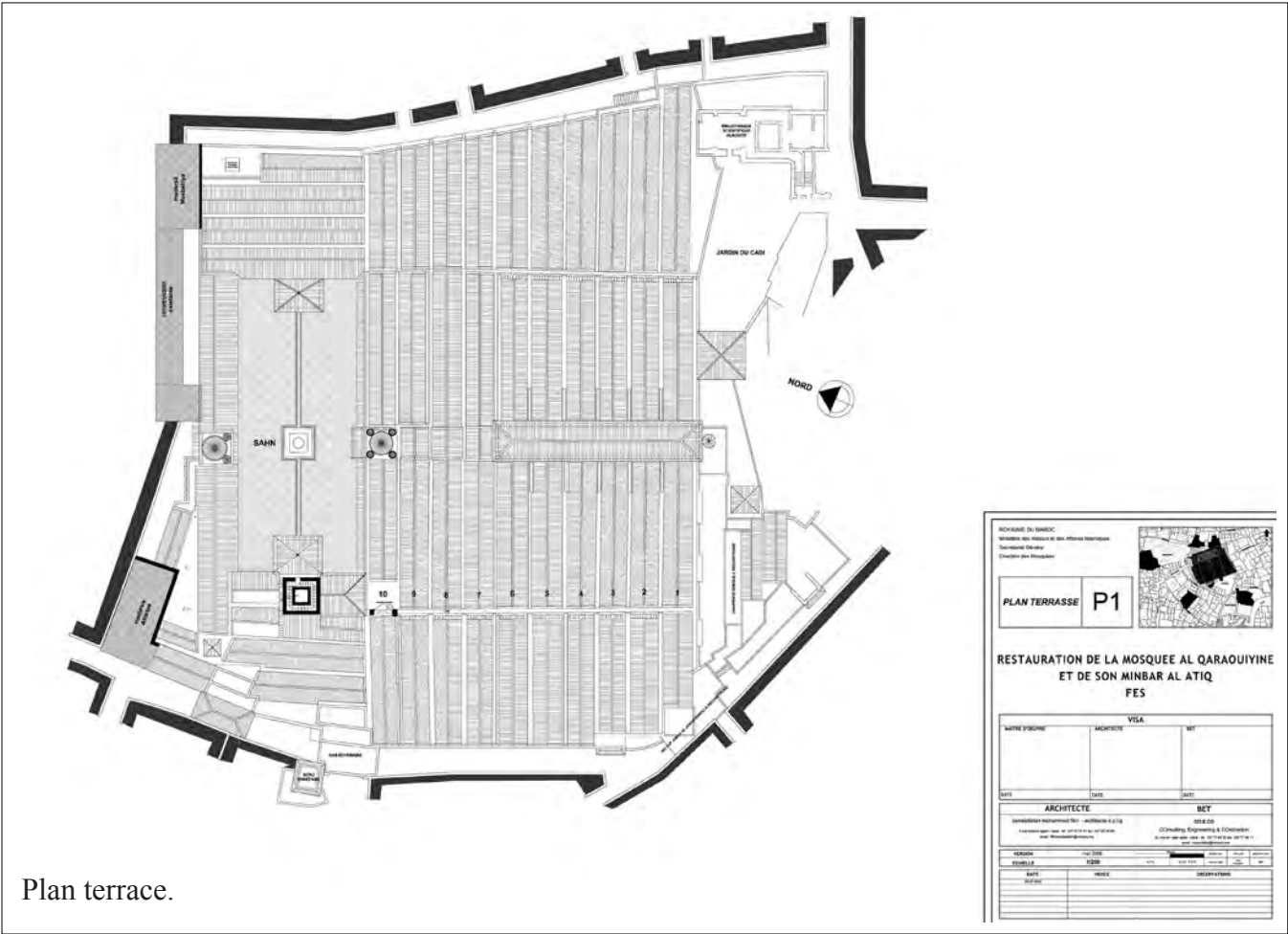
According to the Ministère des Habous et des Affaires Islamiques, there is an intention to publish a book about the rehabilitation project at al-Qaraouiyyine.

A short documentary film about the project was made in Arabic.











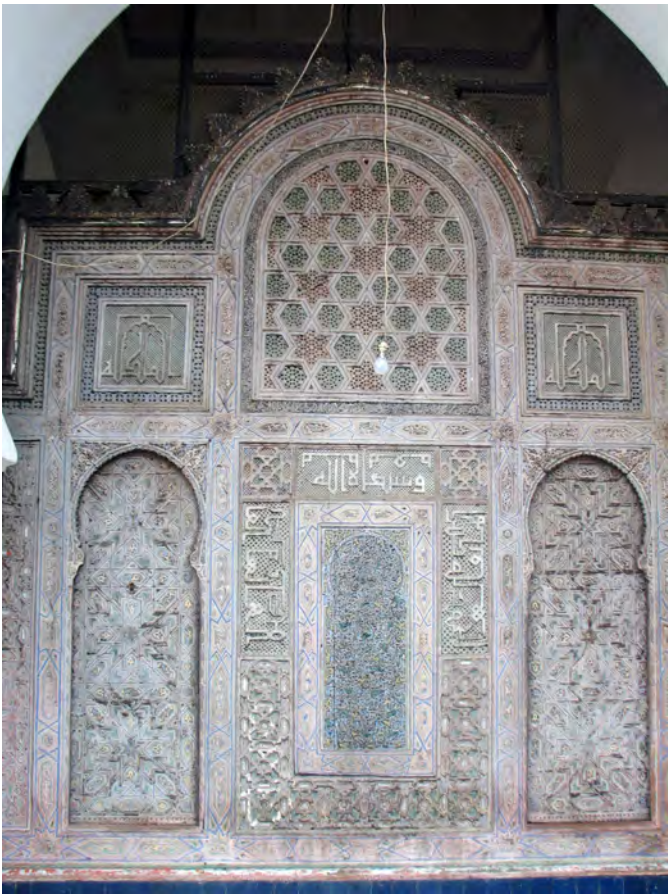


Renovated courtyard viewed from the roof.

Central fountain of the courtyard.







Before restoration.

After restoration.







Restoration work in the courtyard.

Details of the restored fountain in the courtyard.







Restored mihrab.

Wood ceiling and lamp, before and after restoration.







Restoration work in the prayer hall.

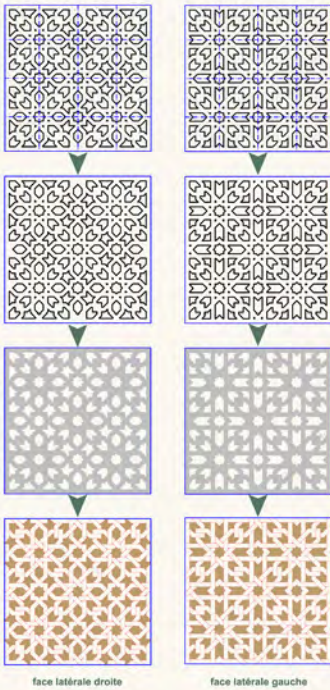
Restored prayer hall.



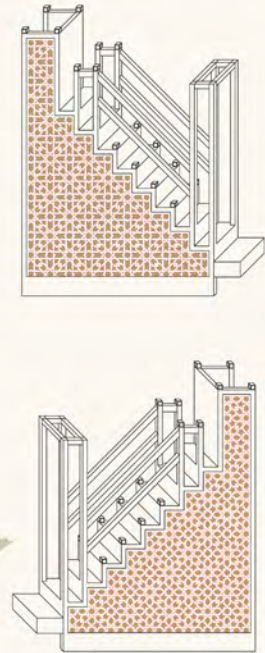




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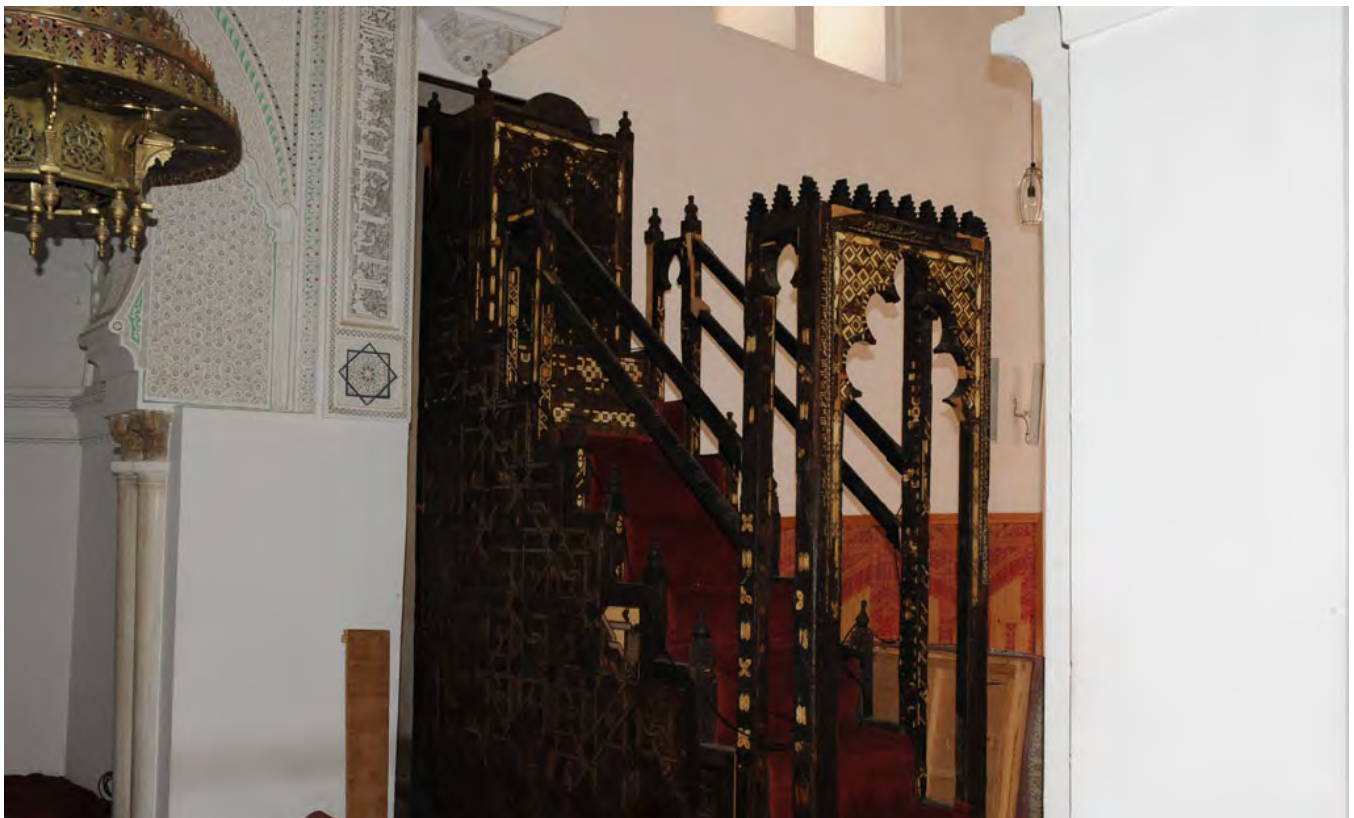
structure porteuse



Drawing of the minbar Al Atiq.

mohammed fikri benabdallah architecte

Minbar Al-Atiq after restoration.







Restoration of stuccos.

Stuccos after restoration.







Resoration of the entrance wooden canopy.

Restored wooden canopy.







Restoration of tiles on the roof.

View of the roof restored.



