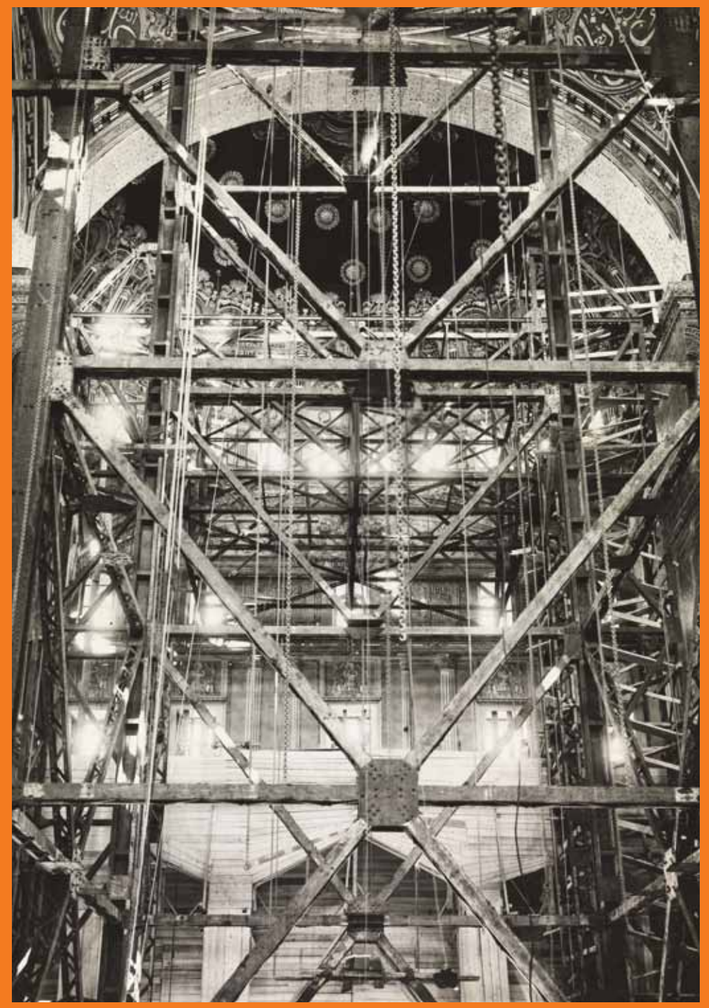
The restoration of the Muhammad Ali Mosque in Cairo, 1931-1938

Mercedes Volait



Muhammad Ali Mosque, Cairo: The interior scaffolding for restoration in the 1930s

Muhammad Ali Mosque, Cairo: Cracks at the top of the northern wall

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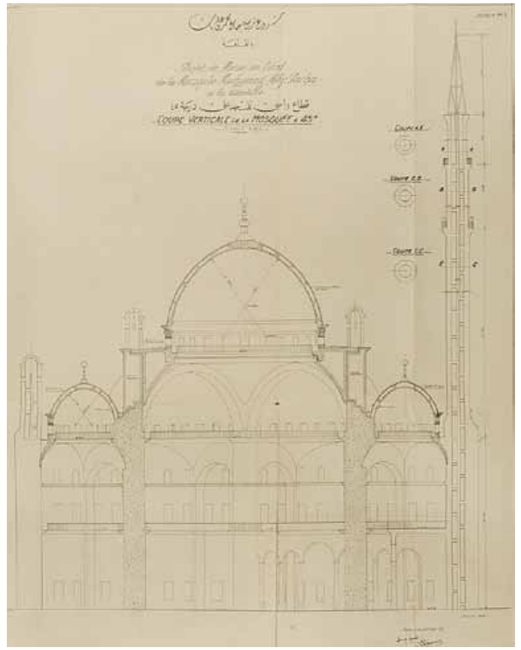
On the southern side of the Mediterranean, European construction companies were not only called upon for buildings, industrial constructions, public architecture, and modern dwellings. They were also invited to take on restoration, even reconstruction work on historic monuments. From the 1870s, steps were taken by local or colonial authorities to protect the ancient centers of the region's cities, while also carrying out modernization works. In Cairo, partial reconstructions, alignment setbacks, and even relocating historic buildings, were done from the end of the 19th century.[365] The Hennebique archives have retained a record in images of the reconstruction in reinforced concrete of the sepulchral mosque of Qalawun (1284) in 1904-1905, as well as the restitution of the barriers on the cap of the Sultan Hasan Mosque (1356-1362) in 1909.[366] We know that a competition for the construction of the Amr Ibn al-Ass mosque (827, numerous subsequent alterations) was launched in 1925.[367] One major project is now well documented thanks to a comparative analysis of the sources.[368] The "restoration" of the Muhammad Ali Mosque was carried out during the 1930s. Built a century earlier on the orders of the reigning sovereign, the building constitutes Cairo's principal monument in the Turkish style. Its prayer room is covered by a large central dome supported on four half-cupolas, themselves resting on four arches and pillars; the two minarets follow the slender template in use in Istanbul. The sovereign had been ambitious: the minarets reach 82m, the dome has a height at its summit of 52m, ten more than the Sultan Ahmet Mosque (1616), its model in Istanbul, and the wall cladding is made of alabaster. Oversized, the mosque showed signs of weakness from the end of the 19th century; an attempt was made then to reinforce the masonry of the pillars supporting the dome by lining them; iron rings were placed at the springing of the main arches.[369]

Law n° 8 of 1918 for the protection of monuments of Arab art expanded the perimeter of protection to all buildings earlier than the end of the reign of Muhammad Ali (1849). The mosque was therefore included on the list of protected structures (n° 503) and from then on entrusted to the Comité

de Conservation des Monuments de l'Art Arabe, the protection agency for historic monuments created in 1881, so that its maintenance could be supervised.[370] It was on this occasion that a detailed examination of the building took place, and revealed worrying deterioration. The mosque had cracks all over, some fissures appearing through the entire height of the building; others, located at the bases of pillars, were almost 10 cm wide. Urgent action was required.

On December 29, 1931 a technical commission was formed under the leadership of the architect Sayyid Metoualli Bey,[371] director of the technical service of the "Arab Monuments" department at the ministry of the *Waqf*. Its other members were Charles Andreae (1874-1964), a Swiss civil engineer

Muhammad Ali Mosque, Cairo:
Rehabilitation project (1933), vertical section of the mosque



who since 1928 had been director of the Cairo Polytechnic School,[372] three civil engineers from the Ministry for Public Works: Serge Leliavsky (1891-1963),[373] Ismaïl Omar Bey and Ahmed Fahmy Ibrahim Effendi, and an architect, Farag Amin, Inspector of the Royal Buildings. The commission had to carry out a detailed examination of the mosque's condition, issue an opinion on the causes of the defects it identified, and present suggestions for its restoration, even though nothing was known about how the building had been constructed, because any building plans that had ever existed had been lost. Surveys and excavations were carried out on the mosque's foundations. An analysis of the construction materials was commissioned. Calculations of strain were made[374] and indicators were put in place. Sixteen months later, in May 1933, examination cleared the foundations of responsibility for the deterioration. A chemical analysis by Ismaïl Omar showed that the cracks were caused not by the materials used for the domes (bricks and mortar), but by their support structure: arches, drums, pendentives, and pillars. A verticality check showed that the building was sagging towards the exterior; on the walls, the deformation equalled 10 cm for 11 m in height, while in the minarets, some 20 cm of deflection were measured. The calculation of average strain led to the conclusion that the building's structural mechanics suffered under the thrust from horizontal forces. By elimination, the Commission came to identify the structural reasons for the deformities and tearing as insufficient anchorage of the straps placed at the springing of the arches, as well as rust. The iron dowels, sealed in lead, binding the stones together, like the metal ring around the drum, revealed badly eroded areas. It also appeared that the building had been weakened by a past earthquake, the later explosion of a munitions store, and Cairo temperatures.[375]

From May 1932 to February 1933, the Commission worked on a reconstruction project. Two scenarios were studied: either rebuilding the entire lower part of the structure (the pillars) without touching the domes, or redoing the upper area (the domes) and the pillars. In both cases, the entire building would require interior scaffolding. The first solution was rejected after studying the cost of scaffolding capable of supporting the upper structure whose weight was estimated at 4,000 t (of which 1,750t for the central dome). For reconstructing the domes, the Commission recommended using reinforced concrete framework. Originally, they planned to fill in with bricks, like in the original construction; in the end, prefabricated slabs flashed with lead sheeting were used to roof the structure.[376] The decision was based on the conclusions of the very recent International Congress on the Conservation of Artistic and Historic Monuments which accepted "the principle of using modern materials for the reconstruction of ancient buildings."[377] There, the issue of raising the main monuments of the Acropolis of Athens by the process of anastylosis had also been discussed.

The half-cupolas and the small domes had to be constructed on the ground and then raised; the large dome was to be reconstructed in situ. The work was estimated at 60,000 Egyptian Pounds (EP), of which 50,000 EP was budgeted for the metal scaffolding to support the building during the works. The structure was delicate to install because it could not use any bearing points likely to weaken the mosque even more.

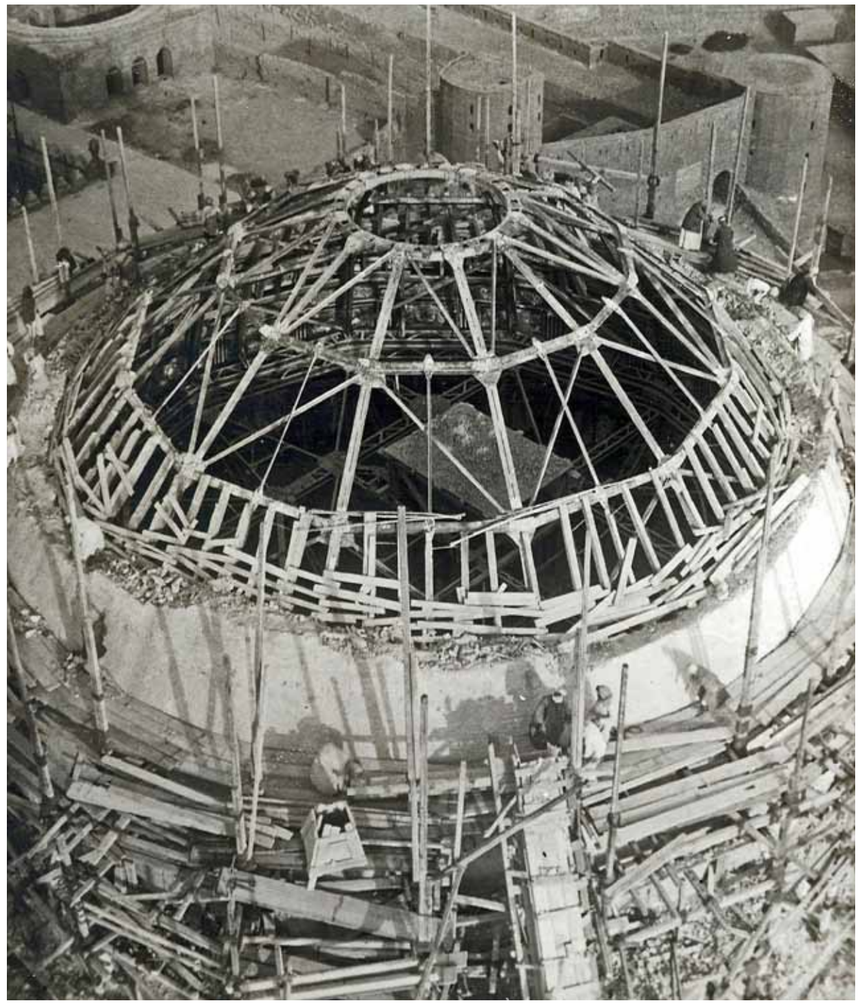
The work was put to tender in September 1933. Eleven contractors responded to the invitation.[378] With the help of its local agent, the Belgian Léon Rolin, Hennebique submitted a bid.[379] On December 27, 1933, the Commission endorsed the offer from the Swiss company, Rothpletz & Lienhard.[380] Andreae had already worked with both engineers, Ferdinand Rothpletz (1872-1949)[381] and Friedrich Lienhard (1873-1952); all three were graduates of the Federal Polytechnic Institute of Zurich. With 53,095 EP (including the installation of iron scaffolding for the entire mosque in one go), it was the lowest bid, ahead of the Italian company Garozzo (54,034 EP) and the *muallim* (master mason) Siyam Muhammad (54,061 EP).[382] The satisfaction of the Egyptian Ministry for Public Works with Rothpletz & Lienhard, in association with the companies Almagià (Italian) and Ruegg (Swiss),[383] on their first Egyptian worksite, the digging of the al-Ahaywa Tunnel in Middle Egypt, seems to have played a part.[384] Hennebique would subsequently admit to having incorrectly overestimated the cost of the metal scaffolding.[385]

The works were scheduled to be completed in 22 months, from March 1, 1934 to December 31, 1935. They lasted two months longer. The photographs of the worksite taken by the company and the report on the works made by Charles Andreae allow their progress to be followed.[386] The first stage was designing the scaffolding. It was completed and installed by March 1, 1935. Weighing 650 t, it was made by Goganian, a local locksmith company, from designs by two professors at the Cairo Polytechnic School, H. Schwyzer and I. El-Demerdash.[387] The central tower of the scaffolding was equipped with a lift for the workers (built by the Schindler company at Schlieren near Zurich) and a paternoster (a continuous caterpillar track supplied by the Swiss firm Oehler based at Aarau) to carry the concrete and the mortar. In parallel, the consolidation of the minarets with triangular slabs was done in July 1934. The coffering in wood for the large dome was prepared on the ground (September 6, 1934). Outside scaffolding was erected simultaneously; the demolition of the large dome in brick was begun in February 1935; the demolition works, pillars included, was finished in July 1935. The small domes were finished on December 24, 1935, the central dome on February 6, 1935, the half-cupolas a week later. The original covering in lead was returned to most of these; the large dome received new sheets of lead 3 mm thick. Some of the cut stone for the exterior casing was reused; the missing elements were replaced with imitation stone.

The project was managed locally by the architect Farag Amin Bey, Inspector of the Royal Buildings, Serge Leliavsky and Charles Andreae. They kept scrupulously to the allocated budget; the scaffolding (16,110 EP) and the reinforced concrete (21,260 EP) were the biggest expenses. An amount that was almost equivalent (40,000 EP) was spent on renewing the decoration, which Andreae considered

Muhammad Ali Mosque, Cairo:
Rehabilitation project leaders, c. 1935

Muhammad Ali Mosque, Cairo: Demolition of the great dome, February 1935



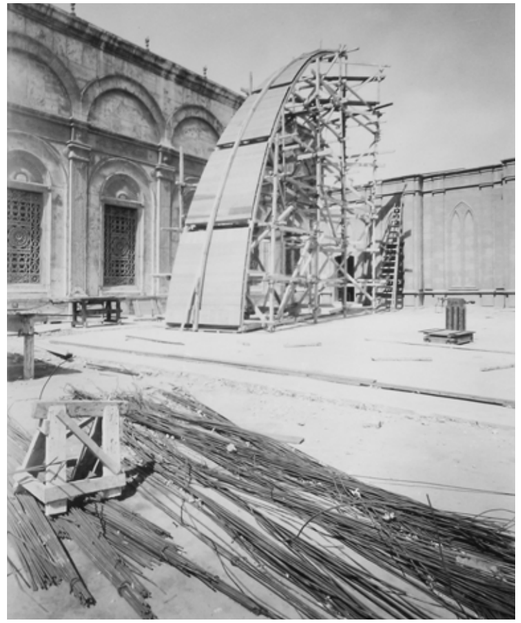
Muhammad Ali Mosque, Cairo: General view after dome demolition, July 1935

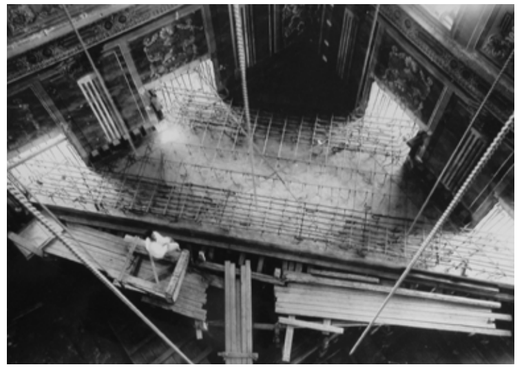
Muhammad Ali Mosque, Cairo: Installing the timber casing for the large reinforced concrete dome, autumn 1935

Installing the concrete tiles for the west half dome, January 1936

Muhammad Ali Mosque, Cairo:
Reinforcement of the concrete slab at the base of the northern minaret, August 1934

Plywood forms for a part of the great dome, September 1934





to be of much less value than the quality of the structure.[388] The Ministry of the *Waqf* had taken care to allocate 1,000 EP in 1934 to the Comité de Conservation des Monuments de l'Art Arabe for the execution of drawings in color, photographs and rubbings of the mosque's décor; plaster casts had also been taken.[389] At least the décors were recreated identically.

The mosque was renovated again in 1999, when the dome covering was redone, and the minarets were refaced.[390]

The restoration of the Muhammad Ali Mosque earned the company Rothpletz & Lienhard a similar project, the restoration of the Nilometer. The structure, serving to measure the ebb and flood of the Nile, dated from 861 and was located at the tip of Roda Island. The company made it permanently impermeable with complete casing in reinforced concrete. The sizing of the structure was calculated free of charge by Serge Leliavsky. Carried out in 1937-1938, these works were complemented in 1945 by the reconstruction of the Nilometer's cupola, a subject that had long been debated within the Comité de Conservation des Monuments de l'Art Arabe. Some advocated replicating the roofing the Nilometer might have had when it was erected in the 9th century, under Fatimid rule. Another wing of the committee was in favor of restoring the curious Seljuk-influenced pyramidal dome, probably built at the beginning of the Ottoman period. It had been surveyed quite accurately in 1737 by the Danish traveller Frederik Norden. The arguments of the latter group prevailed.[391]

These two projects are only the tip of the iceberg. In a region steeped in history, the sector involving the restoration of ancient monuments was undoubtedly much more important than we imagine today, but we lack of an overview on the subject. Let us hope that in the future, architectural historians will engage in the study of these projects. Reconstructions and relocations of historic buildings required as much ingenuity as than new construction. European engineers and builders were active in the field, and transferred know-how to local professionals.

Roda Island Nilometer, Cairo:
Restoration work in progress (1937-1938)