



## **PROBLEMS ISLAMIC MONUMENTS IN CAIRO FACE**

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### **Abstract**

A number of concerns arise upon studying the state of Islamic Monuments in Cairo. Among these concerns is the factors leading to their deterioration. Also how the deterioration is pronounced is of importance, since that would indicate what type of restoration would be required. Sources of damage range from physical problems such as ground water related issues to problems caused by lack of maintenance and inappropriate previous repair attempts. Several signs of deterioration exist such as structures with collapsed elements, cracks and decomposing stone or other materials. The paper attempts to highlight these types as well as their sources. To reduce the continuation of the decline of the health of Islamic monuments in Cairo the sources causing this decline must be minimized if not eliminated and repair attempts sensitive to previous mistakes and the history of the buildings must be utilized.

**Key Words** : Ground water, Islamic monuments, Old Cairo, Retrofit

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## 1 Introduction

There are many different problems that Islamic monuments face in Cairo today, some are physical and others are more subtle to notice. Attempts have been made to solve these problems. This paper describes the physical problems and the lack of maintenance that resulted in the fast deterioration of many Islamic monuments. The paper also describes potential problems.

## 2 Physical Problems

### 2.1 Ground Water

The rise in ground water is a factor that has been the most commonly found in Old Cairo today. Most historic structures were built at a time when the ground water level was much lower, as was the street level. Water has flooded many basements and ground floors of historic buildings in Old Cairo. Two notable examples are the Hanging Church where the water had covered the lower level that is composed of part of the fort of Babylon. A second example is Beit El Sinnari (a historic house) where the water had covered the ground floor hiding an entire fountain in the courtyard; many other historic houses experienced the same fate. As the water rises, it brings up salts to the stone walls and the porous stones absorb these salts. When the soluble salts come into contact with air they crystallize (often to a larger size than the pores) and can cause spalling or flaking. Not only is this water rising, but also, in many cases, it is mixed with sewage water. Figure 1 displays how this undesired water has flooded the floor of the bath of Al Mu'ayyad, which is one of many examples where this situation can be found. Naturally, sewage water is much more dangerous because along with it comes bacteria, fungi and chemicals such as chlorides, sulfates and nitrates. The Egyptian government is currently undergoing efforts to try to solve the sewage problem by rearranging the network.



*Figure 1 Sewage and garbage found in Hammam Al Mu'ayyad*

## **2.2 Pollution**

### **2.2.1 Dust**

The level of dust has increased over 60 percent in Cairo from 1962 to 1988 (Abo El-Ela 1995). Included in the dust are a lot of heavy metals coming from nearby factories. This dust has caused many of the structures to change in color to a grayish shade. Originally the structures are commonly of a cream or white color and some are even striped with the “ablaq” style (in some instances it is hard to spot the stripes due to the amount of dust covering the surface). Many repair projects are involved in cleaning such buildings. For example, a lot of the work done on Bab Zuwayla (an 11<sup>th</sup> century gate into Old Cairo) minarets were added in the 16<sup>th</sup> century by the ruler al Muayyid Sheikh) and the exterior of the El Azhar mosque was cleaning the surface from all the dust and exhaust which had caused its original yellow color to turn gray. Figure 2 shows how dramatic the difference is between the clean and un-cleaned minarets of al Muayyid on top of Bab Zuwayla.



*Figure 2 View of Bab Zuwayla showing the difference between clean and unclean surfaces.*

### **2.2.2 Exhaust**

Old Cairo is a very crowded area and many cars pass through bringing products and people as well as CO<sub>2</sub>, NO<sub>x</sub> and SO<sub>2</sub> all of which hinder the historic buildings. Again, the exhaust also brings in discoloration of the surfaces of the structures. It has only been four years since the Azhar mosque's surface was cleaned; yet it has turned darker in color again. The tunnel built under the Azhar Street (a main street through Islamic Cairo) helps to reduce the traffic thus lessen the problem.

### **2.2.3 Garbage**

There is no organized way of getting rid of the garbage in the Old Cairo. Instead, it is accumulating by and in many of the Islamic monuments and it is really a sad sight to see. In one of the old houses near the Citadel (that of Ahmed Kekhia) the garbage covers the entrance of the house. To enter one must literally dive into the rubbish and squeeze into the door only to find more garbage inside. Not only is the garbage ugly but it contains harmful chemicals.

### **3 Lack of Maintenance**

Lack of maintenance is a major problem that has resulted in the fast deterioration of many monuments. Many factors described below are contributing to lack of maintenance.

#### **3.1 Lack of Funding**

The Egyptian government has provided funding for some projects like the El Azhar mosque and the Hanging Church. Also, various Arab countries have provided funding. The Arab Fund organization funded the Beit El Suhaymi project (a 17th century home). Furthermore, there has been funding provided by the USAID and the Agha Khan organization. However there are many monuments that haven't been touched. For example, Beit el Sadat near the Ibn Tulun Mosque is in such a deteriorated state that its roof has collapsed and neighbors throw their rubbish in the courtyard, which in the past would have been a beautiful sitting area. Priorities and a limit of resources are the main reasons for this neglect of some buildings. Most historic buildings are supposed to be maintained according to the "waqfiyya", or deed, of each building, but in many cases the "Awqaf" (the Ministry of Endowment that now owns around 90% of the monuments) is too slow in providing the funding required. The "waqfiyya" of a building is a deed that usually describes the building and what should be done with it. In most cases, the writers of the deeds (the original owners) describe that the building should be maintained and left land or income generating projects to help fund such activities. The ministry responsible has not been active or organized in releasing such land left by the owners or up keeping any projects to aid with money.

#### **3.2 Lack of Understanding and Care**

If the people who live by historic buildings are not aware of their significance many problems can arise. It is common to find graffiti and garbage around, in and over historic houses, indicating an uncaring attitude towards the building. Thus, not only is there deterioration of aging but deterioration brought on by human beings. Awareness and understanding needs to be instilled with people in the surrounding areas of these structures. One method used in the Beit el Suhaymi project to promote awareness was to bring people of the area into the house and let them enjoy it. The neighboring children were allowed to come into the house and draw sketches of it. A healthy atmosphere was produced between the building and the neighbors. This way they might learn to care for the structure and then will, at least, stop adding to the problems.

#### **3.3 Lack of Awareness of Certain Monuments**

Some historic buildings exist that very few people know of so there is no high demand on maintaining, let alone, restoring them. If any of these structures were lost they would not resonate a strong reaction as would if more publicized buildings were. This does not mean that these unheard of structures are of an inferior architectural or historic nature. Examples of such non well-known structures is the Palace of Yashbak, which is a large multistory building with many collapsing elements. It has a number of fascinating Islamic architectural elements and inscriptions. Another example is a number of baths, such as that of Al Mu'ayyad Sheikh. These baths, though are simple, are a traditional building type in which people used to socialize. They are special because they shed light on people's activities in the past.

### **4 Inappropriate Repair Attempts**

#### **4.1 Speed**

Time is money and for a lot of construction companies there is no time to waste. However, speed usually means overlooking different factors and not having enough time to study different aspects which could make a difference in deciding what materials to use or which elements to start with. Any restoration activity is irreversible so much thought needs to be given to methods

used. Not enough time is given to studying the history of a certain structure. This is a much more delicate subject and it should be considered because the history tells a lot about how a structure was built. Which parts are original and which were later additions and why such additions were made and whether they are significant or not are learned by studying the history of the structure, both through literature and on site. The architects at Bab Zuwayla studied the towers well with all the history surrounding them. One thing they had read about helped them uncover some interesting finds. In the past there used to be a ramp under the towers that carts would pass under. One Mameluk ruler of Egypt was passing under the towers and his carriage flipped. He immediately ordered that the street should be leveled. The architects gathered that there could be more of the tower under the street that presently exists and they did in fact dig and found three hidden meters buried along with coins and pottery. Besides studying the history of a structure, it is important to study similar structures with similar problems to help gathering clues on common mistakes and deterioration patterns. Furthermore, it is beneficial to find if some elements worked and some didn't and how to improve on the repair if there were previous ones performed.

## **4.2 Use of Inappropriate Materials**

**Concrete-** The use of concrete or cement on stone in general creates undesirable outcomes. Portland cement is composed of aluminum silicates, calcium sulfate and alkaline salts. These chemicals penetrate into the stones creating discoloration, efflorescence and salt crystallization stresses. Furthermore, using cement mortar can create a bond that is stronger than the stones themselves causing the stone to crack first in case of stresses. The two materials (ie. cement mortar and stone) can react differently to heat and moisture creating imbalanced expansion or contraction.

**Steel-** Steel introduces the problem of corrosion. This corrosion naturally changes the color of the material around it. Also, steel can cause stresses instead of trying to help carry them especially as it expands upon corrosion.

**Coatings** - Coating stone surfaces closes up the pores that allow the stones to breath and let out moisture. Applying paint can render a new look instead of a preserved old one. In the Khayamaya market in front of Bab Zuwayla the stores were all coated with a new paint that made the historic market look modern. This is not a desirable outcome. On the other hand, the preservationists in Beit el Sinnari used the same paint used in the past to reapply paint where it was missing. They employed careful means of cleaning painted surfaces so the painted regions maintained an authentic appearance.

## **4.3 Inappropriate Techniques**

### **4.3.1 Sand Blasting**

This technique has the disadvantage of scouring away at the exposed layer of stone. It is not a gentle method that rids the stone of unwanted dust because it goes beyond cleaning the dust and scratches the stone itself. Therefore, part of the stone gets blasted away.

### **4.3.2 Replacing Before Repairing**

It is always easier to remove and replace. However, this is done at the cost of authenticity and history.

### **4.3.3 Repetitiveness**

Not one repair technique should be used for all structures. Some are more slender than others. Some have thicker or thinner wall. Some are older than others. One technique that has been used blindly in Cairo is the micropiling technique. It was used in the mosques of El Azhar, El Ghuri and the Hanging Church as well as in other sites to aid the existing foundations. The idea of these micropiles is to transfer load from the walls to the ground. However, in many cases the historic foundation walls are already thick enough to support themselves and have already survived throughout the centuries. For example, the foundation walls of the Hanging Church are

2m thick so are strong enough to carry themselves and the structure on top. Also, the piles can eventually cause instability due to eccentricities.

#### **4.3.4 Lack of Studying Available Documentation**

Studying documentation of the past is important as is documenting the present activities to aid future projects. In some cases, looking at documentation from the past is neglected. Old plans, diagrams and sources help indicate information on the structural system of the historic building. They also give clues on the building's original appearance and special features to look out for. Reading about a certain structure helps the restorers understand and appreciate the building. This appreciation is crucial to ensure the utmost care is given. It needs patience to deal with these delicate historic structures so a pleasant relationship must be developed with it and this can only be gained by becoming more familiar with these structures. If a person goes to a doctor the doctor must know what type of medical history the patient has (previous operations, allergies, medicine taken before) because this affects his decision on how to treat a person. The same applies with our patient- the historic building.

#### **4.3.5 Lack of Providing Documentation**

Lack of documentation makes it hard for future restorers to track where present ones made mistakes or where certain additions were not original. Documentation involves providing photographs, detailed drawings and condition surveys. Besides being a future reference, carrying out the documentation process creates a whole new familiarity with historic buildings.

**Unclear plan-** Many of the Islamic historic buildings have an unclear plan due to many additions and alterations over the centuries. These additions complicate the matter because leave a lot of the buildings with a wall layout that is not uniform. Some walls can be thicker than others and there could be an increase in the concentration of walls on one side as compared to another. This can create a decrease in the torsional resistance of the building (Drysdale et al 1999) and can cause differential settlement.

**Infringing structures-** This is a problem found in many of the Islamic monuments in Cairo. Foundations and ground floor walls were commonly recycled as the foundations for a newer structure. For example Beit el Suhaymi is built on stonewalls belonging to older structures. More modern buildings can also be found resting on parts of historic structures throughout the Old Cairo area. The Citadel itself is a fine example of this exercise. Parts of old palaces have been found under the mosques and buildings that exist on the citadel today. Bab Zuwayla (Figure 3) is the base of the two minarets belonging to the Al Mu'ayyad Sheikh Mosque. Bab Zuwayla was built in 1092 AD whereas the minarets were built around 1415 AD. Having one structure over another complicates the matter when one considers if both are to be restored or if one is to be sacrificed. Also, it creates the problem of having to deal with two systems of building instead of just one. The stability of the monument must be considered in such a case. A lot of times infringing structures are not historic themselves and actually cause a high amount of damage. For example, the Ayyubid wall that once enclosed old Cairo has buildings on top or adjacent to it and, in many cases, these buildings suffer from drainage problems and a lot of the moisture ends up affecting the wall.

## **5 Damage Encountered**

Following the 1992 Earthquake, the Egyptian Antiquities Organization made a list of damages reported in Islamic and Coptic Monuments in Cairo. Many cracks were reported as well as the collapse of the upper parts of several minarets. Other indications of damage appear on many of the monuments, but they are not all due to the earthquake.

## 5.1 Collapsed Elements

Elements such as domes, slabs, roofs, minarets and top bulb of minarets have been collapsed. The mausoleum of El Ghuri and the Hammam of Al Mu'ayyad (Figure 3) are both examples of structures where domes have collapsed. Other parts of buildings like minarets and slabs have also collapsed and, in some cases, repair attempts have replaced them with inappropriate newer ones. For example, in some cases, the missing dome was replaced with a new concrete one. The Qalawun Mausoleum is an example of this approach.



*Figure 3 Dome of Hammam Al Mu'ayyad no longer exists*

## 5.2 Cracks

Cracks can be classified based on width, activity (active versus dormant) and orientation. Cracks found range from vertical to stepped cracks. These cracks can be found where there are openings, see Figure 4. Diagonal cracks can also be observed in piers around openings. The cracks in stone buildings are different than those in buildings primarily composed of brick. In stone structures the cracks tend to propagate through mortar joints causing separation of stones. Being a brittle material, stone masonry cracks when tensile stresses due to loads and/or differential movement exceeds the material's tensile strength (Drysdale et al 1999). Cracking may or may not have a significance on the structural integrity of the structure depending on wall boundary conditions at the supports and the degree of indeterminacy (Drysdale et al 1999).

### 5.2 Separation of Elements

Separation of elements such as minarets from rest of the mosque structure has been observed (Figure 5). Minarets are the most common of elements to separate because they have a different shape and mass distribution than the rest of the structure. Figure 6 shows the minaret of the Amir Mithqal Mosque separating from the rest of the building. There is no bond between them since the stones are not teathed together. Therefore the minaret is creating for itself a separate movement joint which is not disastrous if controlled.

### 5.3 Decomposition of Mortar and Stones

Most Islamic monuments are built of limestone. With rising underground water discoloration of the stones occur as well as further decomposition. Deterioration of the stone can range from flaking to spalling to delamination. The loss of mortar in the mortar joints is another factor that can be found. The Mausoleum of Sultan Abu Said (located in the cemetery area) is an example that displays all of these problems.





*Figure 4 Madrasa of Amir Mithqal (vertical crack propagating through openings)*



*Figure 5 Crack between minaret and mosque*



*Figure 6 Display of deterioration of stone in Mausoleum of Abu Said*

#### **5.4 Rotting of Wooden Elements**

In many cases ceilings of Islamic monuments were constructed of wood. With increasing humidity and moisture wood is affected. Deterioration in the form of staining ( Figure 7), delamination and cracking are observed. A lot of times rotting occurs especially at the end of wooden beams which rest on masonry affected by moisture or are under wet areas such as roofs or bathrooms.



### 5.5 Excessive Deflection

Excessive Deflections of walls, slabs and beams have been encountered. Deflection is usually a problem related to wooden floor or roof elements such as beams. It could be due to overloading or creep along with material weakening, perhaps due to moisture.

### 5.6 Missing Elements

Missing elements vary from fountains and other various finishes, missing windows and grilles. Figure 8 is a photograph of Wekalat Qaitbay and it is missing many of its window grilles.



Figure 7 Wooden ceiling belonging to the Mausoleum of Sinan



Figure 8 Wekala of Qaitbay

## 6 Future Problems

### 6.1 Earthquakes

The possibility of encountering an earthquake in the near future is frightening and is a threat that must be protected against. The coming on of an earthquake can cause the collapse of more elements and widening of cracks in certain structures. Earthquakes pose large lateral forces that can cause overturning of structural elements such as walls and columns and tall structures like minarets. The monuments that are deteriorating rapidly without even being aided with temporary bracing face a greater danger of collapse.

### 6.2 Advancement of Deterioration

Lack of maintenance and continual existence of sources of pollution can only increase the deterioration process. Priority will decide which buildings are to be preserved before others. Therefore, those left unpreserved will only continue to disintegrate. Furthermore if the sources of problems are not dealt with, even restored buildings will continue to deteriorate. Such sources are sewage, pollution and mistreatment.

### 6.3 Continuous Mistreatment of Monuments

Monuments left unprotected will continue to be dumped on. Buildings in better conditions will be continued to be built on, thus, ruining its structural characteristics and appearance forever.

### 6.4 Lack of Finding Proper Use

If recently restored buildings are not put to a proper, healthy use they will eventually start deteriorating again. No use means no maintenance and no appreciation of the building since it serves no practical function. At the same time, if the building is used in the wrong way, it would also be harmful.

## **7 Closure**

It only takes a visual inspection to notice many of the damage types existing in historic Islamic monuments in Cairo. In other words, it is very easy to spot the deterioration that is occurring in these buildings. This deterioration is an ongoing phenomenon. It is dangerous not to address the sources of this problem. Developing guidelines for the restoration of such structures should involve studying ways to eliminate the sources of deterioration as well as ways to remedy the damage already there, while at the same time, taking into account not repeating certain previous mistakes.

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