

The computing tools to assist with the restitution of a heritage building.

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Abstract — Nowadays when we reconstitute a heritage realization it doesn't mean that we will reconstitute only its formal shape or its spatial organization, but it is also used as an activation element of student curiosity, scientist, or interested

This article tackles the particular question of the computing tools applied to the heritage domain. It concerns the presentation of the results obtained during the restitution of an extension of the great mosque of Algiers. This extension is called the "mahkama" or "court house" which is a nearest part of the original great mosque. This restitution has been done in a pedagogic environment with post-graduated students in architecture.

To make the restitution, three important phases have been done. The first one concerns the construction and the definition of the monography and the historical part of the building. The second one concerns the architectural survey with different tools as the theodolite, photographic images. And the third one concerns the 3D laser survey. This part has been done in association with the student of the ENSA of Paris La Villette.

Index Terms— digital restitution, heritage realisations, photomodelling,

1 INTRODUCTION :

Several studies have shown that the restitution process is very important to capitalise and transmit knowledge in several domains such as the scientific domain, pedagogic field or even in the tourist way.

The work presented in this paper has been done in a pedagogic environment with post-graduated students of the LVAP laboratory of the EPAU. Students made surveys and a monography of a building belonging to the Algerian heritage. The objective of the work was to allow students to discover and to be familiarized with the tools. This work has been done during a university year and starts with a monograph and a historical study of the reconstituted building.

To reconstitute the building several tools of 3D modeling and rendering have been used.

This paper is structured in two main parts. The first part concerns the historical study to present the heritage particular character of the reconstituted building. The second one concerns the presentation of the various tools used to reconstitute the chosen building.

2. Geographic situation [5]:

The great mosque of Algiers is situated in the lower Casbah (Figure 1). The casbah usually called « El Kasbah » in Arabic « la citadelle » in French and was added to the world heritage list of the Unesco since 1992. The original city was built by Bologhine Ibn Ziri over the structural failure of the Roman city called "Icosium".

It is situated in the Beni Mezghena area. The original name of the city given by Bologhine was because of the small islands faced the coast of the Algiers city at that time and they were linked to the city to constitute its actual jetty [4]. The "Algiers" means group of small islands "djozor" in Arabic.

The casbah is situated in a sloped site oriented toward the sea and is divided into two parts.

The "lower casbah" is situated between the sea coast and the bab el oued – bab azzoun road.

The "upper casbah" situated between the bab el oued – bab azzoun axe and the "citadelle". The upper part was bordered by "ramparts". Nowadays these ramparts were changed as roads.

The lower part of the Casbah undergoes the most important changes during the various historical periods and their modifications especially the French period. The most important military opening (Haussmann principles) were edified in this part of the Kasbah [2].

Such as the expansion of the circulation roads and the edification of places such as the "matyrs" place and the high-rise block of Socard. Nevertheless the lower Casbah kept some of the oldest realisations which stay particular witnesses of their period.

The great Algiers mosque and its dependences belong to these kinds of realisations.



Figure 1 : Actual location of the great algiers mosque

3. PART 01 ; THE RESTITUTED REALISATION :

As written before, the great Algiers mosque is one of the most important building of the lower Casbah. We will focus on the “Mahkama” or “Dar El Kadi” which is a small space used to make and apply the public justice at that time.

In general the studies and research works related to the lower casbah studied the great mosque but the mahkama which is an appended building to the mosque was not studied. For this we chose to reconstitute it because it is an important part of the mosque from a spatial and a social point of view.

The historic presentation that will followed will be divided in two parts. The first one concerns the presentation of the great mosque and in the second part we will present the mahkama.

3.1 The great mosque :

The great mosque was built by the Almoravide «Youssef Ibn Tachfin». the minaret or the prayer tower was built by the zianide sultan abu Tashfin in 1324 [1].



Figure 2 : The pecherie mosque and the great mosque 1836

The historic studies reveal that the justice cases were studied in this place but the results and the verdict were known in the great mosque space.

At that time most several mosque possess a “court house” part where justice cases were treated. The size and the location of the court house was depended of the size of the mosque.

So the Mahkama is an appended building to the Algiers great mosque which is one of the oldest mosque in Algiers city.

The prying room, without central dome, is “hypostyle”. The columns are linked by big arcs. The “mihrab” is decorated by columns and ceramics. The minaret is

A handle with three-brass balls with decreasing thickness overcomes the minaret. The outside gallery is not original and was added in the French period. More precisely it was added in 1836. Its marble columns (Figure 3) including floral motives are from the Sayida mosque which was located in the matyrs place. The roof of the great mosque was recovered with red tiles [8].

It is constructed with stones, bricks and wood. The decorative inside was made by ceramic and wood.



Figure 3 : Some view of the great mosque and its Mahkama

The great mosque is situated in the « La marine » (Figure 3) street and is the oldest mosque in Algiers. Its constitute with the Great mosque of tlemcen and the great mosque of Nedroma the only witness of the Almoravides dynasty today.

The building is in rectangular shape and is covered by a double roof cover with tiles as all the almoravides mosque.

We access inside the building by a portico oriented given to three entrances in the wall oriented toward the north direction. The courtyard is surrounded with porticoes which some of them constitute the extension of the nef of the prying room.

The prying room possesses sideways entrances and is divided in eleven perpendicular naves to the qibla wall in five bays.

The multilobes arcs are parallel to the mihrab and constitute sequences with moorish arch which are perpendicular and are based on rectangular and cross pillars.

The construction of the great mosque happens approximatively to the Ziride period eleventh century

because over its minbar is written 1096. After that the great mosque knows several modifications but keeps the spatial organization and the structural elements from the Almoravide period shared with the tlemcen mosque and the Nedroma mosque.

The stratigraphic studies of the great mosque shown important phases :

- Medieval phase
- Ottoman phase
- French phase
- Modern phase

3.2 The Mahkama :

When we combine the differents historic documents founded in studies about the great mosque and the mahkama, the initial restitution have been done. According to the founded information, the students restitute the map and the elevations of the various period and the modifications that happens in the mahkama.

We do not possesse a lot of documentations about the Mahkama, then we supposed that the mahkama have been construced during the Ottomane period. Because in the map drawing by Albert Devoulx [6], were the great mosque was also represented, the military modifications are represented, it was in 1838.

These modifications concerns the alignment lengthwise the marine road and then the modifications in the mahkama (Figure 4) [7].

So from this map, students suggested the main hypothesis that allow us to reconstitute the main room of the mahkama (Figure 4). These hypothesis concerns the composition in three parts of opening rooms to constitute a whole group of spaces.

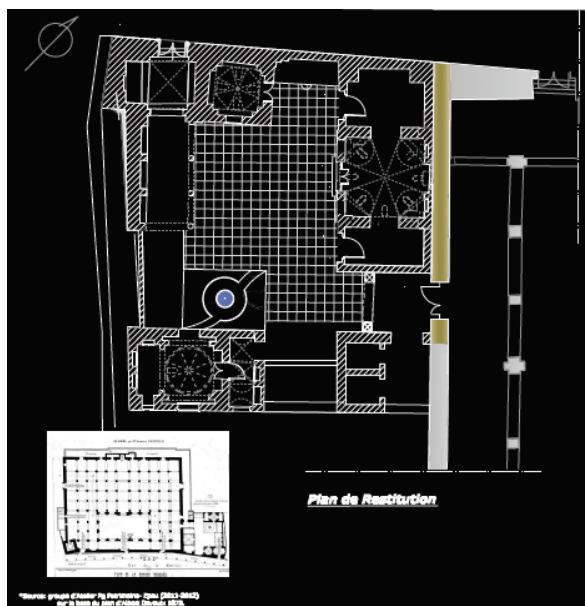


Figure 4 : Mahkama's map

4. PART02 ; THE TOOLS USED TO THE RESTITUTION

We decided to restitute the building as he exist (Figure 5). We choose this way because the main original building is still exist. Their have been some modifications but their was not fondamentory changes when we compare them with the original building. And it was very difficult to restitute and to identify the various steps of the modifications that happens in the mahkama because there was not a lot of documentation about the building rather than the great mosque.

The restitution happened in several steps ;

4.1 Step 1 ; the manual survey

In this step several tools have been used.

The range-finder or remote rendering with laser pointer, the theodolite and the decameter.

The decameter ; we use it as a measure tape, it allow student to make a survey of the building with traditional method. It allow us also to calibrate the distometre (range finder) to check the first recovered measures.

The theodolite; this tool allow us to recover some difficult measures more specifically the measures of elements situated in the upper parts of the building.

The range-finder : allow student to recover distances quickly.

All these tools allow students to restitute the building at the beginning in 2Dimensions. Students restituted a general and a global view of the building and identified the limits of the building.

But most of these measures were kept inside the building or outside the building. To recover the outside measures of the building we used other technics such as the photomodelling.

4.2 Step 2 ; the photomodelling [3]:

This technic allow us to make two things;

- The first one was to complement the measures recovered with the decametre and the distometre. We completed the measures by using the photogrammetry principles to recover the distances. For example we recovered the measures of the prying tour from photographic images. We recovered distances after the calibration of the relevant points, the calibration of the distances and the angles (Figure 7).
- The second one was to restitute from photographic images by extracting textures from photos and by modeling the building in 3 dimensions.

We just have to remember that the building is situated in a urban area, and it was difficult to keep some measures because of cars, people, ...

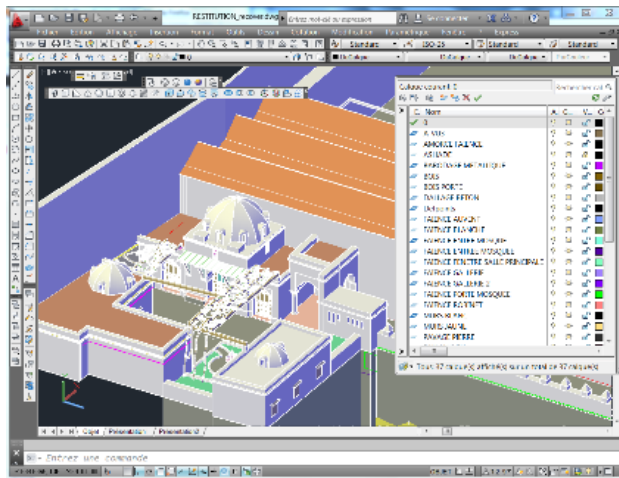


Figure 5 : The mahkama 3D restitution (student B.M horra's work)



Figure 6 : Some illustration of the 3D model restitution.

The extraction of textures (Figure 6) and the possibility of treating textures with specific softwares. When we extracted textures, we treated them with specific softwares of image editor to make orthophotos for texturing the 3D model (Figure 5) and (Figure 6).

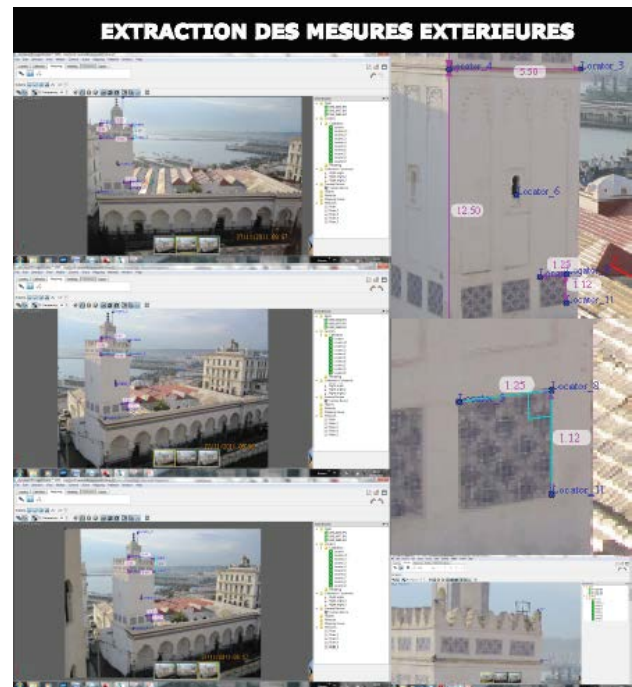


Figure 7 : The measures extracting process

The photomodelling technic allow us also to recover some measurements information about ;

- the cracks appearing in walls after an earthquake, specifically when the construction is very weak or unstable.
- the additives constructions added over the existing houses and which are not accessible because of their illegal statement.

4.3 Step 3 ; the 3D laser measurement :

This part have been done with students of the ENSA of Paris La Villette with the laser Leica. This step was done outside and inside the building (Figure 8).

The steps followed were;

- First to put some target points to be able to recognize the differents angle of view of the cloud points,
- Second, to clamp and group the differents points cloud that were taken.
- Third, to erase the none relevant points
- Fourth, to construct the model by basing on the cloud point
- Five, add textures to the 3D model.

Than the more difficult parts concerns each view with some dropped parts.

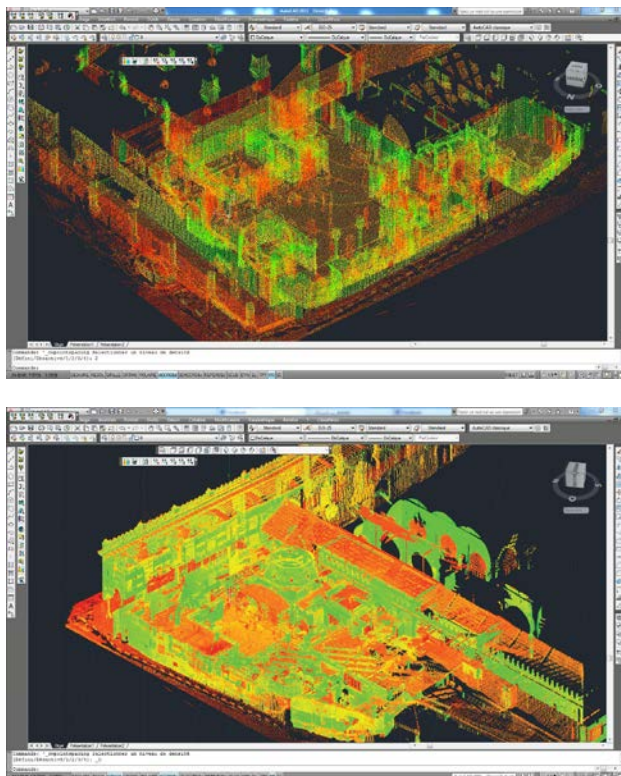


Figure 8 : Cloud point of the mahkama with the Leica 3D laser

5. CONCLUSION :

In this paper we presented the different steps used to reconstitute the mahkama of the great mosque of the Algiers city. This reconstitution has been done by a student having an architecture diploma and is still in a progress formation to be specialised in heritage conservation management and the protection of the heritage architectural realizations of the EPAU LVAP laboratory.

This pedagogic environment was shared with students from ENSA of Paris La Villette for the 3D laser survey tool.

Then several tools have been used to reconstitute the building. Each tool allows students to recover a specific kind of measures. All these tools are complementary to have a complete and a global restitution.

Other restitutions of heritage buildings will be done in a pedagogic environment. These restitutions will be included in a database to constitute references for scientific or general people reaching about Algiers building heritage information.

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