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Documenting Earthen Architecture

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Introduction

The Kasbah of Taourirt is one of several major earthen complexes along the former caravan route between the Sahara dessert and the city of Marrakech in Southern Morocco. It is located in the city of Ouarzazate, situated about an hour away from Marrakech. It was built in the 16th century by the Glaoui family, who dominated the Southern Atlas Region. During its peak of importance in the mid-19th century, the Kasbah of Taourirt held a strategically important location in order to control the Saharan Caravan Route to West Africa. After the French domination in the region, when the Glaoui lost their dominance over the region in 1930s, settlers and squatters started occupying the site and used it for housing purposes and artisan shops until 2010. Although part of the site of Taourirt is restored and functioning as a museum, the site is in various degrees of ruin.

The documentation of this historic site was undertaken by the Carleton Immersive Media Studio (CIMS) for the Getty Conservation Institute (GCI) as part of their Earthen Architecture Initiative, which aims to develop a rehabilitation approach of earthen architecture settlements using the Kasbah of Taourirt as a case study.

Setting up the network (traverse)

Prior to the start of the documentation, we established a survey network to allow both our production teams to capture the data in a common coordinate system at the moment that it is captured. Once that was established, the survey was carried out by dividing the areas of the Kasbah.

The first step in the documentation process was to select the appropriate tools and methods to obtain the information needed to create the site atlas, which includes floor plans, elevations, and sections. Main considerations in the decision making process were: the time available, the technology and skills that are available to the local management team, as well as the complexity of the site. The team decided to use a 'total station' and photogrammetry technologies for the recording.

A total station is an electronic instrument used in modern surveying. It sends an infrared wavelength to an object or a target, and measures the time it takes to bounce back to calculate the distance. Since we had the survey network established in and around the site, we started recording by identifying the location of the room or the area we were in on the survey network.

Once that was established, the room was drawn using the total station. You can think of the total station as a giant mouse, connected to a tablet PC, loaded with CAD. Using the total station, we drew the walls, stairs, grades, openings and built-in furniture directly on CAD.

This process was repeated each time we moved the total station to a different room or location. Each drawn area was grouped together and then tied back to the main survey network.

Major benefits of the total station for this project were the speed, time and the ability to measure over long distances. The learning curve is not steep and only minimal training is required. It also allowed us to digitize our data directly on site. At the end of the fieldwork period, the data collected by the two production teams were combined in CAD. This is what we found.

Photogrammetry

Photo =light, -gram =drawing, -metry= measurement

Photogrammetry is the practice of determining the geometric nature of an object from photography. The art of photogrammetry is as old as modern photography, dating back to the 19th century. The basic concept is that the distance between two points that lie on a plane parallel to the photographic image can be determined by measuring their distance on the image. The scale of the image must be known. The products of photogrammetry are generally maps, architectural drawings, measurements and 3d models.

In our case we used photogrammetry to create digital meshes and cut lines that were used to produce plans, sections and elevations. Close range photography was used with a handheld camera.

Data Collection:

- At least 3 x,y,z data points measured by electronic distance meter (EDM) in the room, preferably at different heights
- A "ring" of photographs taken in every part of room with 60 - 80% overlap
- Optimal height of photos midway up the subject matter
- Fixed optics, i.e. no zooming
- Consistency in illumination and height
- Floor and ceiling photos required in order to create a complete mesh, f
- Point numbers in order to locate them later in the modeling process
- More photos and points better than not enough

Limitations:

- Size of the room must be large enough to accommodate the photography
- Materiality must have texture and surface cannot be reflective

Panoramic Photos

A set of spherical panoramic photographs was prepared from specific locations throughout the site for future reference. These images were prepared by stitching 8 overlapping images for coverage of 360 degrees of the captured scene. This included 6 horizontal, one at the top, and one for the bottom.

Conclusion

This contribution provides a comprehensive approach that is based on developing 'the how' according to the 'why' and 'when' in heritage recording. The 'how' relates to the integration of surveying techniques to capture the geometric configuration of the Kasbah, the 'why' relates to the purpose of the records, in this case for conservation, and the 'when' relates to the requirements of the ultimate beneficiaries of this information, the Moroccan partners.

Although there is a vast array of digital techniques of heritage recording that facilitate the capture of historic places quickly and accurately using active (e.g. 3D Scanning, Total Stations, etc.) and passive sensors (e.g. photogrammetry, rectified photography, etc.), it is important to evaluate the required final set of deliverables, the time frame and the level of expertise available. Heritage documentation projects should not undermine the ultimate goal of producing an accurate diagnosis of the fabric required to extend their life cycle for the benefit of present and future generations.