PRELIMINARY RISK ASSESSMENT FOR THE PETRA ARCHAEOLOGICAL PARK
RECORDING STRATEGY

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Abstract: this paper describes the activities carried out in Petra by an international and multidisciplinary group of graduate students specializing in heritage conservation from the Raymond Lemaire International Centre for Conservation (RLICC), University of Leuven (Belgium) in cooperation with the University of Jordan, Faculty of Architecture, and the Al Hussein Bin Talal University and in partnership with the UNESCO Office in Amman.

The main objective of the work was to assess the risks affecting the integrity of the Petra World Heritage Property, due to both natural and man-made events in order to understand the impact of the site’s major threats. The outcomes provided the foundations necessary to develop a risk management plan, which could be used in the development of the overall management plan of the site.

The result of the overall study has been a preliminary risk management recommendation completed by the rapid assessment technique which readily identified vulnerabilities, hazards and threats to the state of conservation of the PAP. Outcomes of this work comprise two movies using time-lapse photography, 25 geo-referenced panoramas, a GIS system showing GPS track logs for all trails, satellite imagery & location of facilities, signage, monuments, 395 geo-referenced photos for the trails assessment, 105 geo-referenced photos for the areas assessment. An easy way to understand and visualize the circulation in the PAP was to bring the different trails on a satellite image through the use of a GPS system, combined with the ArcGIS software, in order to create a live track log while walking the trails in the PAP. Tracing this track log later in the GIS software indicated the actual location of parts of the PAP circulation.

Keywords: World Heritage, risk assessment, Petra Archaeological Park (PAP), recording strategy
1. Introduction

This paper describes activities carried out by an international and multidisciplinary group of graduate students from the Raymond Lemaire International Centre for Conservation (RLICC) at the University of Leuven, in cooperation with the University of Jordan, Faculty of Architecture, and the Al Hussein Bin Talal University and in partnership with the UNESCO Office in Amman. The purpose of the project was to complete a risk assessment of Petra Archaeological Park (PAP) by natural and man-made events. Work was carried out in June 6-18, 2010, first in Petra, and then presented at the UNESCO office in Amman. The fieldwork was combined with introductory lectures by both local and national authorities. This paper focuses on the description of the recording methodology and techniques used in the survey of the area, which led to the collection of the final data for the risk assessment.

Why Petra

The World Heritage Site of Petra turned to be an ideal learning laboratory for conservation students. Despite its inscription on the UNESCO World Heritage list in 1985 and its protection as Immovable Heritage in 2005, it is threatened by risks of different kinds, mainly of man-made origin. The lack of definition of the site buffer and core zones, together with the increasing number of visitors to the property are two main problems which have had a negative impact on the state of conservation and integrity of the site. Therefore, a risk assessment of Petra Archaeological Park (PAP) by natural and man-made events has been carried out at different levels and in different locations on the site. Additionally, the establishment in 2009 of the Petra Development and Tourism Region Authority (PDTRA), a new authority to improve the management of Petra and surroundings, requires appropriate information. In order to make decisions to improve the management and visitors experiences at the property, as well as to increase revenues from tourism by the increasing visitors number.

Methodology

In order to understand the impact of the site’s major threats, a risk assessment within the Park area was carried out on the trails, site areas, traffic flow in and out of the site and visitors experiences. The work on these four main topics was supported by a recording and documentation team. The first two studies of the trails and areas led to a rapid assessment of the current condition of monuments, trails and facilities offered to visitors. Due to the constant increase in tourism in the PAP, a carrying capacity evaluation was also conducted in order to gain a better understanding of visitors flow and usage. This included evaluating the number of individuals entering and exiting the site and also included a complete count of tourists, locals, and employees. Questionnaires were also given to some of the tourists in order to obtain direct feedback from them about their experiences maneuvering within the PAP. The result of the overall study has been a preliminary risk management recommendation completed by a rapid assessment technique which readily identified vulnerabilities, hazards and threats to the state of conservation of the PAP. The full amount of data has been archived and is available, on request, for a more detailed consultation.
2. Petra: general information

The caravan-city of Petra, world known as the capital of the Nabatean kingdom, has a history which can be traced back to Prehistoric times thanks to its location at an important crossroads between Arabia, Egypt and Syria-Phoenicia and in the vicinity of the Red Sea and the Dead Sea.

Its peculiar architecture including structures half-built and half-carved into the rock, and its breathtaking setting among mountains riddled with passages and gorges make it one of the world’s most famous archaeological sites, where ancient Eastern traditions blend with Hellenistic architecture.

The site’s outstanding archaeological heritage and the combination of archaeological, geological, bi-ecological and landscape resources led to its inscription in the UNESCO World Heritage list in 1985 according to the following criteria:

- criterion i): the property represents a masterpiece of human creative genius;
- criterion iii): the property bears a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;
- criterion iv): the property is an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history.

This condition recognizes its unique value to the world and highlights the important need to protect it.

Petra is also a very fragile site due to the perishable nature of sandstone which composes its monuments and the high increase in tourism registered at the property in the last few years has exposed it to a wide diversity of risks, both of human origin as well as natural and geological hazards (i.e. earthquakes, floods and landslides).

The lack of definition of the site buffer and core zones, together with the increasing number of visitors to the property are two main problems which have had a negative impact on the state of conservation and integrity of the site.

3. The recording strategy

Given the extension and complexity of the PAP, the recording process was essential to fully comprehend and monitor the area.

On the other hand, a major challenge to deal with was how to combine and compare data coming from different sources. Computerized systems were used for this purpose. This way, the recording process could be tied strongly to the management of data, thus making the two mutually related.

To capture and record trails, areas and related information within the Petra Archeological Park, the documentation team conducted a baseline documentation survey. The documentation team, responsible for this survey, operated not independent from the groups that were working on the visitors flow and the trail/area assessment. In fact, the documentation of the PAP was carried out in order to support the findings of these studies.
3.1 Techniques

Different documentation techniques were applied to provide the project with valuable information. The main techniques used were time-lapse and panoramic photography, on site GPS recording, and a GIS database.

- **Time-lapse photography**, in which photos systematically were made each 3-5 minutes, was done in order to illustrate the volume of visitors flow by sampling three hours of continuous photography of people, animals and vehicles coming to Petra in selected high-traffic areas.
- **Panoramic photography** was done in order to show 360° impressions of the places in which the areas and the trails are assessed in the PAP.
- **ArcGIS system**: a Trimble GPS, equipped with Arc Pad, was used to map the different trails of the PAP.
- **Geo-referenced photography**: each photo taken on site is identifiable by its geo coordinates or a reference map. The monuments were also geo-referenced and photographed to complete and visualize the data electronically.

3.2 GIS Database

In order to organize and display all the information collected on the trails, site areas, traffic flow in and out of the site and visitors experiences a GIS database was created. The data gathered were automatically compiled in layers compatible with ArcGIS and put into the program in order to create a better topographic understanding of the site and its facilities in relation to one another.

For instance, an easy way for the documentation team to understand and visualize the circulation in the PAP was to bring the different trails on a satellite image. In order to do so, the aforementioned GPS system, combined with the ArcGIS software, was used to create a live track log while walking the trails in the PAP. Tracing this track log later in the GIS software indicated the actual location of parts of the PAP circulation.

An inventory of the facilities and monuments found along the trails was also completed, as well as for the monuments, which were geo-referenced and photographed.

The intention of the GIS file, however, is not to be considered as finalized in its current state. It has to be considered instead as a working file and database of information for other researchers who wish to conduct future work on the site that are concerned about similar topics.
3.3 Trail assessment

At the level of the trails, an assessment was carried out on 4 different paths to identify the factors affecting the site’s integrity and the experience of the visitors. 
Trail A coincides with the site Main Spine from the Siq and Outer Siq (Street of Facades) to Qasr al Bint; trail B leads from the Outer Siq (Street of Facades) to the High Place of Sacrifice and Wadi Farasa; Trail C starts opposite the theatre and leads to the Royal Tombs and the Petra Church till Qasr al Bint; Trail D goes from the restaurants up to the monastery.
For each trail an individual report was compiled in order to identify the major risks for the visitors, the site and the local community. It consisted of 1) a general and a detailed assessment; 2) a detailed photographic survey; 3) a photo log file containing GPS coordinates or references to locations; 4) maps with indications of photographs and elements assessed.
3.3 Area assessment

The area assessment was conducted in 5 different locations within the Petra Park: Wadi Farasa (Area 1) with the Roman Tomb and the Garden Complex; the Petra Church and its surrounding area (Area 2); the Palace Tomb (Area 3); the Urn Tomb (Area 4); the area of Siq al Barid with its Painted Cave (Area 5). Assessment was carried out based on specific criteria: condition, threats to the monuments, relation to the visitors (Accessibility, Safety, and Supervision), presentation to the visitors and interpretation. Each assessment team produced a report consisting of 1) an Excel spreadsheet containing a detailed assessment of the area for one or more of the above criteria; 2) a photographic survey of the area with features illustrating one or more of the above criteria; 3) a photo log file containing the locations on maps for the different photographs; 4) maps and sketches with indications of the photographs and the elements assessed. This way, global risks for the site and the visitors were identified for each area.
3.4 Traffic flow and usage

In order to evaluate the number of people, animals and vehicles accessing and using some sections of the site a carrying capacity survey was carried out. Given the different types of use of the site, it was decided to gather information both on a week day and during the weekend from 6am to 6pm. Four different locations were selected: the Siq, the High Place of Sacrifice, the Monastery, Wadi Turkmaniyya/Abu Ollega Gate and Siq al Barid. The outcomes include statistical data showing results on the flow of people, the use of animals and as well the usage of the Turkmaniyya gate.

Traffic flow and usage – GIS map

3.5 Questionnaires

Questionnaires were submitted to visitors and workers on site in order to obtain a direct feedback about their experience in the Petra Archaeological Park. Habits and expectations of the site-users were also investigated. Overall, this allowed to understand the weaknesses and the strengths of the services provided as well as to evaluate the general awareness of the status of the site as World Heritage Site, and its influence on the users’ attitude.

Two types of questionnaires were submitted, one type for tourists and visitors (184), and one for the workers on site (75).

4. Closing remarks

Recording limits and suggestions

Some suggestions for future recording and documentation can be made from this work. First of all, boundaries of study should be mapped as well as creating maps that differentiate between archaeological and natural areas. Additionally, a buffer zone should be defined and mapped according to the determination of Jordanian and UNESCO authorities. Problematic areas for a deeper study, such as poorly documented areas, or areas where GPS signal is not available, should be identified for future work. The GIS
work should also be continued in order to obtain a complete survey of all the trails in the PAP. Other types of information could also be combined into the GIS database, such as the carrying capacity statistics and the results of the questionnaires. GIS is not just a map-making tool, but an active database to store and graphically display various types of information, and should be used as such. Finally, the coordination of data available between different organizations and public authorities needs to be improved. At the same time, there are some limits to the work. First of all, the short time available did not allow us to obtain a comprehensive overview of the site, leading us instead to the selection of areas to work on. Secondly, the cost of the equipment should not be underestimated. Lastly, the necessity to integrate printed maps with the digital recording was not easy to accomplish.

**Overall recommendations**

Recommendations for future work could be done at different levels. First of all, the process of information gathering should be improved continuing and expanding the survey on traffic flow and usage of the property. The questionnaires to the visitors and the Park users should be continued and adapted to gain more knowledge about the visitors’ experience and have the data necessary for the improvement of the current management plan.

The facilities for the visitors should be also improved by outlining an overall plan with guidelines to identify a suitable location for them and appropriate aesthetics (shops, toilets, garbage bins, rest areas, information and direction panels). The information collected could be of use to improve tourist maps by providing the locations of the monuments, trails and facilities, but also to improve the spatial distribution of tourists over the site. Furthermore, directional signs indicating the duration of the visit, the type of routes, and the level of difficulty for each trail should be created. In fact, a clear understanding of the trails in the PAP will be useful to better communicate them to the tourists and locals, and also to determine where new paths should be created.

Finally, all the information gathered including the results from the survey on the site should be considered the basis for an improvement in the management of the Park and of its overall vision. Eventually this could lead also to the identification of the site’s boundaries and buffer zones and to an effective system for the monitoring of the state of conservation of the monuments. As a closing suggestion, it would be therefore recommendable that all the efforts convey towards a contribution to the overall vision of the conservation and sustainable development of the property.
References


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