Appendix D

PRELIMINARY STANDARD PROGRESS REPORT OUTLINE *

Reporting UN Participating Organisation: UNESCO
Country: Lebanon

Programme/Project No. and Programme/Project Title: 222LEB4000
LEBANON RECOVERY FUND - Capacity building of human resources for digital documentation of World Heritage Sites affected by 2006 war in Lebanon

Reporting Period: July-August-September 2009

I. PURPOSE

UNESCO assessment mission for (July–August 2006) war damages on World Heritage Sites of Lebanon expressed concern regarding the routine maintenance of those sites and recommended to prioritize the establishment of an integrate action plan for tangible cultural heritage conservation all over the country. This Action Plan should be considered as an umbrella for few most important components such are:

- Establishment of risks' map for World Heritage Site;
- Establishment of digital exhaustive technical documentation for World Heritage Site;
- Capacity building of human resources able to address above components;

Main objective of the proposed activity is to build capacities of Human Resources in charge, or potentially linked with, the conservation, the development and the enhancement of tangible cultural heritage in Lebanon. The main target group will be the DGA staff, but also Lebanese University (UL) students, while the main subject of the action is to establish accurate high definition 3D digital data and documentation for World Heritage Sites through pilot on-site operation for Baalbek or Tyre World Heritage Sites
Immediate Objectives:

- To contribute to the risk mapping of the affected World Heritage Sites in Lebanon
- To ensure the state of conservation of the affected World Heritage Sites in Lebanon
- To build capacities of human resources for conservation and enhancement of cultural heritage sites in Lebanon
- To establish a model of full survey of one of the affected World Heritage Sites in Lebanon

II. RESOURCES

Summary of the resources available to the programme/project from LRF after the approval of the Budget revision

	US dollars
Grand Total requested from LRF	**767,226**
10- Project Personnel	65,971.00
20- Sub-Contracts	350,062.00
30- Training	10,000.00
40- Equipment and Premises	285,000.00

50- Miscellaneous	6,000.00
80- Programme support costs	50,193.00

III. RESULTS

2009	June	
	11	Leica delivered the replacement scanner
	22	Scanning work was finally resumed
		Amendment of the contract of the International Consultant and the Local Contractor for September instead of July
	30	The laser data gathered during the first week was checked for consistency
2009	July	
	28 - 2	Mid-term evaluation - Field mission carried out by Dr. Van Genechten
	1-2	Evaluation on site
		Mid-Term report
		The local scanning team consists of 1 DGA and 2 local contractor persons
		Scanning activities continues on site
2009	August	
	15	End of Scanning activities on site 80% of site scanned
	26-30	Final evaluation
		Project postponed for one month to scan the remaining parts
		Preparation of the phase 2 Risk Mapping
2009	September	
		Establishment of the TOR of the International Consultant of the phase 2
	7-17	Laser scanning activities continues after interruption
	21-26	Registration
		Meeting and presentation of the results to the DGA/UNESCO
	30	Submission of report the final is to be submitted in November

IV. FUTURE WORK PLAN

Planned work for October-December

1. The actions defined in this work plan are presented in order of priority.

1.1 The International Consultants:
October 26-30 Final review
Beginning of November submission of the Final Report

1.2 Contractor
Submission of the data according to the TOR specifications

1.3 Phase 2 Risk mapping
Signature of the contract with the International Consultant
Execution of Phase 2

2. Strategies and targets
The defined action of Laser scanning and Risk Mapping will be undertaken on Baalbek. This World Heritage Site was selected by the DGA.

3. Estimated Budget required for October-November-December

	US dollars
Technical Coordinator	8,000
International Consultant for all activities	65,000
Total	**73,000**

SPECIAL PROBLEMS ENCOUNTERED:

We have encountered several problems that delayed the implementation of the activities:

- Technical failure occurred to the new laser scan, it took around 3 months for replacement and preparation;
- The international consultant requested some additional material to be purchased just before starting the training;
- Delays due to Baalbek international festival installations and the Hizbollah exhibition.

RECOMMENDATION ON DECISIONS TO BE TAKEN DURING THE REVIEW MEETING:

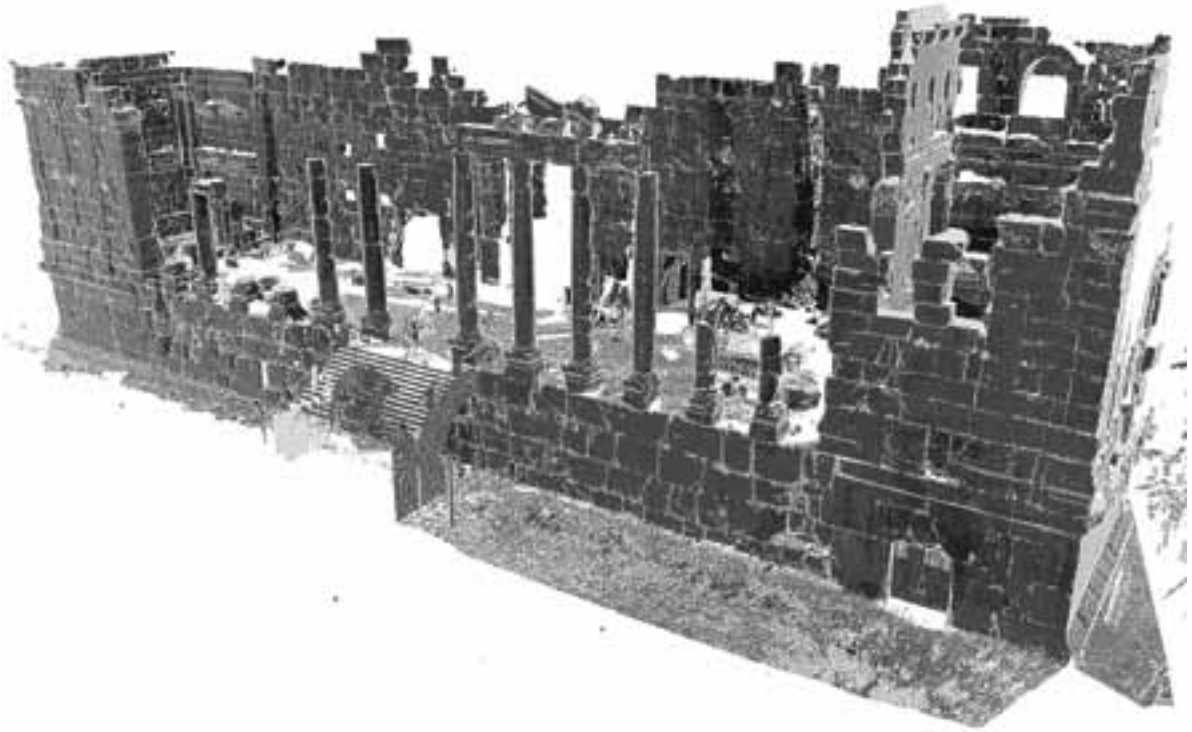
With reference to the above-mentioned problems encountered and the delay in the implementation of the activities, it is requested that the extension of the project implementation period till 31December 2010 be granted .

ANNEX I

Capacity building of human resources for digital documentation of World Heritage Sites affected by 2006 war in Lebanon, United Nations Educational and Cultural Organization (UNESCO) and The Directorate General of Antiquities (DGA)

3D DOCUMENTATION OF BAALBEK

FINAL REPORT



SEPT. 2009

M. SANTANA QUINTERO / B. VAN GENECHTEN
RAYMOND LEMAIRE INTERNATIONAL CENTRE FOR CONSERVATION, UNIVERSITY OF LEUVEN

Acknowledgements

The authors wish to acknowledge and thank the support of UNESCO Beirut The Directorate General of Antiquities (DGA) for inviting to contribute in the project entitled “Capacity building of human resources for digital documentation of World Heritage Sites affected by 2006 war in Lebanon”.

It has been a unique opportunity to contribute to the capacity building of Lebanese experts in the field of information and 3D documentation of built heritage for its conservation and preventive maintenance.

In addition, we wish to thank the support of Joseph Kreidi, Frederic Husseini , Assaad Seif, Ghassan Ghattas, Selim Germanos and the rest of the UNESCO Beirut and DGA staff for their support of this project.

We must also acknowledge the cooperation of Bureau Stephane, Rand Eppich, and Jon Bedford for their contribution to this project.

Finally, we want to thank all those individuals and institutions that in one way or the other helped with the completion of this report.

Figure 1: laser scanning target, B. Van Genechten

Contents

1 EXECUTIVE SUMMARY

This report describes activities carried out by consultants from the Raymond Lemaire International Centre for Conservation (RLICC), University of Leuven according to objectives and terms of reference of the project for '*Capacity building of human resources for digital documentation of World Heritage Sites affected by 2006 war in Lebanon* project is a donation of the United Nations to Lebanon administered by the UNESCO-Beirut for Lebanon's Directorate General of Antiquities (DGA), which is the beneficiary agency.

According to the terms of reference of this project, the main objective is to build capacities of Human Resources in charge, or potentially linked with, the conservation, the development and the enhancement of tangible cultural heritage in Lebanon.

The main target group will be the DGA staff and local experts while the main subject of the action is to establish accurate high definition 3D digital data and documentation for World Heritage Sites through pilot on-site operation for Baalbek World Heritage Sites.

The RLICC as international consultant was in charge of:

- Procure and monitor the laser scanning survey by providing training, monitoring and auditing the integrity and accuracy of the measurements obtained with a laser scanner;
- Training on heritage documentation, especially on laser scanning documentation;
- The preparation and submission of the report on laser scanning procedures and training.

According to Letellier, R. "detailed recording may take place prior to, during or after a conservation activity so as to record a site's physical configuration, condition and significant features. Detailed recording occurs when a highly significant resource becomes the subject of directed research and analysis, or intervention planning and conceptual design. To ensure cost-effective detailed recording, completeness should be tailored to the immediate needs of a conservation team. Detailed recording may be phased over a number of years depending on planning requirements and related budget. The accuracy of a detailed record can vary between approximately ± 5 mm (for details) and ± 25 mm (for building plans)", this is the main accuracy aim of the scanning project.

This final report will provide:

- Reporting on project implementation, achievements and lessons learnt for future projects using laser-scanning technology for recording heritage places in Lebanon;
- Guidelines and recommendations for preparation of 3D models and recording for future monitoring of the property;
- Reporting on project implementation, achievements and lessons learnt for future projects using laser-scanning technology for recording heritage places in Lebanon;
- Audit of project accuracy and results;
- Recompilation of procedures developed during the project into Guidelines for repeatable measurements for monitoring the physical configuration of Baalbeck;

Image from ARS Progetti (http://www.arsprogetti.com/documenti/LebanonBaalbeckUrban.pdf accessed: 17/09/2009)

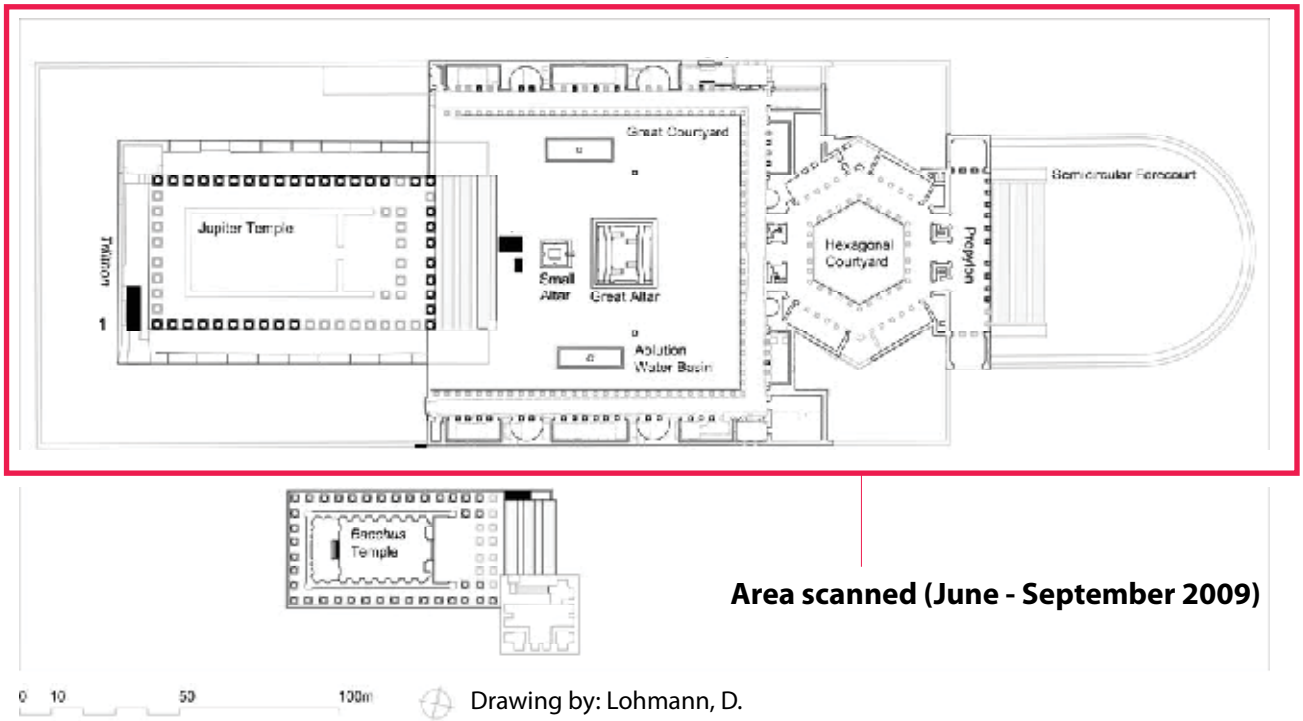
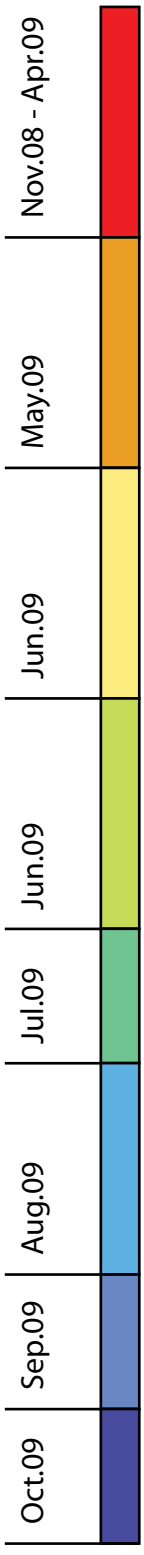


Figure 3: location of Baalbek and area of work

PROJECT TIMELINE



Negotiations, agreement and signature of terms of references

Activity 1: mission to Lebanon

20-25

Implementation meeting with the local contractor and the DGA

Malfunction in the equipment detected
Additional equipment neccesary to obtained desired resolution and accuracy

Activity 2: training

10 - 18

Heritage documentation training is delivered to local contractor and the DGA

Interm. Report delivered

The malfunction and desired equipment causes delays in starting the survey - project is posponed for one month

Activity 3: scanning

22 Jun starts

Scanning is started at Baalbek

The late delivery of replacement equipment and desired equipment causes further delays in starting the survey - project is posponed for 15 more days

Activity 3 - 4: midterm evaluation

28 JUN - 3 JUL

Scanning progress is reviewed

Mid Evaluation Report delivered

Several recommendations are provided to improve scanning work. Some minor difficulties are identified. Proecdures are re-calibrated for accuracy, it is suggested to continue work for final mission

Scanning continues until mid august

Activity 4 - 5: Final evaluation

26 - 30 (Mission)

Data scanned is reviewed

Team has scanned 80% of site, project is postponed for one month to complete remaining parts.
Advice is given about integirty of data and identification of gaps in existing scanned data
A new mission is scheduled for mid october to finalize checking of data collected
Phase 2 of project is proposed

Activity 5: Final report

Draft delivered

Final evaluation mission expected to certify data collected

Final report to be submitted

Chart 1: project timeline, authors.

- Recommendations for 3D modelling of the data collected using the laser scanning:
  - Using Geomagic to reach a 3D detailed model;
  - Using innovative software in 3D Studio Max (B. Van Genechten)

2 BAALBEK'S BACKGROUND

This important heritage place has been inscribed on the UNESCO World Heritage list on 1984 under criteria:

- (I): to represent a masterpiece of human creative genius (UNESCO World Heritage Convention) and
- (V) to be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change (UNESCO World Heritage Convention).

According to the brief description of this property: "This Phoenician city, where a triad of deities was worshipped, was known as Heliopolis during the Hellenistic period. It retained its religious function during Roman times, when the sanctuary of the Heliopolitan Jupiter attracted thousands of pilgrims. Baalbek, with its colossal structures, is one of the finest examples of Imperial Roman architecture at its apogee" (http://whc.unesco.org/en/list/294 accessed: 25/09/2009).

The property has been extensively research by different national and international organizations. A World Bank project implemented by ARS progetti

Figure 4: DGA staff measuring control points for accurate measurements, authors.

(http://www.arsprogetti.com/documenti/LebanonBaalbeckUrban.pdf accessed 17/09/2009) has been working on the site with the aims of

- to maintain the integrity of the archaeological sites and establish a connection network with the central historic urban area;
- to consider the conservation of the urban and architectural heritage as a substantial part of a rehabilitation and regeneration process, aiming both to improve livelihood for residents and make urban environment attractive for tourist and visitors as well.

The mapping project can be a relevant contribution in the implementation of this project, specifically in guaranteeing an

appropriate and accurate record of the integrity of the physical configuration of the property.

3 RECORDING THE SITE: COVERAGE AREA

The 3D laser scanning of the World Heritage Baalbek is defined in figure 3, this area has been predetermine by the DGA.

The international team of experts provided training and advice to establish not only an accurate network of fix points, but to map this area of the site to the highest possible accuracy using laser scanning. Other areas of this property were not included in the scope of action.

4 DELIVERABLES

RLICC engaged itself in a six month project to assist the DGA and local experts in the:

- Accurate acquisition of Baalbek's physical configuration by the use of 3D digital data and documentation, using advanced laser scanning technologies.
- To provide guideline in the representation and use of large datasets of point clouds for monitoring changes in Baalbek's historic fabric.
- Provide guidelines in collaboration with the DGA for an appropriate procedure acquisition of regular updates of the digital documentation for each monument.
- Provide assistance to a specialized unit at the DGA with participants from local experts that will be trained to produce digital documentation for monuments of world heritage sites.
- Heritage Site conservation improved and furnished by advanced 3D laser technology tools and other relevant equipment.

5 ACTIVITIES

RLICC experts implemented the following activities in collaboration with UNESCO Beirut, DGA, and the local contractor:

- Activity 1: laser scanning heritage recording: planning and initial implementation;
- Activity 2: introductory and advanced training of Lebanese experts in heritage documentation;
- Activity 3: recording of Baalbek using laser scanning;
- Activity 4: Evaluation and follow up
- Activity 5: preparation of reports and deliverables

Activities 1 through 3 have been described in appendix 1 Interim report. Activities 3 and 4 have been described in appendix 2: Mid-Term Evaluation. The description of activities will be limited to highlight achievements and constraints. The "Project Timeline chart" provides a quick overview of the activities implemented.

ACTIVITY 1: LASER SCANNING HERITAGE RECORDING: PLANNING AND INITIAL IMPLEMENTATION

The first expert mission provided guidance to:

- Identify the work of laser scanning on the monument to be scanned;
- Define the points of station of the scan station and the scan resolution(s);
- Define the control network to be used for monitoring activities;
- Plan and schedule the scanning

activities on the monuments of the site. Discuss the best strategy of work with the Local Consultant(s).

However, two issues dealing with the equipment were identified:

- A malfunction in scanner delivered to UNESCO was detected and report to Leica Support, actions were taken to request a replacement device;
- Additional essential equipment was identified, the international experts assisted in purchasing support photographic equipment and to order additional targets and tripods to improve the accuracy of the scanning.

These issues affected the overall planning of the project, it was necessary to postpone progress one month and the deadline of the project was amended by UNESCO to September 2009.

THE TRAINING – ACTIVITY 2

The original training concept that included teaching of DGA and other associated institutions, such as the University of Lebanon, but finally did not participate. Therefore a new strategy was adapted to fulfill only requirements of the DGA. During the first visit, Mr. Van Genechten met with DGA staff and drafted a training program to satisfy the needs of two different groups of trainees:

- Group A: laser scanning surveying team consisting of DGA specialized staff and the expert appointed by the local contractor;
- Group B: DGA inspectors with essential knowledge of digital recording tools.

The training schedule was organized also to satisfy time limitations of DGA staff on duty, the objectives of the training were:

Group A: provide comprehensive training on:

- Introduction to heritage documentation;
- Use of laser scanning for recording heritage properties with highest possible precision, consisting of:
    - Planning;
    - Implementation of field work: definition of terms of reference and procedures (forms);
    - Processing of fieldwork information acquired: registration and modeling.

Four days were spent on site with the malfunctioning scanner in order provide experience in planning of the scanning and assuring the quality of the data. During this course, the scanner crashed 8 times.

A set of procedures/checklists (please consult appendix 3) was prepared. These checklists have to ensure that the local contractor takes all possible actions in order to guarantee accurate and useable results.

During the remaining 2 days courses were given on data registration, important Cyclone settings and Geomagic workflows in order to process the obtained data. Different tests were performed using the data obtained during the first four field scanning days. These tests allowed the optimization of the workflow and the determination of certain parameters.

Group B: provide comprehensive training

Figure 4: DGA staff during training course, session on laser scanning, authors.

on:

- Introduction to heritage documentation;
    - Introduction and demonstration of laser scanning to record historic buildings and archaeological sites, including an overview of possible applications and best practice illustrations
- Digital photography to record heritage properties, emphasizing on procedures and provenance (metadata) needs;
- Panoramic photography: taking photographs, stitching and dissemination;
- Rectified photography, using hand survey and total station, emphasizing in its application and constraints.
- Illustrated examples in heritage recording.

Each participant received a 2GB USB memory key with reference material and free software, as well as, printed manuals from English Heritage and the Getty Conservation Institute. The team of instructors consisted of heritage recorders from RLICC and English Heritage.

The training was carried out from May 10 to 18, 2009 using DGA's meeting room as classroom. More detailed information about the training and schedule 'as it happened' is provided in Appendix 2. Participants were encouraged to provide feedback, the results of the survey are presented in Appendix 3, and attendance log is included in Appendix 4. A short report on Jon Bedford from English Heritage particpation as instructor is provided at Appendix 6.

Activity 3: laser scanning recording of Baalbeck

Due to the technical difficulties identified in the scanner and requirement equipment, this activity was postponed one month to start end of June. UNESCO has agreed to amend the current contract to extend the project deadline to September 2009.

INTERMEDIATE REPORT

An intermediate report was delivered to UNESCO describing RLICC experts' implemented activities in collaboration with UNESCO Beirut, DGA, and the local contractor, which included:

- Activity 1: laser scanning heritage recording: planning and initial implementation;
- Activity 2: introductory and advanced training of Lebanese experts in heritage documentation;
- Activity 3: laser scanning recording of Baalbek.

Technical difficulties were identified in the scanner and requirement equipment, therefore in agreement with UNESCO all subsequent activities were postponed one month, scanning work wa to be resumed in June 2009. UNESCO amended the contract to extend the project deadline to September 2009. More details and results are described in Appendix 1.

ACTIVITY 4: MID-TERM EVALUATION

A mid-term evaluation was carried out in the months of June and July 2009. This involved a field mission that was carried out by Dr. B. Van Genechten between the June 28 and July 2, 2009, in order to evaluate progress and provide recommendations to improve the precision, integrity and coverage of the documentation works of Baalbek.

A report submitted in July 2009 to UNESCO and included in appendix 2 provides information on the progress achieved at this stage.

ACTIVITY 5: EVALUATION AND FOLLOW UP

The International Consultant was responsible of the accuracy of the plans and documentation treated and collected by laser scanning by the local Contractor. Therefore, a final monitoring mission was organized between august 26 – 30, 2009 to review the data collected. Due to problems with the temperature onsite and a festival that had stands covering parts of the property, the field team decided to stop scanning mid august and resumed after mid September 2009. This affected the project timeline, UNESCO and the DGA suggested to prepare a mission in October 2009 to finally evaluate the integrity of the surveyed points.

Although, this mission was not originally planned, the local contractor offered to cover travel and lodging costs for Dr. B. Van Genechten. UNESCO agreed to accept the final report in November 2009.

The team implemented the following actions during this mission:

- Review accuracy of scans;
- Review accuracy of registration of multiple point clouds
- Review of coverage of scans and completeness of the dataset:
    - Some areas are missing, like the back of some columns, identification of gaps is required and additional scanning time should be allocated, before going back to the field;

Based on the meeting with the field team, the

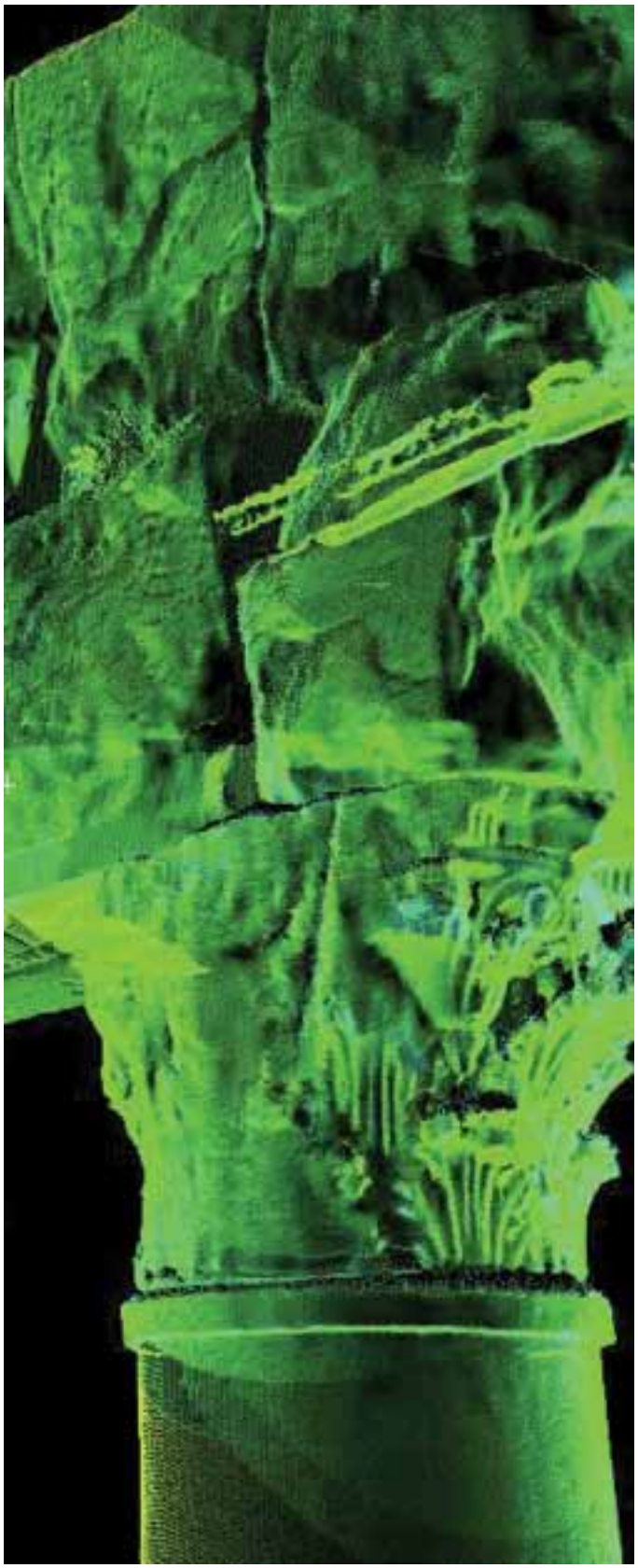


Figure 4: point cloud sample from Baalbek,project team.

following activities were completed:

- Approximate 90 % of the procure parts of the WH property has been recorded, including internal control network points adjustment and registration of points clouds:
  - A reduce zones remained to be scanned (due to the music festival);
  - A number of gaps of existing areas have been identified, like columns and niches; these areas are currently been checked and will be recorded during the planned fieldwork.
- Internal and external control network points need to be adjust to ensure accurate results.

To be completed:

- Control network
  - Extramuros network has been measured but needs to be adjusted
- Scanning (general and fine scans)
  - Areas missing: remaining parts need to be scanned, this also requires identification of gaps in the current dataset, like covering all the columns to have a complete set of data;
  - Stitching of panorama images and linking them to the scan data;
- Registration: prepare a full registration of the site;

It was recommended that all the scanning dataset is reviewed using shading and

large point size in the point clouds, identify the gaps and procure scanning time in the upcoming fieldwork. Also, the team should check day by day, mark the gaps, and describe areas where is impossible to scan.

Finally, a presentation was given to project participants, F. Huseini and J. Kreidi about the project achievements, identification of remaining work, and suggestions for phase 2 in risk preparedness for the site.

Activity 5: The reports and deliverables

This report is part of the results of activity 5; this is a preliminary draft to be reviewed for the final report after the audit mission in October 2009.

6 GUIDELINES

The following guidelines have been prepared for continuous scanning work and processing in order to make appropriate use of the laser scanner to capture the physical configuration of Baalbek throughout the coming years for monitoring and/or actions aimed at the conservation, preventive maintenance, and dissemination of the property.

The training has been based on the didactic package provided in the publication: Theory and practice on Terrestrial Laser Scanning; Training material based on practical applications, which was prepared by the Learning tools for advanced three-dimensional surveying in risk awareness project (3DRiskMapping). This material has been made available to the DGA and local contractor.

The following parts complement the information provided in the tutorial and teaching material given to the DGA and project partners:

- Part 1: Field laser scanning procedures: planning and site work;
- Part 2: processing procedures to guarantee audit of the integrity of the measurements and completeness of the mapping exercise;
- Part 3: modeling procedures to prepare 3D models of the scan sets.

Please register at http://www.3driskmapping.org for more information and accessibility to the 3DRiskMappng training material, which is freely distributed.

7 RECOMMENDATIONS

In relation with the scanned dataset:

- Registration of entire recorded zones;
- Reference recorded zones with basemap made with photogrammetry;
- Prepare a site atlas with measured representations fro Phase 2;
- Prepare a simplified 3D model of the point clouds for visualization purposes.

In relation with Phase 2 (risk preparedness)

Please follow the check list:

- Preparation of site atlas (measured maps);
- Definition of condition mapping standards and specifications;
- Mapping;
- Digitalization;
- Statistical research;
- Therapy proposals;
- Monitoring;

The DGA has suggested using reports

prepared about the condition of Baalbek, the international consultant suggested a preparatory mission to review how to transfer this information to accurate measurements taking with the laser scanner and the resulting site atlas. The folllwoign taks has been suggested prior to Phase 2:

- After completion of all measurements a site atlas should be prepared with measured representation, such as elevation, sections, and plan sections of the property to be used as baseline for condition assessment;
- For example the preparation of ortho-photographs to scale using points from the high-resolution panorama images, which has been correlated with the point clouds, this will allow the generation of elevations of the whole property;
- 2.Condition assessment classification: weathering forms, cracks, etc… according to Baalbeck situation;
- Condition mapping (building archaeology) onsite using printed maps or a digital solution (ex. For further research www.adapx.com: capturx – www.anoto.com);
- 4.Digitalization of condition maps into GIS or CAD platforms for statistical studies of weathering forms, cracks, in order to understand the condition of the physical configuration of the site.

8 LESSONS LEARNT: CLOSING STATEMENTS

This project has achieved to record a complete physical configuration set of Baalbek. However, several important reasons should be taking into consideration that the information acquired by the scanning project should be aimed at ensuring timely, sufficient and relevant information to:

- Ensure a 3D global and integral picture of the physical configuration of the property that can help in identifying threats;
- Monitor and detect changes;
- Re-evaluate significance and its relation with integrity;
- Record interventions, manage and plan ahead;

9 REFERENCES

Letellier, R. Schmid, W. LeBlanc, F. Guiding Principles Recording, Documentation, and Information Management for the Conservation of Heritage Places, Getty Conservation Institute, 2007 J. Paul Getty Trust

Lohman, D. Drafting and Designing. Roman Architectural Drawings and their Meaning for the Construction of Heliopolis/Baalbek, Lebanon, Proceedings of the Third International Congress on Construction History, Cottbus, May 2009, p. 959 – 966.

UNESCO World Heritage Convention: http://whc.unesco.org/en/conventiontext (accessed: 19/09/2009)