PARTNERSHIP IN LEARNING: ENGLISH HERITAGE AND THE RAYMOND LEMAIRE INTERNATIONAL CENTRE FOR CONSERVATION

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ABSTRACT:

The Raymond Lemaire International Centre for Conservation (RLICC) organises an advanced interdisciplinary and international study programme in architectural conservation, aimed mainly at architects, architectural engineers, civil engineers, art historians and archaeologists who intend to specialise in the field of the protection of monuments and sites. It is embedded in the postgraduate programmes of the departments of Architecture, Urban Design and Regional Planning and Civil Engineering of the Faculty of Engineering of the University in Leuven, Belgium.

The Centre actively promotes international and interdisciplinary co-operation in its training and research programmes. Moreover the Centre maintains strong ties with international organisations concerning heritage, amongst others UNESCO, ICOMOS, the Getty Foundation, and the Council of Europe. Collaboration in research and training projects as well as in student exchange with these institutions results in an internationally renowned and modern study programme.

English Heritage is the government agency responsible for the historic sites and buildings in the care of the state of England and is also the UK government's lead advisor on the built heritage. As part of the agency's mission to protect and promote England's spectacular historic environment and ensure that its past is researched and understood, their Metric Survey Team undertake a number of training and outreach initiatives both within the UK and internationally.

The invitation from the RLICC to teach heritage documentation skills resultrd from the training expertise gained from the Metric Survey Team's delivery of the Measured Survey Summer Schools in England from 1989 onwards. The RLICC offers access to a truly unique student base: the international focus means that the skills taught are disseminated worldwide and feedback on the application of metric survey in local projects uniquely validates metric survey practice and procurement.

The Metric Survey Team supplies a three-day module on preparing digital data sets for heritage documentation, involving the use of TheoLt for real-time EDM to CAD work, digital rectified photography with PhoToPlan and a live stereo demonstration of digital photogrammetry from photo acquisition to orthophoto generation. From the first teaching mission in November 2001 RLICC was keen to extend both practical 'hands on' skill transfer but also procurement skills in documentation. Therefore the Team's experience in managing contracts for the supply of metric survey is shared as part of the programme.

1. INTRODUCTION

Nowadays a number of digital sensors are applied to capturing the cultural heritage. They offer the opportunity to acquire large amounts of information in a relatively short time. These sensors include digital cameras which are used for photogrammetry and rectified photography, total stations and laser scanners. Much effort has been put into the application of these tools to the field of conservation. A significant gap, however, exists between professionals working in the field of conservation and the manufacturers of these new technologies with regard to their realistic application to heritage documentation projects. Conversely the profusion and relative accessibility of digital tools has resulted in a recent loss of traditional skills. Measured drawing is an essential technique which is now rarely taught to students of architecture and archaeology, yet it is almost impossible to fully complete a historic buildings survey project without it. These gaps can be addressed by offering the architectural heritage community training courses and materials on how and when these various techniques can be used appropriately.

English Heritage had gained considerable experience in such training through offering a Measured Survey Summer School in the UK since 1989. From 2001 this experience has been applied

to a three-day workshop which forms part of the RLICC master's programme in architectural conservation. Recently the workshop has been supported by a teaching manual 'Metric Survey for Heritage Documentation' which is in preparation for the CIPA: RecorDIM initiative (RecorDIM, 2007).

2. THE NEED FOR DOCUMENTATION

To understand the role of digital capture technologies in heritage documentation it is necessary to be clear about how information collected through their use can be helpful. It is otherwise easy to fall into the trap of 'documentation for the sake of it' and whilst populating an archive is a laudable aim it is perhaps not the best use of scarce resources. The information required to inform conservation action is enshrined in Article 16 of the Venice Charter (ICOMOS, 1965) and expanded in the Sophia Principles (ICOMOS, 1996).

2.1 The Conservation Cycle

Conservation of the built heritage is cyclic and consists of a number of processes which form the conservation cycle. These are analysis, diagnosis, therapy and control. As will be shown below each phase requires documentation of a greater or lesser intensity (Searls etal, 1997).

Analysis
Analysis is the investigation and research needed to establish the value or significance of a building or site. This is required in order to prioritise action and the allocation of resources. It involves the acquisition of key thematic, social and academic data for inventory and preliminary asset management. This task is multi-disciplinary and whilst mapping is an essential element it will be highly selective.

Diagnosis
Diagnosis begins with the identification of the causes of damage and decay. It is a synthesis of the gathered information needed to come to an understanding of the building's condition and the actions required to maintain it in an agreed state. Diagnosis should lead to the definition of aims and objectives based on deliberate and clear choices that in their turn are based on generally accepted conservation principles. Metric survey data, particularly records of condition as well as base mapping is required as a framework for monitoring.

Therapy
Therapy is the execution of the necessary remedial measures identified by the diagnosis. Documentation will be required for planning and costing of works as well as the production of design drawings.

Control
This phase is also known as monitoring and as the name suggests is the process of reviewing and assessing the efficacy and efficiency of the therapeutic measures. As any change to a historic building has an impact on its authenticity the condition post-intervention must be evaluated with regard to material change, value and significance.

Conservation techniques should adapt to change. The change therefore must be detected and measured. In order to achieve minimal impact on the historic building and to use resources in a considered way it is necessary to repeat the steps of the cycle in an iterative process. Each step has a need for survey data that must be met by discerning the appropriate technique and the intensity of its application. The validity of a variety of survey activities is established when, for example, at the earliest stage of the cycle hand drawn plans and details can convey highly valuable information to the project team. Such drawings may not exhibit rigorous metric performance but require highly attuned information selection in a short period of time. Such records will of course be of enhanced value with respect to future utility if they have a metric base.

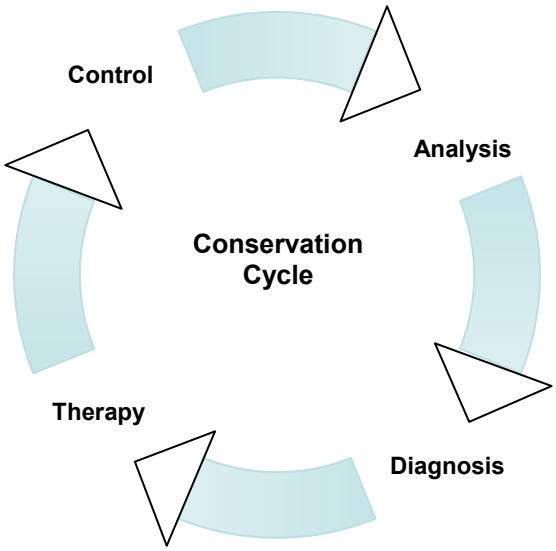

Fig.1 The Conservation Cycle

3. AIMS AND CONTENT OF THE WORKSHOP

The aim of the three-day workshop given by English Heritage at the RLICC is to give the students an appreciation of a number of different metric survey techniques. Through hands on practise and learning by doing they are able to understand how different techniques are best applied and for which subjects they are most suitable. Most importantly working towards a finished product to be presented at the end of the session demonstrates both the time and effort required to produce a complete survey and the fact that no one technique will provide all the answers.

Of the extensive palette of techniques shown in Table 1 it is only practical to teach a salient few over the three days of the workshop. These are drawing, EDM and rectified photography. Photogrammetry is demonstrated to break-out groups because it is only possible to have one photogrammetric system available on site.

The workshop begins with lectures on heritage documentation and an overview of the various techniques which will be studied in depth as the course progresses. The cohort of students is divided into about five smaller groups and each one is assigned to a particular part of the historic Kasteel Arenberg. Under the supervision of their English Heritage tutors the groups use the different metric survey techniques to produce a number of deliverables, for example, a plan and section. Each group has the use of a reflectorless EDM (REDM) which is interfaced via

SUMMARY OF METRIC SURVEY TECHNIQUES FOR HERITAGE DOCUMENTATION						
		Product	**Used for**	**Scale**	**Range**	**Requires**
Indirect methods						
Remote sensing	2D	Satellite Imagery	Prospection Small scale mapping	<1:5000	>10000m	Post-processing and image processing software, GIS
Rectified Photography	2D	Scaled Images	Condition assessment and recording, works scheduling	1:10-1:50	2-25m	Metric or good quality camera. Coordinate control or scale bar. Digital rectification software
Photogrammetry	3D	Stereo-photography	Condition and ante-disaster records	1:10-1:100	5-50m	Calibrated camera and precise coordinate control Photogrammetric plotting system and experienced operator with image interpretation skills CAD and 3D modelling software
	3D	CAD drawings	Architectural elevations, landscape survey	1:20-1:1000	5-500m	
	2D	Orthophotographs	Condition recording, works scheduling	1:10-1:50	5-25m	
	3D	Digital elevation models (DEM)	Condition monitoring, 3D modelling visualisation	1:5-1:50	5-50m	
Lidar	3D	Point clouds	Landscape prospection	1:500-1:1000	500 -1000m	Laser scanner, Lidar requires aircraft Point cloud processing software 3D modelling software CAD/CAM software
Terrestrial laser scanning	3D		CAD drawings, 3D modelling	1:20-1:100	5-200m	
Artefact laser scanning	3D		Condition monitoring, 3D modelling replication	Actual size-1:10	0.1-5m	
Direct methods						
Drawing	2D	Sketches	Diagnosis, support to 3D modelling			Trained draughtsperson
	2D	Measured drawing	Plans, sections and Elevations	1:20-1:50	1-15m	Trained draughtsperson and CAD software/skills
Levelling	1D	Precise levelling	Monitoring	1:20-1:50	0-30m	Trained surveyor
EDM/REDM	3D	Point data	Photo-control Terrain models	1:20-1:200	5-25m	Trained surveyor and computation software
	3D	Wire frame CAD drawings	Plans, sections and Elevations	1:20-1:50	5-25m	REDM, field CAD system and CAD skills
GPS	3D	Point data	Aerial photo-control Terrain models	1:500-1:1000	1-1000m	Differential GPS equipment Trained surveyor GPS processing software
	3D	Wire frame CAD drawings	Site mapping landscape survey	1:100-1:1000	20-1000m	

Table 1. Summary of metric survey techniques for heritage documentation

TheoLt™ with a lap top running AutoCAD™. TheoLt™ is a software program which allows measurements taken with the REDM to be plotted directly into AutoCAD™ in real time. As well as being of obvious use for survey projects it is a valuable teaching tool as it allows students to easily understand the performance and limitations of REDM. The REDM is used to record a wire frame of the location the group is working on. A network of control points have been established through-out the Kasteel so that each group's work is in a common coordinate system. This means that at the end of the course it is possible to load all the drawings into the same AutoCAD session thus demonstrating the way digital recording methods can help unravel the often complex arrangements of historic buildings. Through hands-on experience the students soon appreciate that REDM is not capable of recording the fine detail of, for example, architectural mouldings to a precision sufficient for plotting at the common architectural scales. It therefore becomes necessary to undertake measured drawings which can either be constructed in CAD or scanned for digitising. These details are floated into the main drawing using the REDM wire frame for registration. Rectified photography is mainly taught as a way of supplementing the details collected by REDM but it can of course be used as a product in its own right. The recent advances in the quality and resolution of consumer grade digital cameras has made rectified photography extremely accessible to heritage professionals and this is reflected in the fact that the students are often able to use their own cameras to produce the photographs needed for the project work. PhoToPlan™, an AutoCAD™ plug-in, by Kubit, is the digital rectification package employed by English Heritage and it is used during the work shop. The rectified photographs can seamlessly form part of the drawing or detail can be digitised from them directly in AutoCAD™. Lower cost methods using, for example, Photoshop Elements™ are also demonstrated.

Fig 2. Students learning to use the REDM to record a vaulted ceiling.

The photogrammetry element of the workshop is taught by demonstration to groups of four or five students who break-out from their project work groups. To support its outreach work the English Heritage Metric Survey Team has a digital stereo projection system which is used with a laptop running SOCET SET™ by BAe Systems. This system allows up to 50 plus people to view the same stereo scene just by wearing polarising glasses. It has proved to be an invaluable teaching aid both for demonstrating the power of the stereo view and the complicated process of setting up a stereo model and producing three-dimensional line work, surface models and orthophotographs. Each group is shown the setting-up process and given the chance to transcribe some detail. They are also shown a number of example projects.

Whilst it is unlikely that the students will undertake their own photogrammetric projects it important that they understand the scope and limitations of the process. This will hopefully equip them to procure such surveys from specialist contractors should their future work require it.

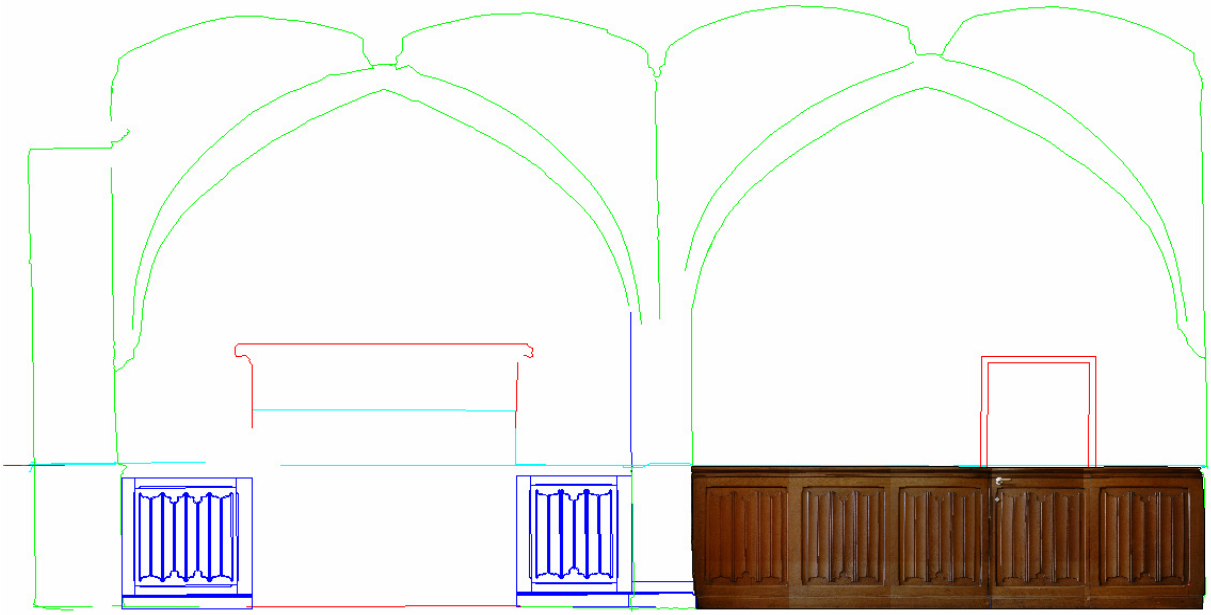

Fig 3. Screen-shot of work in progress on the Salon Heraldique, Kasteel Arenberg showing panelling recorded both by measured drawing and rectified photography. The rectified photography was later digitised for the final drawing.

4. TEACHING MATERIAL

In response to a need identified by the RecorDIM initiative the English Heritage Metric Survey Team has developed a teaching manual called 'Metric Survey for Heritage Documentation'. This is based on lesson plans and experience from teaching short courses over the past few years as well as various other sources. It consists of seven parts as follows:

1. Introduction
2. Drawing
3. EDM
4. Rectified Photography
5. Photogrammetry
6. GPS
7. Laser scanning

Each chapter describes the technique and itemises the tools and skills required. Examples are given in the form of case-studies. The emphasis of the document is in making metric survey techniques accessible so it is important that their proper application is discussed. Rectified photography and to a lesser extent REDM controlled real time CAD are benefiting from the recent technological advances which have resulted in price reductions for many electronic items. This has allowed for the broadening of experience for non-survey professionals.

5. OUTCOMES

Each group is tasked with producing a final set of drawings for presentation to the whole cohort on the last morning of the work shop (Fig. 4). As part of the presentation they communicate any problems faced and lessons learnt. Working towards a set deliverable is valuable experience for later in the master's programme when survey work is required for thesis projects. Another strand of the workshop has required the groups to prepare a brief for survey of nominated parts of the Kasteel and buildings in the grounds. Increasing awareness of the difference between using a minimum skill set and developing survey and selection skills helps the students' understanding about situations when a project requires the commissioning of experts.

6. CONCLUSIONS

The master's students are likely to undertake careers as conservation professionals internationally and in a number of different fields. It is hoped therefore that experiences of the conflicts and compromises involved in getting metric survey techniques to deliver heritage documentation will be communicated far and wide. It is evident that the misapplication of techniques due to a lack of appropriate knowledge is a common cause of the gaps and needs identified by the RecorDIM initiative.

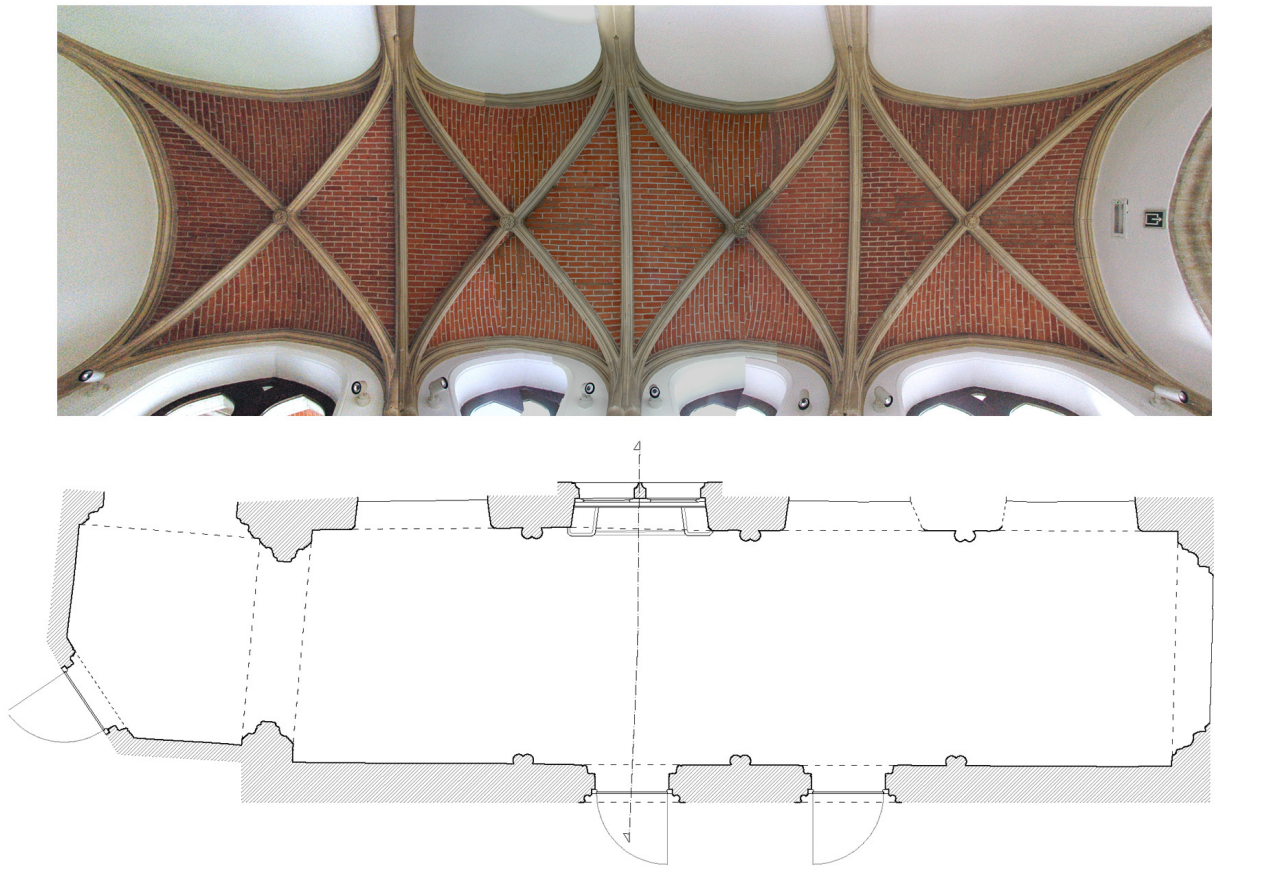

Fig 4. A photo-montage of the ceiling and floor plan produced by one of the groups of their work area.

The skill set delivered in short introductory courses is effective if clear deliverable products ensue: getting students to generate a plan or a rectified photograph and seeing how it performs as a record of condition or form is a powerful validation of technique. A balance has to be struck between tasks, which require time to master, and those which deliver feedback of conservation concerns. By using metric survey techniques the principles of measurement, data selection and information communication are reinforced by real-world practice.

The partnership between the English Heritage Metric Survey Team and the RLICC means survey skills are disseminated to a wide audience with a conservation focus. English Heritage is able to reach practitioners worldwide with the message that heritage documentation skills are accessible, flexible and user orientated as part of a conservation driven master's course. The forth coming RecorDIM publication of the teaching guide for the course will carry descriptions of the survey techniques, how they are used and examples of their use which will allow similar courses to be convened by other survey professionals and institutions.

As techniques become more accessible training in their application becomes ever more important. The all too common idea that heritage documentation can be delivered by 'black box' systems without an understanding of information needs can only be challenged by first hand user experience of how metric survey processes perform. By placing the conservator's hand on the controls it is hoped heritage documentation of the future will be effective, timely and relevant!

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