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DIGITAL DATA AND THE CONSERVATION OF THE HISTORIC BUILT ENVIRONMENT

Over recent years, the awareness of the need for conservation of the historic built environment has increased, and the role of the building historian and archaeologist, and employment of modern survey techniques and associated computer applications, has been extended.

An accurate record of a building or site is often an essential prerequisite to the planning of fabric and ground intervention works. As well as providing the basis of detailed works specifications and other contract documentation for conservation and management programmes, the record also informs the processes of analysis and interpretation, and thus enhances an ability to understand the significance of the historical and archaeological resource.

The production of graphic documentation is dependent on careful preparation and selection of the basic survey requirement. A variety of different methodologies, equipment and related software packages are available to capture, manipulate and output survey data. The choice of the most appropriate and reliable methodology should be dictated by the scale, accuracy and level of recording required. Data acquisition by means of photographic-based, instrument-based and hand-measured survey techniques may be applied individually, or more commonly in combination, and are increasingly being linked to CAD systems for onward processing by digital means (Fig. 1).

Instrument-based survey is a basic requirement for recording programmes in order to establish and maintain a standardised control framework, ideally in three dimensions and linked to national coordinates. Instrument survey may comprise total station observed control, consisting of a closed-traverse run, around and through a building or site, followed by trigonometric intersection of suitably observed points on a facade; or EDM tacheometry utilising micro-prisms (or reflectorless EDM survey) for cross-sections through complex enclosed structures.

Photographic-based survey (with instrument-based or hand-measured control) includes:

- close-range photogrammetry (based on stereo photography taken using 'metric' or 'partial metric' cameras)
- rectified photography (consisting of single photographs or a mosaic of overlapping photographs taken using large- or medium-format cameras aligned square to the object)
- semi-oblique photography (consisting of single or multiple non-metric photographs or freeze-frame video stills taken in a tilted plane to the object).

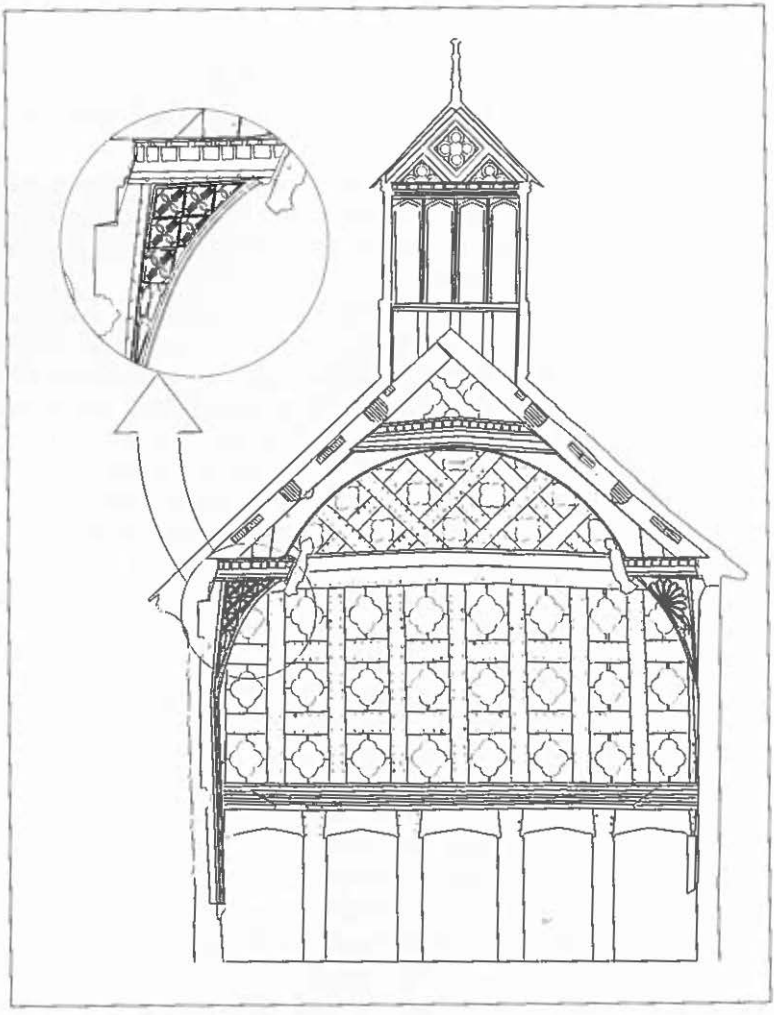

Fig. 1 – Rufford Old Hall (Lancashire, UK) – CAD drawing derived from reflectorless EDM and rectified photographic survey of a cross section of the late fifteenth-century Great Hall in advance of major roof repairs (Client: The National Trust. Drawing: Lancaster University Archaeological Unit).

Digital data processing within a CAD environment ensures:

- accuracy (raw survey data is incorporated into the CAD system and manipulated with no loss of original accuracy)
- security (the original data can be copied cheaply for storage or distribution)
- flexibility (it is possible to view and output data in a multitude of ways, at different scales, sizes and colours, and in two and three dimensions; to

layer drawing files and incorporate relevant textual information, as well as to spatially relate existing analogue records)
- economy (re-drawing, alterations and many of the more repetitive processes can be undertaken automatically).

CAD packages are many and varied, ranging from the simpler to the more advanced. The main differences between them include:
- the range of drawing and editing functions
- the efficiency and speed with which they carry out tasks
- flexibility of application
- three-dimensional modelling and rendering capabilities
- ability to customise to suit particular needs
- compatibility with other software and ease of file transfer
- interfaces with relational databases.

Not all structures need to be recorded in the same detail and different levels or hierarchies of documentation will be required in different circumstances, depending on the projects' aims and objectives, and in accordance with written specifications. Levels can range from comprehensive recording of complex buildings or sites, to selective recording of structures of more regular or repetitive construction. If the survey requires photography, then this may become the end product in itself. For comprehensive drawn records, each individual component of the relevant parts of a building's facade may be delineated. For selective recording, an outline of the major architectural features and associated detail is often sufficient. Where appropriate, these outline drawings can be supplemented by the provision of scaled rectified photographs to form a composite record.

For example, the requirements which may be considered for the different types of drawn and photographic record for a major building conservation project might include:
- base records (plans, elevations, cross-sections, and details)
- intervention records (before and during works and 'as-built')
- analysis and interpretation records (material type, surface finish, building periods, construction phases, occupational detail, and evidence for abandonment, demolition, reconstructions and projections).

What problems and opportunities face us:

1. More work is necessary to appraise and evaluate the performance of different types of survey and computer hardware and software against the practicalities of their use for the capture and manipulation of data both on and off site. The relative merits of the increasingly available low-cost systems offering so-called 'simple photogrammetry' could be explored, and developments in the use of high resolution digital cameras, video

rectification, reflectorless instrumentation, and pen-pad computers furthered.
2. Accepted guidelines for the different levels, hierarchies and specifications for documentation need to be established, or existing ones more widely publicised.
3. The use of such data beyond the archaeological record also needs to be addressed, and raises questions of whether file types, layering conventions and software should be standardised, and where and how the data should be safely held and properly archived and/or disseminated.
4. The value of three-dimensional computer modelling and virtual reality as aids to academic research and conservation management (as well as to presentation, education and marketing) could be expanded. The level and accuracy of detail and the methodology of two- and three-dimensional coordinate data capture are factors here, as are the affordability of hardware platforms and rendering and animation packages, and the availability of suitable training courses.
5. The creation of substantial data sets such as currently exist for large conservation or facility management projects are now requiring the full integration of three-dimensional survey and CAD systems with relational databases. Further work is necessary to establish whether these GIS principles have a major part to play in advancing spatial and functional analyses.

Finally, and perhaps above all, the now commonplace use of digital data offers the prospect of greater integration between those bodies responsible for the protection and management of the historic built environment, and the benefits of improved links within the planning, conservation, architectural and archaeological professions. It is only by working in close partnerships within multi-disciplinary teams that the historical and archaeological value of buildings and sites can be preserved and released.

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ABSTRACT

This paper illustrates the importance of digital records for the conservation of historic buildings and sites. The various survey techniques appropriate for the production of graphic documentation are explained, with an outline of the advantages of processing within a CAD environment. It introduces the debate on the scope and level of recording, and identifies problems and opportunities requiring further research. Finally, the paper stresses the need for integrated project management, and the development of recording strategies in conjunction with all other professional bodies involved in the conservation process.