

1. INTRODUCTION

1.1 Background

1.1.1 This document acts as an appendix to the main CAD/GIS strategy, and all methodologies set out there will apply here. Sites including cemeteries will be treated as a special case due to the complexity of the data and special requirements for their analysis. This document will deal with those additional levels of data necessary for cemetery analysis on top of this base level. For details of this base level refer to the main document on CAD/GIS methodology. The methodology set out here is intended to apply mainly to three specific sites with substantial funerary activity which warrant special treatment; Pepper Hill, Cuxton, and Saltwood Tunnel.

1.2 The Sites

1.2.1 It is not proposed to go into detail here about these sites and their research aims. A brief description of each site is given below to ascertain the parameters of the requirements for each site, as regards CAD/GIS data.

1.3 Pepper Hill

1.3.1 A Romano-British Cemetery consisting of approximately 600 graves just outside the Romano-British complex at Springhead (*Vagniacis*). The cemetery is adjacent to a hollow way and is a mixture of inhumations and cremations including pyre sites and in-situ cremations. The stratigraphy is complex with many inter-cutting graves. Bone preservation is generally very poor, but some coffin and body stains were identified. Spatial patterns in grave position and orientation were difficult to determine.

1.4 Saltwood Tunnel

1.4.1 A complex multi-period landscape including settlement activity as well as funerary elements. The principle funerary elements are an Early Bronze Age barrow cemetery (including associated cremations and an inhumation), a small Romano-British cremation cemetery and a substantial Anglo-Saxon cemetery, consisting of 219 graves in three distinct phases.

1.5 Cuxton

1.5.1 A small Anglo-Saxon cemetery of 36 graves many badly disturbed by root action. Other period remains include evidence of a farmstead with varying levels of occupation from around 900-300 BC.

1.6 General Research objectives

1.6.1 A summary of general objectives common to all sites is given below.

- Ascertain and refine a chronology for each cemetery. Investigate the spatial development of the cemetery and any spatial variations within the cemetery.
- Investigate the nature and distribution of structural features located within the cemetery and identify ancillary features associated with burial practise. Investigate the interface between the cemetery, nearby monuments and the landscape in terms of ritual and ceremonial use of the landscape.
- To obtain a detailed understanding of burial practise and its implications for religious beliefs, social status and cultural identity.

- To investigate patterns in the population using paleodemography and paleopathology.
- To compare cemeteries of the same period from different sites in relation to the above criteria.

1.6.2 Many of these research objectives will be assisted by hypothesis testing using statistical techniques and spatial analysis. This is especially so for Pepper Hill, where spatial patterns of grave orientation and position have been difficult to identify.

1.6.3 The site analysis methodology will generally consist of two main aspects, intra-grave and inter-grave. Inter-grave encompasses comparison of grave types across a whole cemetery, between cemeteries and burials within their wider landscape and in relation to adjacent features and monuments, as well as, comparison of graves from different cemeteries of the same period. Intra-grave comparison involves analysis of relative grave artefacts' position within graves, and combinations of grave artefacts.

1.7 General data structure.

1.7.1 The basic data structure will follow that defined in the main CAD/GIS document. A methodology has been established for other projects where the cut context number is used as a unique identifier in the database, called an 'intervention number', for all deposits and artefacts associated with that cut. The 'intervention number' is then attached, as appropriate, to excavated segments in the drawing. To query unexcavated parts of a feature, for example where a linear feature has several sections excavated through it, the group number for that feature is attached to a polygon encapsulating both the excavated and unexcavated parts of the feature. This allows the whole feature to be queried out for purposes such as phasing, but just the excavated portion, or a centroid point based upon it, for finds distributions etc. For the purposes of this document it will be assumed that the basic structure for all scheme drawings will be based on this system.

1.7.2 In most cases each burial has been assigned a sub-group number encapsulating grave cut, grave fills, grave finds, human remains etc. body shadows and inhumation human remains where present are identified by a specific context number. Cremated human remains are identified by deposit. The use of group numbers is not consistent across all the sites however. A more consistent identifier for each grave is the cut context number for each grave cut.

1.7.3 This will be sufficient for most inter-burial analysis and phasing, and comparison between cemeteries. However, additional levels of data will be required to address intra-grave analysis, as regards position of grave artefacts, human remains and other features within graves. This requires a greater level of spatial accuracy than position on a grave cut level. The position of these elements within the grave cut will need to be included.

2. USER REQUIREMENTS

2.1 Aims

2.1.1 To provide a standard approach to spatial data structure for cemetery sites.

2.2 General Requirements

2.2.1 The drawings must have the potential to be used for spatial analysis of the cemetery. This means they must be either compatible with GIS software or easy to export to the format used by GIS software.

2.2.2 The drawings will form the basis of all publication and archive illustrations for these sites. As such they must conform with a standard style for illustrations on a scheme wide level.

2.2.3 The drawings must be in a standard archival format for preservation purposes. Archive formats must be compatible with those accepted by the Archaeology Data Service (ADS), as they will curate the archive.

2.3 Specific User Requirements

2.3.1 The data will be structured for the creation of a GIS for each site. It is anticipated a degree of spatial statistical analysis will be appropriate for hypothesis testing. This should also allow for streamlining production of both report and monograph illustrations and the grave catalogue as outlined below.

2.3.2 Specific issues relating to how best to analyse and present cremation an pyre data will need to be addressed.

2.3.3 A grave catalogue will be generated in a standard format for all graves. The CAD/GIS structure must take this into account and if possible streamline the creation of this archive. This will be supplemented by a basic GIS, generated from the main GIS, allowing data to be explored as an online or CD resource.

2.3.4 Illustrations for the period based monographs and site reports will be generated either using *Adobe Illustrator* or *AutoCAD*. The data will need to be structured to allow easy export to these specific software requirements. The digitising process will also have to take into account the final scale of these illustrations, this is equally applicable to the grave catalogue.

3. DESIGN SPECIFICATION

3.1 Purpose

3.1.1 To provide an integrated approach to the spatial analysis and illustration of substantial cemetery sites on a scheme wide level. In order to achieve these requirements a structured and standardised approach to digitising of the site record will be implemented.

3.2 Scope

3.2.1 This methodology covers only the CAD/GIS aspect of sites with a substantial cemetery element, which qualifies them for detailed analysis above that provided for by the general site digitising process. It is assumed that a base level of digitising will have taken place before this is implemented. The specific sites this will cover are Cuxton, Pepper Hill and Saltwood.

3.3 Overview

3.3.1 Additional work will consist of digitising of all grave artefacts as an outline polygon and a centroid point location. Each will be tagged with a unique identifier, dependent on type of artefact. A standard grid will be placed over each grave and the positions of artefacts within that grid queried out into a database. This will form the basis of statistical analysis of artefact position within graves.

3.3.2 A GIS will be developed for each cemetery. The data will be exported as a series of Shapefiles. These can then be used, or converted to a format that can be used, in most commercially available GIS.

3.3.3 This will form the basis of a GIS as an online or CD resource. This will be based on using a free GIS viewer such as *ESRI Map Explorer 2.0* or similar freeware. As well as descriptive data, this will consist of interpretative layers of data as shapefiles created by attaching data from a database to the relevant shapefiles and querying out data of interest.

3.3.4 Illustrations for the grave catalogue and for publication will not be a specific function of this methodology, although this will need to be standardised. The data produced will form the basis for these drawings and will be readily transferable to whatever software packages are used for final illustration purposes. The basic building blocks for illustration purposes can be queried out via a GIS for specific purposes.

3.3.5 An exact methodology for spatial analysis of pyres and cremations has yet to be finalised. To assist this the GIS will also fulfil a spatial decision support role. This will allow specialists to fully explore the data and decide what kind of analysis will best achieve the research objectives.

3.3.6 Archiving will not be specifically addressed here as this is a function of the main CAD/GIS methodology.

3.4 Methodology

3.4.1 The cemeteries will be initially digitised in line with the general methodology for all sites. In addition to this the following additional work will be carried out on the cemetery sites to support the additional analysis necessary.

3.4.2 All grave artefacts will be digitised as a polygon outline and a unique identifier number will be attached, as attribute data, to each polygon. Polygons will be digitised as closed polylines. From these polygons a centroid point will be generated with the same unique identifier attribute data attached. This will include coffin furniture, where recorded, for illustration purposes. It is not proposed to do any in-depth analysis of coffin furniture at this stage.

3.4.3 The unique identifier number will be the context number of that object where a context number has been assigned (e.g. for pottery vessels, coffin stains and articulated skeletal remains), and the special find number for all other objects.

3.4.4 Vessels containing cremations have been excavated and planned by spit. From this it should be possible to establish whether there is any pattern to how remains have been placed within the cremation vessel. It will not be necessary at this stage to digitise these cremation vessel plans, except where grave goods have been identified, position of human remains can be noted in the database and this data queried out for spatial analysis via the unique number attached to cremation vessels. However more complex analysis may be found to be necessary, including statistical analysis, to ascertain any pattern. Therefore this methodology does not preclude this being done if it is found to be significant enough to warrant more detailed analysis.

3.4.5 From the initial CAD drawing a series of shapefiles will be exported. Since different GIS software may be in use by different contractors no standard format of GIS projects will be set out here. However Shapefiles will form the standard interchange format for GIS data. The form of these shapefiles is outlined in the section on data structure.

3.4.6 A basic GIS will be built to supplement the site catalogue of burials. The exact form this will take has yet to be finalised but it will be either web-based or based upon a free viewer such as *ESRI Map explorer*. The standard shapefiles generated from the CAD data will form the basis of this, but as well as a level of descriptive data a series of more interpretative layers (phasing etc.) will be generated.

3.4.7 A standardised grid will be generated over each grave centred on the centroid point for the cut of that grave and orientated on the grave's longest centreline. The position of grave artefacts in relation to this grid will then be queried out into a database. Areas of disturbance or truncation of graves will also be recorded on this grid.

3.5 Software Requirements

3.5.1 The Drawings will be compatible with, or easy to export to, *Autodesk AutoCAD Map 2000, ESRI Arcview 3.2* and *Adobe Illustrator 9.0* software.

3.6 End Product

3.6.1 The basic end product will be a series of standardised shapefiles for each cemetery which can be tailored to the individual requirements of each cemetery, and a database recording artefact position based on a standard grid. They can be used to build a GIS for spatial analysis and spatial decision support, querying out spatial data for illustration and form the basis of a grave catalogue and general access GIS with interpretative shapefiles derived from the base set of shapefiles.

3.7 Data Structure

3.7.1 The following shapefiles will be produced additional to those produced for main site digitising:

Shapefile description	**filename***	**file type**	**Attribute data**		
			data type	**field size**	**attribute description**
grave intervention	grave.shp	polygon	integer	6	context number of grave cut
grave intervention centroid	gravept.shp	point	integer	6	context number of grave cut
grave artefact identified by a context	artefact.shp	polygon	integer	6	context number assigned to artefact
grave artefact identified by a context centroid	artfpt.shp	point	integer	6	context number assigned to artefact
body stain	stain.shp	polygon	integer	6	context number assigned to body stain
body stain centroid	stainpt.shp	point	integer	6	context number assigned to body stain
coffin stain	coffin.shp	polygon	integer	6	context number assigned to coffin stain
coffin stain centroid	coffinpt.shp	point	integer	6	context number assigned to coffin stain
human remains	skele.shp	polygon	integer	6	context number assigned to remains
human remains centroid	skelept.shp	point	integer	6	context number assigned to remains
grave artefact identified by special find number	sf.shp	polygon	integer	6	special find number assigned to artefact
grave artefact identified by special find number centroid	sfpt.shp	point	integer	6	special find number assigned to artefact

*naming conventions follow ESRI advice on shapefile nomenclature of up to 11 (8.3) characters. Longer names can cause problems with Arcview 3.3 or earlier.