STRATASCAN

Geophysical Survey Report

Longstanton, Cambridgeshire

for

Birmingham Archaeology

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1 SUMMARY OF RESULTS

A magnetic susceptibility survey was carried out over 4.75 ha of a linear corridor. Four areas were identified as having enhanced magnetic susceptibility levels and were targeted with detailed magnetic survey.

Area 3 revealed an anomaly which may have an archaeological origin. All other areas show no evidence of any archaeological remains.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by Birmingham Archaeology to undertake a geophysical survey of the proposed route of a new road.

2.2 Site location

The site is located at Longstanton, Cambridgeshire, to the north west of Cambridge, at OS ref. TL 391 664.

2.3 Description of site

The survey area is 4.75 ha of flat grass covered land. The underlying geology is Ampthill clay and Kimmeridge clay (British Geological Survey South Sheet, Fourth Edition Solid, 2001). The overlying soils are of the Evesham 3 soil association. These are slowly permeable calcareous clayey, and fine loamy over clayey soils. Some slowly permeable seasonally waterlogged non-calcareous clayey soils may be present (Soil Survey of England and Wales, Sheet 4 Eastern England).

2.4 Site history and archaeological potential

No details are available.

2.5 Survey objectives

The objective of the survey was to locate any features of possible archaeological origin in order that they may be assessed prior to development.

2.6 Survey methods

The reconnaissance technique of magnetic susceptibility was employed over the whole of the survey area. From this four areas of enhancement were targeted with detailed magnetometer survey. More information regarding these techniques is included in the Methodology section below.

3 METHODOLOGY

3.1 Date of fieldwork

The fieldwork was carried out over 4 days from 15 March 2005 to 18 March 2005 when the weather was fine.

3.2 Grid locations

The location of the survey grids has been plotted in Figure 3, with referencing information given for each individual area in (Figures 4, 10, 16, 22).

3.3 Description of techniques and equipment configurations

3.3.1 Magnetic Susceptibility

Alteration of iron minerals in topsoil through biological activity and burning can enhance the magnetic susceptibility (MS) of that soil. Measuring the MS of a soil can therefore give a measure of past human activity and can be used to target the more intensive and higher resolution techniques of Magnetometry and Resistivity. Measurements of MS were carried out using a field coil which provides a rapid scan and has the benefit of allowing "insitu" readings to be taken.

The equipment used on this contract was an MS2 Magnetic Susceptibility meter manufactured by Bartington Instruments Ltd. A field coil known as an MS2D was used to take field readings. This assessed the top 200mm or so of topsoil. To overcome the problem of ground contact all readings were taken 4 or 5 times and an average taken. All obvious localised "spikes" were ignored.

3.3.2 Magnetometer

Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTesla (nT) in an overall field strength of 48,000nT, can be accurately detected using an appropriate instrument.

The mapping of the anomaly in a systematic manner will allow an estimate of the type of material present beneath the surface. Strong magnetic anomalies will be generated by buried iron-based objects or by kilns or hearths. More subtle anomalies such as pits and ditches can be seen if they contain more humic material which is normally rich in magnetic iron oxides when compared with the subsoil.

To illustrate this point, the cutting and subsequent silting or backfilling of a ditch may result in a larger volume of weakly magnetic material being accumulated in the trench compared to the undisturbed subsoil. A weak magnetic anomaly should therefore appear in plan along the line of the ditch.

The magnetic survey was carried out using dual FM256 Fluxgate Gradiometers, manufactured by Geoscan Research. The gradiometers are suspended on a frame CF6. One gradiometer acts as a master trigger that controls the second slave gradiometer.

The instruments each consist of two fluxgates mounted 0.5m vertically apart and very accurately aligned to nullify the effects of the Earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background.

3.4 Sampling interval, depth of scan, resolution and data capture

3.4.1 Sampling interval

Magnetic susceptibility
The magnetic susceptibility survey was carried out on a 20m grid with readings being taken every 10m perpendicular to the road corridor every 20m along the corridor.

Magnetometer
Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid.

3.4.2 Depth of scan and resolution

Magnetic Susceptibility
The MS2D coil assesses the average MS of the soil within a hemisphere of radius 200mm. This equates to a volume of some $0.016m^3$ and maximum depth of 200mm. As readings are only at 20m centres this results in a very coarse resolution but adequate to pick up trends in MS variations.

Magnetometer
The FM256 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. The collection of data at 0.25m centres provides an appropriate methodology balancing cost and time with resolution.

3.4.3 Data capture

Magnetic susceptibility
The readings are logged manually on site, and then transferred to the office where they are entered into a computer and grey scale plots are produced.

Magnetometer
The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each job, data is transferred to the office for processing and presentation.

3.5 Processing, presentation of results and interpretation

3.5.1 Processing

Magnetic susceptibility
No processing of the data has been undertaken.

Magnetometer
Processing is performed using specialist software known as *Geoplot 3.* This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves 'flattening' the background levels with respect to adjacent traverses and adjacent grids. 'Despiking' is also performed to remove the anomalies resulting from small iron objects often found on agricultural land. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following schedule shows the basic processing carried out on all processed magnetometer data used in this report:

Zero mean grid	*Threshold = 0.25 std. dev.*
Zero mean traverse	*Last mean square fit = off*
Despike	*X radius = 1 Y radius = 1*
	Threshold = 3 std. dev.
	Spike replacement = mean

Raw data and trace plots have been adjusted to remove artefacts of the data collection process.

3.5.2 Presentation of results and interpretation

Magnetic susceptibility
The presentation of the data for this site involves a colour plot of the field measurements overlain onto a site plan (see Figure 2).

Magnetometer
The presentation of the data for each Area involves a print-out of the raw data both as grey scale (e.g. Figure 5) and trace plots (e.g. Figure 6 and 7), together with a grey scale plot of the processed data (e.g. Figure 8). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the Area (e.g. Figure 9).

4 RESULTS

4.1 Magnetic susceptibility

The results from the magnetic susceptibility survey are generally low across the site. This may reflect a naturally low level of magnetic minerals in the soil.

Four areas have been identified as having enhanced magnetic susceptibility readings. Two in the south of the site and two in the north of the site. These have values ranging up to around 20 $x10^{-8}$ SI units. While on many sites these values would be considered low – moderate enhancement, on this site they are considered high compared to the general low response throughout the data. These four areas have been targeted for detailed magnetic survey.

4.2 Detailed magnetic survey

4.2.1 Area 1

Cutting the south west corner of Area 1 is an area of strong magnetic disturbance. This is likely to have a modern origin. It may represent the line of a service, although it is difficult to say without seeing the entire anomaly. A smaller area of magnetic disturbance is observed to the east of this which is also likely to represent a modern feature.

Three faint linear anomalies can be seen cutting across the area at an angle. These are roughly parallel and around 12 apart. They are probably agricultural marks caused by ploughing.

4.2.2 Area 2

Within this area are further parallel anomalies at the same angle as those seen in Area 1. These are likely to be a continuation of the agricultural marks already observed.

A discrete anomaly is observed in the south of the survey area which is probably caused by a modern ferrous object.

4.2.3 Area 3

In the north of this area a positive curvilinear anomaly is observed with an associated negative response. It is possible this is caused by a cut feature with an associated bank on its sides. Its exact origin is unclear, although it may be archaeological.

4.2.4 Area 4

This area contains further evidence of ploughing activity in the form of linear parallel anomalies. These are at a different angle to those seen in previous areas, suggesting they are related to a different phase of activity or a different field.

Positive point anomalies have also been identified which are probably caused by modern ferrous objects.

5 CONCLUSION

The magnetic susceptibility survey returned a generally low level response across the site suggesting that only a low level of naturally occurring magnetic minerals are present within the soil. Four areas were identified within the data which showed comparatively high readings.

The detailed magnetic survey showed all four areas to contain evidence of agricultural activity. Only one area, Area 3, revealed any anomalies that may be of archaeological origin. Area 1, Area 2, and Area 4 appear devoid of any archaeological remains.

REFERENCES

British Geological Survey, 2001. *Geological Survey Ten Mile Map, South Sheet, Fourth Edition (Solid).* British Geological Society.

Soil Survey of England and Wales, 1983. *Soils of England and Wales, Sheet 4 Eastern England*.