STRATASCAN

Geophysical Survey Report

White Horse Hotel, Romsey

For

AOC Archaeology

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J2069

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REGISTERED IFA ORGANISATION

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LIST OF FIGURES

1 SUMMARY OF RESULTS

A Ground Penetrating Radar survey was undertaken at the White Horse Hotel, Romsey. A number of anomalies have been identified that may represent features of archaeological origin including possible fragmented structural remains.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation being undertaken by AOC Archaeology.

2.2 Site location

The site is located in the car park of the White Horse Hotel, Romsey at OS NGR ref. SU 353 212.

2.3 Description of site

The site comprises of 1750m^2 of tarmac car park at the White Horse Hotel in Romsey.

The underlying geology is Barton, Bracklesham and Bagshot Beds (British Geological Survey South Sheet, Third Edition Solid, 1979). The overlying soils have not been surveyed.

2.4 Site history and archaeological potential

No specific details were available to Stratascan.

2.5 Survey objectives

The objective of the survey was to locate any boundary ditches and early buildings that may be below the surface prior to trenching.

2.6 Survey methods

Ground Penetrating Radar was used as an efficient method for collecting data through tarmac

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 1 day on the 6th of October 2005 when the weather was fine.

3.2 Grid locations

The location of the survey grids has been plotted in Figure 2.

3.3 Description of techniques and equipment configurations

Two of the main advantages of radar are its ability to give information of depth as well as work through a variety of surfaces, even in cluttered environments and which normally prevent other geophysical techniques being used.

A short pulse of energy is emitted into the ground and echoes are returned from the interfaces between different materials in the ground. The amplitude of these returns depends on the change in velocity of the radar wave as it crosses these interfaces. A measure of these velocities is given by the dielectric constant of that material. The travel times are recorded for each return on the radargram and an approximate conversion made to depth by calculating or assuming an average dielectric constant (see below).

Drier materials such as sand, gravel and rocks, i.e. materials which are less conductive (or more resistant), will permit the survey of deeper sections than wetter materials such as clays which are more conductive (or less resistant). Penetration can be increased by using longer wavelengths (lower frequencies) but at the expense of resolution (see 3.4.2 below).

As the antennae emit a "cone" shaped pulse of energy an offset target showing a perpendicular face to the radar wave will be "seen" before the antenna passes over it. A resultant characteristic *diffraction* pattern is thus built up in the shape of a hyperbola. A classic target generating such a diffraction is a pipeline when the antenna is travelling across the line of the pipe. However it should be pointed out that if the interface between the target and its surrounds does not result in a marked change in velocity then only a weak hyperbola will be seen, if at all.

The Ground Probing Impulse Radar used was a SIR2000 system manufactured by Geophysical Survey Systems Inc. (GSSI).

The radar surveys were carried out with a 400MHz antenna. This mid-range frequency offers a good combination of depth of penetration and resolution.

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

3.4.1 Sampling interval

Radar scans were carried out along traverses 1m apart on a parallel grid as shown in Figure 2. Data was collected at 40 scans/metre. A measuring wheel was used to put markers into the recorded radargram at 1m centres.

3.4.2 Depth of scan and resolution

The average velocity of the radar pulse is calculated to be 0.085m/nsec which is typical for the type of sub-soils on the site. With a range setting of 45nsec this equates to a maximum depth of scan of 1.9m respectively but it must be remembered that this figure could vary by ± 10% or more. A further point worth making is that very shallow features are lost in the strong surface response experienced with this technique.

Under ideal circumstances the minimum size of a vertical feature seen by a 200MHz (relatively low frequency) antenna in a damp soil would be 0.1m (i.e. this antenna has a wavelength in damp soil of about 0.4m and the vertical resolution is one quarter of this wavelength). It is interesting to compare this with the 400MHz antenna, which has a wavelength in the same material of 0.2m giving a theoretical resolution of 0.05m. A 900MHz antenna would give 0.09m and 0.02m respectively.

3.4.3 Data capture

Data is displayed on a monitor as well as being recorded onto an internal hard disk. The data is later downloaded into a computer for processing.

3.5 Processing, presentation of results and interpretation

3.5.1 Processing

The radar plots included in this report have been produced from the recorded data using Radan software. No processing was undertaken.

3.5.2 Presentation of results and interpretation

Manual abstraction
Each radargram has been studied and those anomalies thought to be significant were noted and classified as detailed below. Inevitably some simplification has been made to classify the diversity of responses found in radargrams.

i. Strong and weak discrete reflector.
These may be a mix of different types of reflectors but their limits can be clearly defined. Their inclusion as a separate category has been considered justified in order to emphasise anomalous returns which may be from archaeological targets and would not otherwise be highlighted in the analysis.

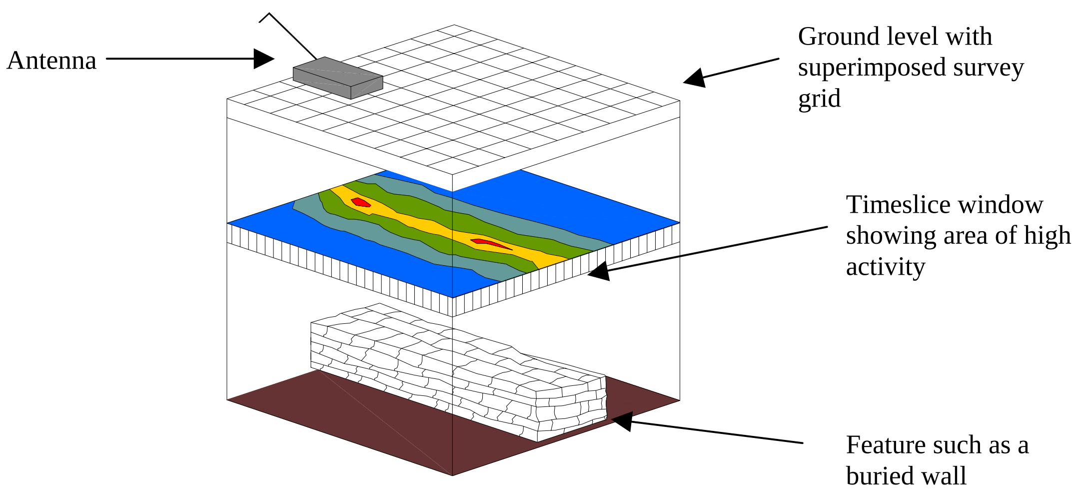
ii. Complex reflectors.
These would generally indicate a confused or complex structure to the subsurface. An occurrence of such returns, particularly where the natural soils or rocks are homogeneous, would suggest artificial disturbances. These are subdivided into both strong and weak giving an indication of the extent of change of velocity across the interface, which in turn may be associated with a marked change in material or moisture content.

iii. Point diffractions.
These may be formed by a discrete object such as a stone or a linear feature such as a small diameter pipeline being crossed by the radar traverse (see also the second sentence in 4. below).

iv. Convex reflectors and broad crested diffractions.
A convex reflector can be formed by a convex shaped buried interface such as a vault or very large diameter pipeline or culvert. A broad crested diffraction as opposed to a point diffraction can be formed by (for example) a large diameter pipe or a narrow wall generating a hybrid of a point diffraction and convex reflector where the central section is a reflection off the top of the target and the edges/sides forming diffractions.

v. Planar returns.
These may be formed by a floor or some other interface parallel with the surface. These are subdivided into both strong and weak giving an indication of the extent of change of velocity across the interface which in turn may be associated with a marked change in material or moisture content.

Timeslice plots
In addition to a manual abstraction from the radargrams, a computer analysis was also carried out. The radar data is interrogated for areas of high activity and the results presented in a plan format known as timeslice plots (Figures 9-12). In this way it is easy to see if the high activity areas form recognisable patterns.



The GPR data is compiled to create a 3D file. This 3D file can be manipulated to view the data from any angle and at any depth within range. The data was then modelled to produce activity plots at various depths. As the radar is actually measuring the time for each of the reflections found, these are called "time slice windows". Plots for various time slices have been included in the report. Based on an average velocity calculations have been made to show the equivalent depth into the ground. The data was sampled between different time intervals effectively producing plans at different depths into the ground.

The weaker reflections in the time slice windows are shown as dark colours namely blues and greens. The stronger reflections are represented by brighter colours such as light green, yellow, orange, red and white (see key provided in Figures 9-12).

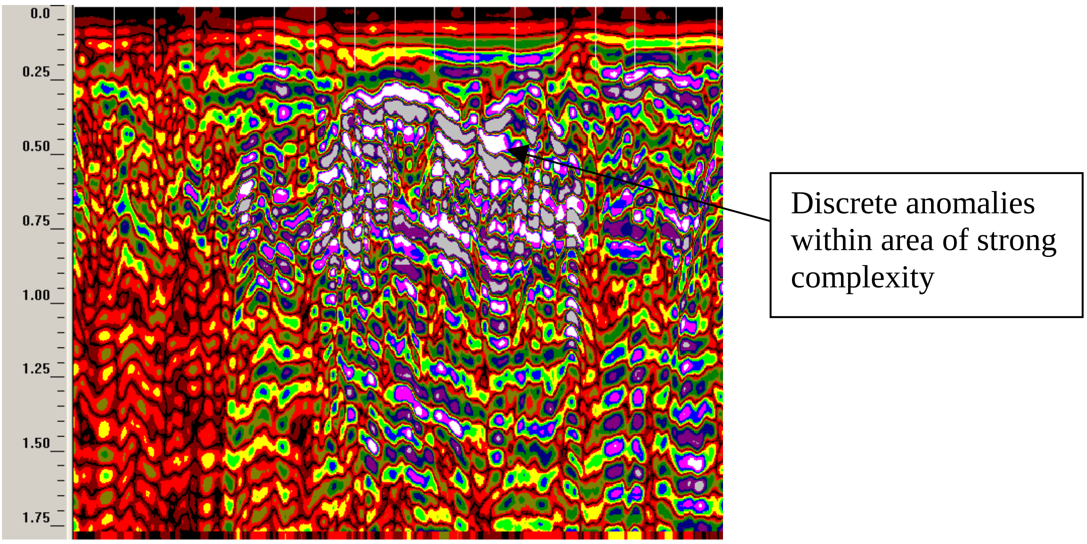
Reflections within the radar image are generated by a change in velocity of the radar from one medium to another. It is not unreasonable to assume that the higher activity anomalies are related to marked changes in materials within the ground such as foundations or surfaces within the soil matrix.

4 RESULTS

The Ground Penetrating Radar survey undertaken at The White Horse Hotel, Romsey was successful in locating a number of anomalies that may be of archaeological potential. These anomalies include complex, discrete, planar and broad crested anomalies.

Complex and Discrete Anomalies

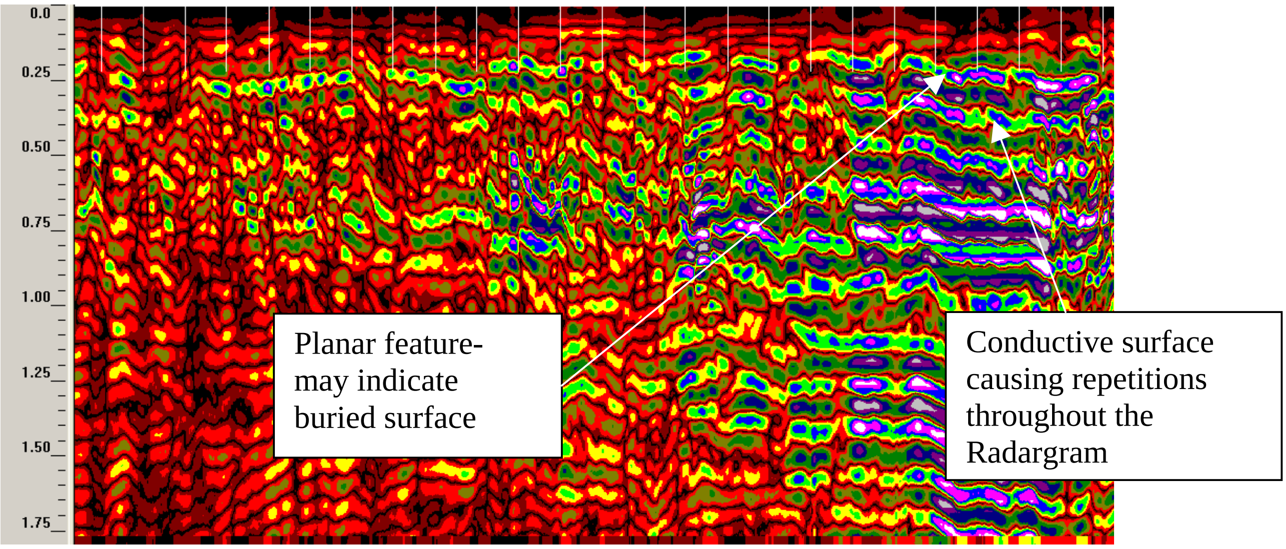
Complex and discrete anomalies can be seen across the site. To the eastern edge of the survey area these anomalies have a depth of around 0.3m. Complex and discrete anomalies occurring together like this may represent evidence of fragmented structural remains. This type of feature can be seen in Example Radargram 1.



Example Radargram 1- Transect along 92N between 104E and 120E

Planar Anomalies

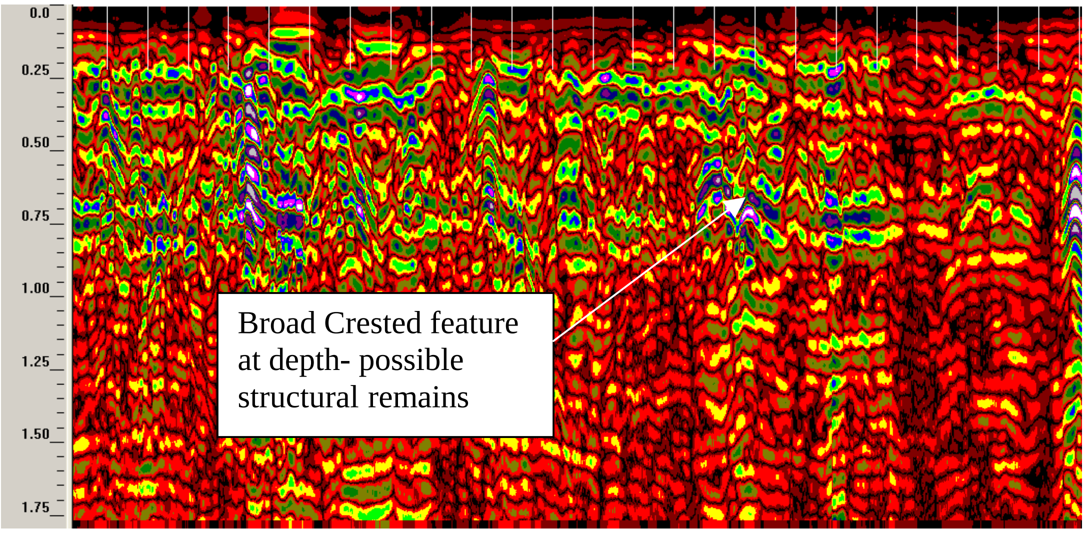
Planar anomalies are evident in the north and eastern edges of the survey area at an average depth of around 0.2m. The strongest evidence for these anomalies can be seen to the east of the site. Planar features may relate to a buried surface beneath the tarmac. Further investigation is required in order to ascertain the nature of these features. See Example Radargram 2. A number of the planar anomalies have a conductive nature which is also evident in Example Radargram 2.



Example Radargram 2- Transect along 95N between 95E and 121E

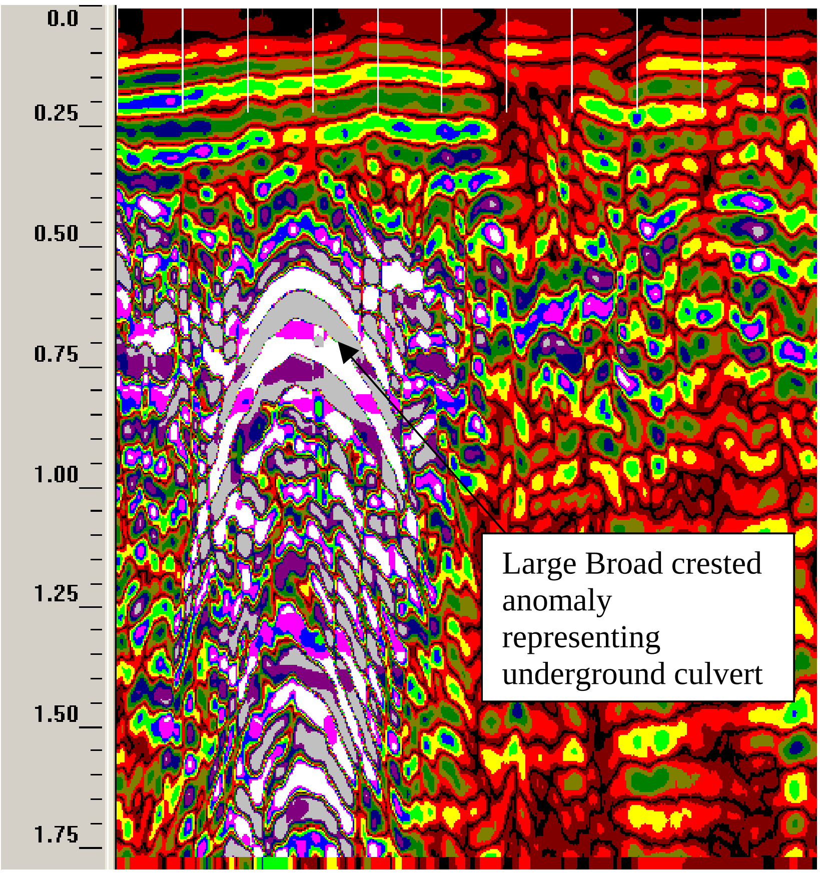
Broad Crested Anomalies

A large number of broad crested anomalies are evident across the survey area, many of which are likely to be related to modern services. However, there is a small group of this type of anomaly located at approximately 100E, 105N. The depth (0.6m) and character of these anomalies may suggest that they are of archaeological origin and could represent fragmented structural remains. This feature is shown in Example Radargram 3.

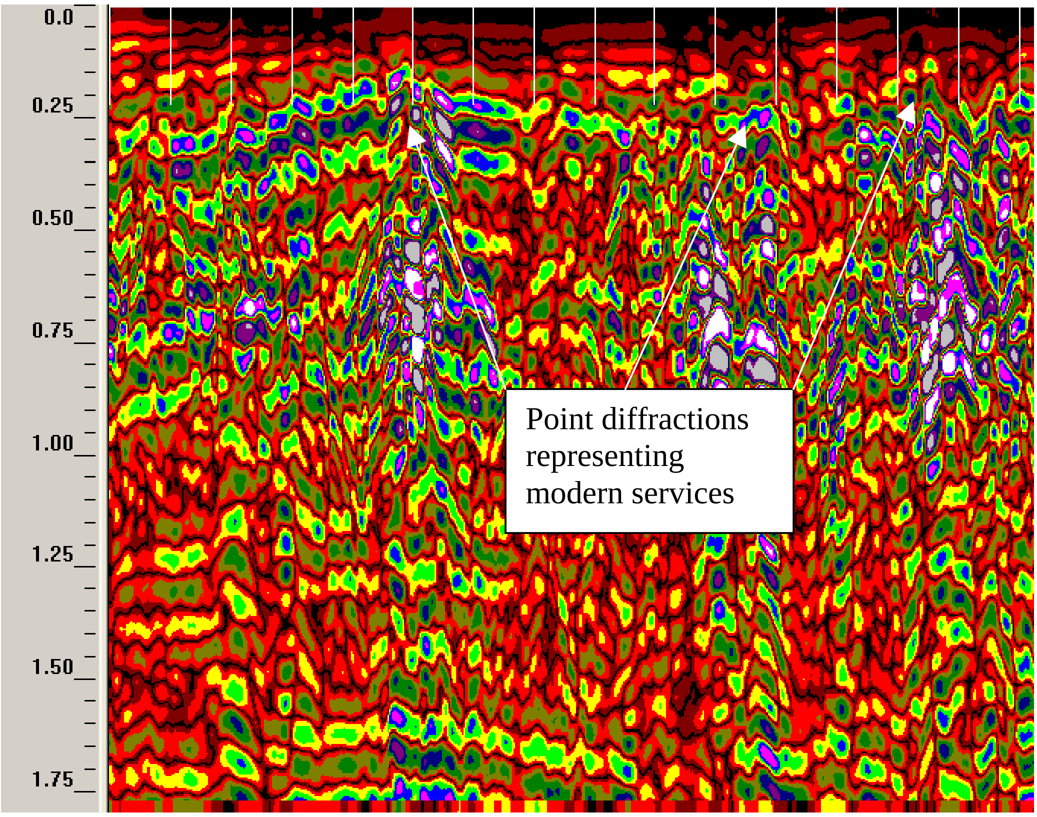


Example Radargram 3- Transect along 105N between 75E and 101E

A number of anomalies have been identified that may represent modern activity. These include point diffractions and broad crested features. The underground culvert that runs through the western edge of the site can be seen in the form of large broad crested anomalies (see Example Radargram 4). Point diffractions representing modern services can be seen in Example Radargram 5.



Example Radargram 4- Transect along 96N between 59E and 69.5E



Example Radargram 5- Transect along 115N between 66E and 82E

5 CONCLUSION

The Ground Penetrating survey undertaken at The White Horse Hotel has been successful in locating a number of features with possible archaeological potential. Areas of complexity with associated discrete features, as seen in Example Radargram 1 and shown in blue hatching in the interpretation may show evidence of buried, fragmented structural remains. Discrete features without areas of complexity may also represent buried structural remains, however, those at a more shallow depth may indicate the cut of a service trench. Broad crested features such as those shown in Example Radargram 3 also indicate the presence of possible structural remains.

The presence of planar anomalies may indicate buried former surfaces. However, it is difficult to determine as to whether these features represent the former floor surface of a building or if they show the surface level of the car park before it was covered in tarmac. Conductive surfaces may show evidence of possible reinforced concrete slabs or other types of conductive material such as ash or slag.

Areas of strong complexity across the survey area show evidence of a change in ground condition. This change could be as a result of ground disturbance or scattered structural debris. Further investigation is required in order to identify the origin of these features. An area of strong complexity can be seen in Example Radargram 1.

Modern activity on the site can be seen in the form of point diffractions indicating the presence of services. Point diffractions are evident across the entire survey area. The underground culvert that runs north to south on the western edge of the site is clearly indicated by the presence of large broad crested features as seen in Example Radargram number 4.