EIA Quality Mark Case Study

Identifying Archaeology Using Satellite Imagery Captured During Drought Conditions

Purpose of the project:
High Speed Two (HS2) is a new high-speed railway proposed by the Government to connect major cities in Britain. Stations in London, Birmingham, Leeds, Manchester and East Midlands will be served by high speed trains running at speeds of up to 225mph (360kph). Trains will also run beyond the HS2 network to serve destinations including South Yorkshire, Liverpool, Glasgow, Edinburgh, Newcastle and York. It is intended to form the ‘backbone’ of the British national rail network, increasing capacity and connectivity to the country.

Description of the project:
HS2 will be built in phases. Phase 2a of HS2 is the western section of Phase Two, between the West Midlands and Crewe, approximately 60km in length. The scheme is being delivered by a ‘hybrid Bill’ which involves a special procedure that is debated in both UK Houses of Parliament. The Phase 2a route extends north-west from Fradley, where it connects with Phase One, to Crewe across a landscape of varying geologies, topographies and regions. The design of the railway tends to avoid topographic extremes and heavily built-up areas, which means that it runs through largely rural areas. Crossing the east-west watershed of the country, the heritage resources of north-western end of the route are quite different in character to those further south-east.

Phase 2a of HS2 has been subject to an Environmental Impact Assessment (EIA), where both construction and operation impacts from the project were considered.
Key Issues:
The first step in the cultural heritage assessment process required the identification of the baseline heritage receptors (‘assets’). However, in a landscape which had seen little previous archaeological investigation leading to an under representative baseline, the use of remote sensing was an essential tool for the assessment team.

The exceptionally dry conditions experienced by the UK in the early summer of 2018 provided an opportunity to gain further understanding of heritage resources within the land required for Phase 2a of HS2 through analysis of remotely sensed data, in this case true-colour satellite imagery captured at the peak of the drought. Additional insights into the extent and nature of the heritage resource can lead to better protection and more informed decision-making.

In essence, sub-surface features are more visible when drought-induced differential vegetation growth emphasises changes to the surrounding soil, grass or crop. Through imagery analysis these changes can be detected and enhance the clarity and understanding of the extent and nature of an archaeological feature.

The output, a remote sensing analysis report, broadened and added robustness to the existing historic environment baseline. When actioned early in the project-cycle this type of analysis can help minimise the risk of potential adverse effects on heritage resources, further de-risking the project.

This work, undertaken in conjunction with Arup, demonstrated the effectiveness of a desk-based assessment that harnessed available higher resolution datasets captured by satellites re-visiting areas more regularly and frequently than in past years. This allowed focused temporal data selection, maximising the effectiveness of the information and resources available.

Lessons Learnt:
Whilst the technique of analysing ‘remotely sensed’ information is not new to the field of archaeology; the availability of high-resolution satellite imagery is playing an ever-increasing role in heritage management. While this was just one of many techniques and data sources used to inform the heritage baseline, it was demonstrated to be a cost-effective way of contributing a considerable amount to our understanding of the buried resource. Without it, our knowledge of the likely extent, nature and significance of the buried archaeology affected by Phase 2a of HS2 would have been reduced.

During the analysis process, the type and significance of features visible in imagery is often open to interpretation. In some instances, features were well-defined, having clear boundaries and extents and corresponding closely to known site-types. However, more often than not, features were unclear or partially obscured, requiring considerable thought, contextual research, and interpretation, based on professional judgement and experience. The combined input of a team of archaeologists, with a variety of backgrounds and expertise, was important in developing a deliverable of the highest possible accuracy.
The graphic presentation of the results, illustrating the newly identified features and distinguishing them clearly from the existing dataset, also presented a challenge. We opted for a ‘split-screen’ approach enabling visibility of the features in the imagery, with and without the transcriptions. This allows the viewer to see the ‘real’ appearance of the features as well as their transcribed interpretation.

True-colour imagery analysis is just one method of remote sensing that can aid archaeological featured detection. Further insights can be gleaned through review of the near-infrared bands, as well as other band-combinations, conducive to archaeologically feature detection. Whilst the science behind alternative complimentary approaches may differ slightly, the data collection, method and process is wholly similar (with minimal additional cost). Including these approaches as part of the assessment process only adds to the toolbox of feature detection techniques.

Overall, the review of the 2018 drought imagery demonstrated the need to remain aware of opportunities for improved understanding of the baseline. The specific nature of the drought conditions provided important new insights into buried archaeology and therefore project risks ahead of construction.

**Contact Details:**

Michael Tomiak ([Michael.Tomiak@erm.com](mailto:Michael.Tomiak@erm.com)) from Environmental Resources Management (ERM) is the Historic Environment Data Manager supporting delivery of HS2 Phases 2a and 2b. He specialises in GIS and remote sensing techniques used for archaeological identification and assessment, and digital innovation relating to the technical field.

Jessica McIver, Karolina Werens, and Leo Thomas are ERM cultural heritage consultants supporting HS2 surveys and assessments.

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