Data Opportunities: Creating a web of knowledge

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Large-scale projects, such as infrastructure or long-term research, generate some of the largest data sets which form the core of their legacy for research and future projects. Due to the scale of the data being generated and managed, projects have developed innovative approaches to transform data into meaningful information and ensure integration of data into the project lifecycle. This paper serves to present the background and context for the session presented at EAA 2022, Budapest, organised by HS2 Ltd and Jacobs Suedlink and summarises some of the papers presented within the session and which are now published in this issue.

1. HS2 and the Historic Environment

HS2 is the UK's flagship transport levelling-up project. It is Europe's largest infrastructure project. The new high-speed line was planned to run between the North West and the South East, stopping at Manchester, Crewe, Birmingham and London with trains continuing on the existing network to Scotland and elsewhere. HS2 intends to integrate with new lines and upgrades across Britain's rail system to deliver faster travel to many towns and cities across Britain not directly on the HS2 route, including Liverpool, Sheffield, Nottingham and Derby, a total of over 230 miles of new high-speed line, with the following original phases.

- HS2 Phase One (linking the West Midlands to London)
- HS2 Phase 2a (extending the line to Crewe)
- HS2 Phase 2b (completing the line to Manchester)
- HS2 East (linking the West and East Midlands with services to Yorkshire)

Video: [HS2 Project Update, October 2022](#)

2. What is HS2 - HS2

- [What is HS2?](#)
- [Archaeology - HS2](#)
- [Archaeology and Heritage](#) (YouTube)

Before bridges, tunnels, tracks and stations are built, an unprecedented amount of archaeological work will take place along the line of route. HS2's historic environment programme is the largest ever undertaken in the UK, giving the opportunity to tell over 10,000 years of British history between London, the West Midland, Crewe and ultimately, Manchester.

Figure 1: The original phases of HS2. Image credit: HS2 Ltd

More than 1,000 archaeologists, specialists, scientists, and conservators are exploring and recording as part of HS2's works. Their work has already revealed sites from the Prehistoric period, through Roman Britain, the Anglo-Saxon and Medieval ages, the Industrial Revolution, to World War 2. HS2's archaeology programme promises to provide a fascinating insight into the everyday lives of the people and communities who made modern Britain. It's a project that will have a huge impact on the UK, dramatically enriching our cultural heritage and leaving a legacy for the future.

Figure 2: Excavations at Blackgrounds Farm, Northamptonshire. At its peak during the Roman age, Blackgrounds would have been a bustling and busy area, shown though the evidence of workshops, kilns, and several beautifully preserved wells, uncovered by HS2 archaeologists. Image credit: HS2 Ltd

3. HERDS

HERDS (Historic Environment Research and Delivery Strategy) was developed as a response to the commitments in the HS2 Phase One Heritage Memorandum and sets the strategy for investigating the historic environment, along with the mechanisms for the design and delivery of the works. The scale of HS2 necessitated an approach that considered the significance of the archaeological remains encountered and a proportionate response to their mitigation.

HERDS proposes a question-led approach to the mitigation of the historic environment. A series of specific objectives around knowledge creation, community engagement and skills were developed. HERDS provides a focus to the works and contributes to public benefit from the work undertaken.

- [HS2 Phase One Historic Environment Research and Delivery Strategy - GOV.UK](#)
- [HS2 Phase 2a Historic Environment Research and Delivery Strategy - GOV.UK](#)
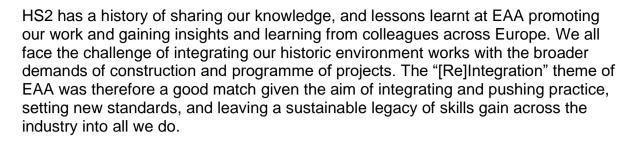- [Environmental minimum requirements for HS2 Phase 2b (Crewe - Manchester) - GOV.UK](#)

The core principles of HERDS are:

- Creating Knowledge – seeking to answer questions about our past through investigation with purpose, exploring investigation techniques and working practices;
- Involving People - we will involve communities and groups along the route and excite them about their past, engage people in the industry;
- Establishing a lasting legacy - we will leave a legacy for future generations through the archive we will generate and the stories we will tell. We will develop new techniques to improve the industry practice and inspire the next generation of professionals and communities to get involved in their local heritage.

From an archaeological perspective HS2 provides an opportunity to examine an unprecedented sample of the historic environment and to examine patterns of past activities across varied geological and topographical areas and across time. It will enable data to be interpreted at broad scales and provide comparative data for other recent studies.

4. EAA Budapest

A quote, attributed to Daniel Keys Moran, says "You can have data without information, but you cannot have information without data". This concept served as the foundational idea for the development of the EAA session 'Big project, big data: creating a web of knowledge'.

HS2 has a history of sharing our knowledge, and lessons learnt at EAA promoting our work and gaining insights and learning from colleagues across Europe. We all face the challenge of integrating our historic environment works with the broader demands of construction and programme of projects. The "[Re]Integration" theme of EAA was therefore a good match given the aim of integrating and pushing practice, setting new standards, and leaving a sustainable legacy of skills gain across the industry into all we do.

The EAA session (led by myself and Holger Schweitzer, Jacobs Suedlink) aimed to reflected on the opportunities inherent in the very large projects which we are working to deliver. Both HS2 and Suedlink have and will generate massive amounts of historic environment data in many forms. We felt therefore that our projects had a lot to share but also could generate an opportunity for the community to learn about the management and approaches to 'big data'.

In line with HS2's Historic Environment Research and Delivery Strategy (HERDS) approach toward leaving a positive legacy, presenting our findings and encouraging the sharing of knowledge is a central pillar of our work. We are committed to involving local communities, our UK peers, and global peers. The EAA session was an opportunity for us to strengthen our collaboration with large projects from across Europe. The broad range of papers presented at the session also reflects the breadth of the conversation in which HS2 is actively engaged.

5. The papers

As a historic environment specialist working for HS2 Ltd, my focus has been to deliver the Phase 2b Western Leg -Crewe to Manchester environmental statement (ES) and supporting the hybrid Bill process. I also worked route-wide to support delivery of archaeological works, capture and share lessons learnt, and explore considerations of carbon footprint and sustainability in the context of HS2. I have observed the massive amounts of data that the historic environment teams collect and manage. I see the many ways in which data serves to as a communication tool for different audiences through finds, site visits, webinars, visualisations, and technical documents. This has underscored the variety of data we collect, ranging from site plans to CBM, from GIS deliverables to written reports. It has become evident how we should use this information to inform and educate and thereby enabling wider engagement. I have gained insights into the various methods employed for collecting, storing, processing, and managing data, spanning the Phase One HERDS to the HS2 historic landscape characterisation assessments and extending to the fieldwork innovation, such as the digital recording approaches at the site of the Round House at Curzon Street, Birmingham, and the use of onsite recording approaches at St James burial ground, Euston.

Large projects offer valuable opportunities for gathering data and generating information to assist in the effective management of heritage assets. Data can assist in decision making and responses to threats from development or other factors, such as changes in planning regime, natural forces, or cultural shifts.

- How data can inform decision-making and storytelling? HS2 Design Vision

We wanted the session to consider the opportunities that gathering 'big data' presents for the application of innovative techniques and new data approaches. We asked ourselves:

- What can we learn from 'big data' for the next project?
- How should we be managing or storing this data?
- What is our digital legacy?

Several papers were submitted in response to these questions and some now published here. Kenneth Aitchison (Landward Research) raises fundamental questions about the collection or creation of data. He reflects on how and why do we collect or create data. How do we ensure we create knowledge and not just data? How do we consider the end use or user of our data at the start of collection? How can we make our data purposeful, facilitating decision making and storytelling? The works at HS2 are guided by these three principles via HERDS.
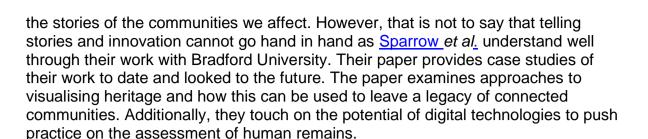
John Halsted explores how HERDS was developed and put into practice to achieve our investigation with purpose approach. He reflects on the outcomes of the application of HERDS and what that means for the future.

Addressing the matter of collecting and storing data, Urankar *et al.* presents some of the work they have been doing around creating Zoot, a database platform for the digitisation of data at every stage of a project. They highlight the savings which can be achieved with the tool while also improving the usability of data for interpretation and responsiveness. This paper touches on how data generation is integrated with the creation of knowledge.

HS2 is a project which embraces the creation of knowledge not data to ensure we leave a lasting legacy for communities and researchers of the future. As such, Teagan Zoldoske (ADS) presents on the need for forward planning when collecting 'big data'. She highlights the scale and range of data the ADS anticipate working with just from Phase One of the project and the challenges presented by this. The paper covers the importance of integrating date creation into project planning, the data lifecycle, and ensuring that the data is FAIR (findable, accessible, interoperable, and reusable). Like Urankar *et al.*, she also discusses the need for management tools and processes and well as the importance of collaboration.

At HS2, we have taken the challenge presented by our data seriously through the development of HERDS, the application of our suite of technical guidance, and the careful work of our data manager Fred Aryankhesal who explores the ways in which we integrate our data with the overall project data to ensure its widest use. Fred also highlights the importance of the data lifecycle in managing data and how we integrate that with our required data hierarchies and standards. Fred provided an overview of the systems he has implemented and how they will assure our data provides the best outcomes both across Phase One and into the future of the project.

These papers emphasised some of the data opportunities which 'big data' offers us. But 'big data' also offers many other opportunities around communicating our findings and telling stories whether these are stories about the heritage resource or

the stories of the communities we affect. However, that is not to say that telling stories and innovation cannot go hand in hand as Sparrow *et al.* understand well through their work with Bradford University. Their paper provides case studies of their work to date and looked to the future. The paper examines approaches to visualising heritage and how this can be used to leave a legacy of connected communities. Additionally, they touch on the potential of digital technologies to push practice on the assessment of human remains.

The work of Bradford University on the Roundhouse for HS2 emphasises our focus on communicating to the widest possible audience on HS2. We do this by using both traditional and digital media, from site visits and information boards to the HS2 YouTube channel. It is all about finding the right language, this therefore raised another question for the session: How can we ensure communication of our findings by assessing the language we use and how it fits our audience?

Video: Curzon Street Roundhouse Drone Footage April 2020

The session was envisioned as a forum for sharing knowledge and case studies about the future of historic environment works on projects of all sizes. But to influence the future you must learn from the past, something we all know well as historic environment professionals.

6. What's next?

For future projects, there is a need to focus attention on making data both usable and reusable through an approach to data gathering, consistent maintainable storage and thoughtful curation.

The discussions at the EAA session highlighted a need to be cognisant of the wider professional and research landscapes that projects operate within, and the importance of finding a common language to ensure interoperability and open opportunities thereby improving accessibility. Removing the need for expensive licenced software was something which was advocated by attendees which would improve accessibility and allow for easier translation and migration of data, and the subsequent potential this has for improving data security in the future. However, this is not always within the control of the practitioner and there is a need to look for opportunities to influence where possible or seek partners who can achieve the same aims for the data.

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