Manipulation of Archaeological Data as spatial Data and the Role of BIM and GIS:

an overview from HS2 Phase 1, UK.

Fred Farshid ARYANKHESAL, HS2 Ltd, The UK.

Keywords: *GIS-BIM-Spatial Data-HS2-Archaeology*

CHNT Reference: Aryankhesal, F.F. 2020. Manipulation of Archaeological Data as spatial Data and the Role of BIM and GIS: an overview from HS2 Phase 1, UK. HERITAGE BIM. Conference on Cultural Heritage and New Technologies.

Conserving our cultural heritage and historic environment as a legacy from the past for the next generations is an accepted value in sustainable approach to development, and has made archaeology research an integral part of the development process in the UK (Department for Business, Innovation & Skills, 2012). High Speed Two (HS2) Phase 1, is a new high speed railway linking up London and the Midlands is witnessing the largest single archaeology programme ever undertaken in the UK. This paper will explain the role of GIS and BIM in manipulating archeological spatial data in different lifecycles of this project.

Revolutionary use of information and communication technology (ICT) in surveys and studies since 1960s for generating and processing information has dramatically developed the role of digital data and computerisation in geography, which was borrowed in archaeology (Greene and Moore, 2010). Another aspect of any archaeological data is its association with location. Archaeology is among the fields in which “Place matters”. Without location, any archaeological data are devoid of identity (figure 1). Archaeological data is captured across geographic space, and they are tagged with a specific location; historic buildings, test pits, trial trenches, intervention areas, geospatial survey results, etc. are all identified as spatial data (Conolly and Lake, 2006). These spatial data are linked to geometrical shapes in a certain geographical coordinate system, and geographical location is the integral part of any spatial data, such as census data and land use data.

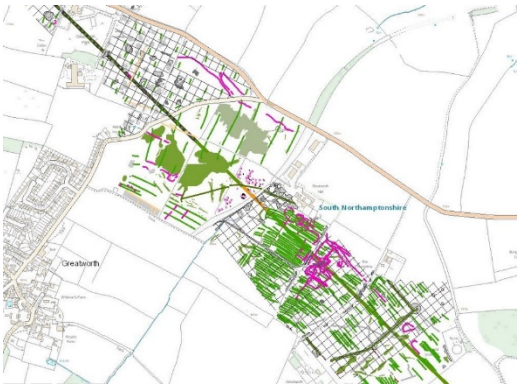

Fig. 1.Polygons and Lines GIS layers to represent a part of Interpretation of Geophysical Survey Results in Northamptonshire, HS2 Phase One, an example of visualisation of archaeological spatial data (© HS2 Ltd).

Processing of spatial data cannot be carried out without Geographic Information Systems (GIS). GIS is the science and art of systematic use of technology (both software and hardware such as sensors, cameras, drones, scanners, monitors, software packages, tools, printers, servers, video projectors, etc. which systematically work together) for capturing, gathering, cleaning, analysing, visualising/mapping, delivery of geospatial data, captured/gathered from the features, existed or planned in the study area, in different layers (Conolly and Lake, 2006, and Green and Moor, 2010). Where archaeological research is a part of a construction project, Building Information Modelling (BIM) can also be a valuable opportunity. BIM is a relatively new process for creating and managing information on construction projects across the project lifecycle, including design, construction and operational stages, enables us to record and capture all archaeological assets and their interrelationship, alongside designed construction elements. HS2 Phase 1 provides a good example of using BIM in archaeological surveys.

By establishing the Historic Environment Research and Delivery Strategy (HERDS) as a subsystem of HS2's BIM to record and archive archaeological assets (HS2 Ltd. , 2017), with the help of GIS, a hierarchy of archaeological assets data has been designed, which connects archaeological spatial data based on their interrelationship and their respective non-spatial supporting documents. This hierarchy comprises Location Specific Written Scheme of Investigation (LS-WSI) as areas of land that will largely be defined to meet construction needs, represented with polygon GIS layers; Project Plans, as locations with a specific package of archaeological activity e.g. a geophysical survey, a building recording survey, archaeological excavation etc., represented with polygon feature classes; Written Scheme of Investigation Interventions (WSI-Interventions), as the extents of archaeological activities (e.g. borehole survey, individual trial trenches), recorded as polygon feature classes; Archeological Features, as areas with a certain intervention activity type, for example, a trial trench, which may uncover features such as a post hole or ditch, recorded as polygon GIS feature classes; and finally, Archaeological Objects, e.g. a hand axe, coin or brooch, found during archaeological investigations, represented with point GIS layers (figure 2).

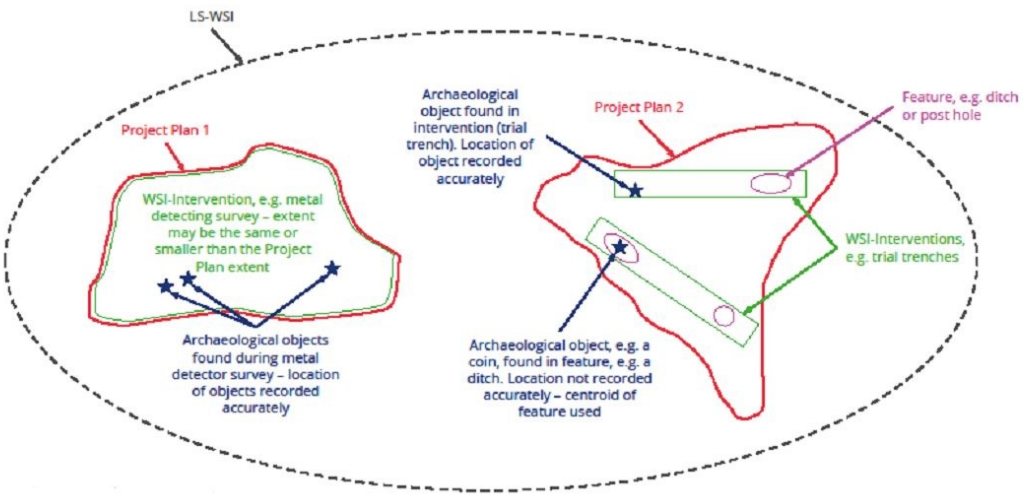

Fig. 2.

HS2 HERDS spatial data hierarchy (© HS2 Ltd).

Such an efficient, transparent and readable data structure provides a lasting and valuable legacy for the lifecycle of the project. An efficient integrated workflow has been created between contractors and their supply chain, HS2's Historic Environment team, and HS2 stakeholders, who benefit from those archaeological data in different lifecycles of archeological spatial data, including data capturing, data cleaning and management, data analysis, data visualisation and data delivery (figure 3).

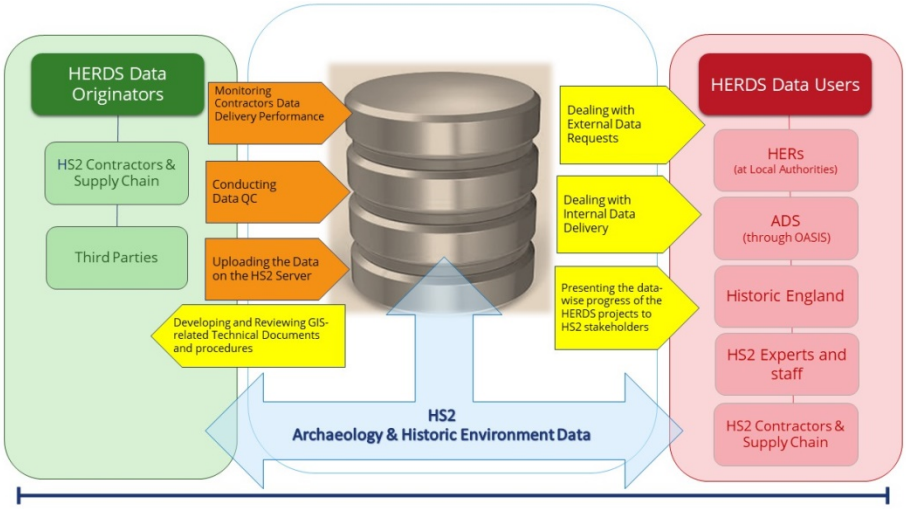

Fig. 3. HS2 Archaeological data lifecycle based on their Historic Environment Research and Delivery Strategy (© Author)

References

Conolly, J. and Lake, M. (2006). '*Geographical Information Systems in Archaeology*'. Cambridge University Press. United Kingdom.

Department for Business, Innovation & Skills. (2012). '*Building information modelling'*. [Online] https://www.gov.uk/government/publications/building-information-modelling (Visited on 20/08/2020).

Greene, K. and Moore, T. (2010). '*Archaeology: An Introduction'*. Fifth edition. Routledge. London and New York.

HS2 Ltd. (2017). *Historic Environment Research and Delivery Strategy*, [Online] https://www.gov.uk/government/publications/hs2-phase-one-historic-environment-research-and-delivery-strategy (visited on 20/08/2020).