An Assessing the Underworld (ATU) data management seminar was organised on 28th April 2014, designed and hosted by the British Geological Survey (BGS), a member of the ATU project team. This seminar was designed to explore the wider considerations of data management and visualisation, and assess how these may be used to inform the different ATU work streams. The seminar was broadly divided into 4 themes:

1. Data Management (Digital Data)
2. Databases / Data Formats
3. Model Development and Visualisation
4. Assessing the Underworld: Integration of Ground and Infrastructure Data

The seminar was well attended by the ATU project team and some core ATU project partners. A Question & Answer session after presentations allowed for an integrated discussion on how these aspects should be considered and managed by the ATU project, as well as by streetworks engineers and infrastructure asset managers.

**Digital Data**
- Information and Data Management: by Garry Baker, Team Leader of Database Solutions at the BGS. This assessed data collection, management and storing, data models, formats and interoperability.
- Data Shipping (Sharing & Distribution): by Geraldine Wildeman, Data and Science Services Manager at the BGS. The data products at the BGS were showcased, including linked data and web services (Open Geoscience), data delivery, formats, BGS apps, external partners and links.

**Databases / Data Formats**
- National Geological Repository and Geoscience Data Centre: by Mike Howe, Team Leader of the National Geological Repository. This provided information on the Geoscience Data Centre, BGS’s core collection, Geoindex Onshore and the Open University virtual microscopes.
- Assessing Subsurface Knowledge (ASK): by Hugh Barron, BGS Marketing Sector Manager. The ASK Network (see Fig 1) and GSPEC/AGS data specifications were presented, along with their use on a presented case study for the BGS’s Clyde / Glasgow project.

**Model Development and Visualisation**
- Construction of Ground Models: by Holger Kessler, Team Leader, Geological Modelling Systems at the BGS. This highlighted issues of data availability and inherent uncertainties, showcasing how ground models are created from geological maps and borehole logs.
- Parameterising the Subsurface: by Andrew Kingdon, Team Leader, Parameterisation and Statistics at the BGS, who described Parameterisation, and its use to create 3D models from existing physical data and derived site information, using a voxel model to populate grids for the subsurface (see Fig 2). The OpenMI modelling application was also showcased, along with its use to improve the ability to model complex scenarios.
- Geovisionary: by Bruce Napier, Geo IT Specialist at the BGS. This showcased data visualisation using Geovisionary, and the use of technology to plug gaps, optimise field work and visualise integrated data sets.
ASSESSING THE UNDERWORLD

Assessing the Underworld: Integrating Geotechnical Data with Road and Buried Utility Infrastructure Data

- **Ground Degradation Data Visualisation:** by Paul Hughes, Co-Investigator on the ATU Project, University of Newcastle. This showcased some of work done on the BIONICS research facility in Newcastle, assessing the mechanisms of degradation (shrink/swell, wet/dry and cracking) due to climate change and vegetation influences, as well as the inherent complexity of assessments due to uncertainties. This also included the integrated concept for deterioration of streetworks infrastructure (see Fig 3).

- **Data Integration for Decision Support:** by Tony Cohn, Co-Investigator on the ATU Project, University of Leeds. This presentation highlighted the data requirements and integration challenges on the ATU project, and showcased previous work done (see Fig 4) at Leeds from the Mapping the Underworld (MTU) and VISTA projects.

Plenary discussions after the presentations drew out many insights and shed light on the challenges that the research team faces, and allowed the wider ATU consortium to take advantage of the integration of BGS’s resources and expertise into the data management and condition assessment research in ATU. The BGS Co-Investigators on the ATU project team include:

- **Dr Helen Reeves** — Science Director of Engineering Geology at the BGS
- **Dr David Gunn** — Team Leader, Geotechnical Properties and Processes
- **Dr Ben Dashwood** — Engineering Geophysicist at the BGS

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**Data Management Seminar / Workshop Outcomes: What Does This Mean for ATU?**

ATU will engage closely with the BGS to optimise the adaptation of its unique capabilities in data management, visualisation and modelling, to support various aspects of the ATU work streams and inform decision making for streetworks. This includes:

- Working with the BGS to adapt data specifications, and to visualise ATU test sites via the BGS Geovisionary system.
- Adopting the parameterisation approach to generate ground models for test sites from borehole logs and geotechnical data.
- Employing a voxel modelling approach to plug data gaps for these ground models and produce robust subsurface imagery.
- Ensuring that assessment frameworks created by ATU include necessary underpinning knowledge to support collated data.
- Incorporating BGS’s expertise of temporal & spatial variations of subsurface processes into ATU’s decision support system.

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**BGS** is a world-leading, multi-disciplinary geoscience centre that aims to advance geoscience knowledge of the UK landmass by means of surveying, monitoring and research. All BGS research activities are underpinned from other specialists in the fields of hydrogeology, geochemistry, engineering geology, mathematical modelling and information technology. Understanding depositional environments and geological history underpins the research in the Engineering Geology Directorate. The BGS research programme is prioritised through close consultation with governmental, academic, industrial and public stakeholders. BGS develops and maintains innovative surveying, monitoring, data management and visualisation technologies focusing on the provision of engineering property data and ground models across a range of scales for societal needs. It manages the National Geotechnical Properties Database, which provides essential properties for detailed attribution of 3D ground models that capture geological, hydrogeological and environmental information required for many socio-economic challenges related to urban planning, such as in our Future Thames and Clyde Urban Super projects. National digital datasets such as the baseline digital geology (DiGMapGB) and derived hazard susceptibility maps (GeoSure) provide the context for BGS’s hazard susceptibility modelling. ATU WS4 (The Geotechnical Infrastructure) requires application of geophysical surveying technologies to detect soil property changes, informing the deterioration process with condition indices. The deliverables from this work stream include a further understanding of the fundamental relationships between geophysical and geotechnical soil properties, which the BGS can support by interrogating our property databases. BGS also supports the latest platforms for development of attributed ground models for the study of subsurface processes at all scales essential for managing underground space, which is vitally important to the development of the ATU Decision Support System (ATU WS7).

**Dr David Gunn**, Team Leader, Geotechnical Properties and Processes, BGS.

For further information please see the Assessing the Underworld website: [http://assessingtheunderworld.org](http://assessingtheunderworld.org)