ORAL PRESENTATIONS

Thursday 20th November 2025

Keynote: Contours and curves: charting the topography of a career in geoscience

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Some people's careers in geoscience resemble well-drawn maps—clear contours, obvious routes, and topographical 'highs' as they advance through their careers, ultimately reaching senior positions – the 'peak'. Others' careers turn out to be more like a poorly labelled sketch map, with a missing legend, no north arrow or scale bar, unmarked elevation changes, and the odd surprise peat bog. But every aspect of navigating a career map – whether that map is clear and unambiguous or a mysterious, hand-sketched treasure map – has the potential to provide valuable professional and life lessons. Experience gained outside conventional routes can enrich enjoyment and career performance.

Non-linear career maps are shaped by unexpected twists and turns, dead ends, deliberate detours, and glimpses of beautiful views, all navigated with curiosity, determination and luck.

Many of us start our careers with expectations of clear career progression - the map we think we have, but some of us discover that the map we are following is quite different from what we expected. Events, challenges, and opportunities may arise during the arc of our career which change the route we are following. The unfamiliar landscape within which we may find ourselves can teach us valuable lessons if we are receptive and curious. Our career journey may take us to topographic highs along the way where we can look back on the journey already travelled and can look forward to the route ahead. Sometimes we may get lost and need help to find our path.

Using topographical imagery, Maria maps out an unconventional career path in geoscience, drawing from her own non-linear career and shares what can come of such a journey, with support from Dr Suess and Dr Viktor Frankl.

SESSION ONE

A case study assessment of debris flow processes and potential impact on the A83, Lower Glen Croe

Frances Crabb[1], *Claire Caley[1], Helen Reeves[1], Matthew Sullivan[1], BEAR Scotland, Transport Scotland*

1Jacobs

The A83 in Argyll and Bute is a road at risk of closure due to blockage by material transported by debris flow activity from the surrounding hillsides. This case study in the lower part of Glen Croe has been undertaken to better understand the slope conditions and processes. Desk study research has included a review of recent and historical aerial imagery, slope gradient data, British Geological Survey (BGS) mapping, databases of recorded failures (e.g. the BGS National Landslide Database and BEAR Scotland defects records), and third party reports prepared from previous geotechnical assessments of the area, including inspections of recorded failures. This has been supplemented by targeted site inspections where information on channel characteristics, variations in terrain, and the availability of source material throughout the area was obtained. The desk based and observational data have been combined to allow a classification of the major channels into domains based on their typical conditions and potential failure processes. These domains have been ranked to illustrate which channels may have a greater likelihood of initiating debris flows and transporting material. The findings of this study will be used as input to geomorphological assessment and debris flow modelling; this will allow for identification of potential areas where future failures may impact the A83 or forestry tracks above, and where mitigation may therefore be required.

Engineering Geological Characterization of Hydrothermally Altered Materials in Dam Foundations

Sarah Jacob*[1]*, *Wenzhu Hou* [1]

1BGC Engineering Inc

Hydrothermal alteration, commonly associated with volcanic and fault activities, causes significant changes in the physical and mechanical properties of geological materials. These hydrothermally altered materials often indicate the presence of mineral deposits due to changes in rock mineralogy caused by hydrothermal fluids. When present in mining areas, they require careful engineering geological characterization for slope excavation and foundation designs. In tropical regions, the effects of chemical weathering further complicate the characterization process, as weathered altered materials exhibit lower intact strength compared to their non-altered counterparts. In this study, we provide a review of hydrothermally altered materials in dam foundations based on published case studies. We also investigate the engineering geological characteristics of hydrothermally altered materials encountered in drillholes of a tailings storage facility project in a tropical area, focusing on key parameters such as discoloration, weathering/alteration grade, core recovery rate, hydraulic conductivity, standard penetration test results, rock strength, and laboratory testing outcomes, along with firsthand drill core photos. Altered and non-altered materials were compared to understand the effect of alteration and tropical weathering on material strength. Through this in-depth review and data analysis from a specific case study, we aim to provide best practices and valuable insights for the engineering geological characterization of these complex materials.

A review of highway chalk cut slope performance and hazards in the Southeast of England

Emily Prosser[1]*, Catherine Rushall*[1]*, James Codd*[1]*, Rob Talby*[1]*, Michael Tandy*[2]

1Mott MacDoanld

2National Highways

Following a review of the performance and stability of existing chalk highway cuttings, an empirical approach for the design of new cuttings was published by Williams (1990). This formed the basis for the related guidance in CIRIA C574 (Lord et al, 2002) . Phipps and McGinnity (2001) proposed another empirical design scheme based on geomorphological mapping, incorporating slope hazards. In the intervening years, new cuttings in chalk have been progressed f or highways, railways and high-speed rail projects, and asset owners have undertaken the necessary inspections, maintenance and interventions on existing cuttings and slope defects. Digital geotechnical records for highway assets on England's Strategic Road Network are held and maintained in National Highways' Geotechnical and Drainage Management Service (GDMS, formerly HAGDMS) (Daley et al, 2020). GDMS includes geotechnical asset data for all earthworks, including cuttings, as recorded during inspections, summarising location, geometry, geology, drainage details and condition, including defects relating to hazards. Other asset owners have since developed their own asset management systems. The experience gained through the design and maintenance of chalk cuttings has been used to inform guidance documents and standards including National Highways (2020), Network Rail (2017), and Transport for London (2023). This study aims to review the influence of asset age and geometry on the performance of existing highway chalk cuttings and associated slope hazards, utilising inspection, maintenance and intervention records from GDMS. In addition, remote data surveys (LIDAR) and imagery from both condition surveys and road-based imagery have been analysed to determine global stability and deterioration rates. The performance of railway cuttings in chalk is also assessed based on available case studies. The findings will be compared to the empirical design guidance presented by Williams (1990) and Phipps and McGinnity (2001), and where applicable against guidance from national asset owners.

Distinguishing mudstone, residual mudstone and subglacial till in CPTu and seismic data

Scott Adam Smith[1]*, Jack Rice*[1]*, Hongjie Zhou*[1]

1Norwegian Geotechnical Institute

Jurassic and Triassic mudstones are prevalent across large parts of the UK, both onshore and offshore. Where mudstones have been weathered by physical, chemical or biological processes, the resulting weathered material may behave geotechnically as stiff clay. The blurred line between clay and mudstone can lead to challenges in sample description, CPTu and seismic interpretation, and classification of laboratory data. This presentation explores the boundaries between mudstone, residual mudstone and mudstone-derived subglacial till, with examples from offshore wind farm site investigations in the East Irish Sea. The Mercia Mudstone was deposited between ~200 and ~250 Ma during the Triassic, with the East Irish Sea Basin as a major depocenter. The top bedrock encountered today by site investigations was buried to a depth of 1-2 km before being exhumed by uplift and erosion (Ware and Turner 2002), classifying the Mercia Mudstone as "overconsolidated clay – weak cemented mudrock", following Cripps and Czerewko (2017). The Mercia Mudstone has since been weathered by groundwater flow and overriding glaciers during the Quaternary to produce residual mudstone. Commonly overlying the mudstone is a conspicuously reddish-brown diamicton, often containing gypsum clasts, interpreted as a subglacial till with the Mercia Mudstone as its primary source material. We compare mudstone, residual mudstone and mudstone-derived subglacial till in CPTu and seismic interpretation, together with laboratory test results, to highlight key similarities and distinctions among these three materials.

SESSION TWO

B4069 Lyneham Banks Landslide Remediation – Improving the georesilience of the UK's wonkiest road

Vicky Corcoran[1], Christopher Cox[1]

1 AtkinsRéalis

The B4069 road in Wiltshire, England, has been affected by ground movements due to periglacial deposits beneath and around it for many decades. This movement typically caused cracking of the road surface which was managed by resurfacing and occasional remediation in the form of drainage and carriageway reconstruction. In February 2022, a section of the road experienced severe heave, subsidence, and cracking leading to its closure. By April 2022, the resultant landslide had displaced the carriageway downslope by up to 25 meters, earning it the title of the UK's wonkiest road. To determine remedial options, it was essential to develop the ground model and determine the likely causes of the landslide. This involved developing digital surface models (DSMs) from drone photogrammetry surveys, digital terrain models (DTMs) from government data, and site-based geomorphological mapping. An extensive intrusive ground investigation was undertaken, including collection of groundwater monitoring and slope movement data. High-frequency data from inclinometers and vibrating wire piezometers provided a detailed understanding of geological and hydrogeological conditions, identifying key failure mechanisms and informing future slope movement. This informed an optioneering exercise to determine the most suitable engineering solution. The final design solution included a contiguous pile wall with micropile supports, slope regrading, and slope drainage to manage the complex landslide. The design ensures long-term georesilience by adopting cost-effective slope stabilisation measures for the slopes above and below the highway alignment. It also accounts for the high probability of future instability impacting adjacent slopes. This approach provided the best value solution for the client, improving future slope stability and ensuring the road remains open and operational except in the most extreme ground movement scenarios. Construction was largely completed in 2024, with the road expected to reopen in Spring 2025.

“How do you recover from no recovery”, overcoming challenges posed by incomplete exploratory hole logs.

Jordan Sinnott[1]*, Dr Jessie Davey*

1SYSTRA Ltd

Has this ever happened to you? You sit down with a cup of tea and start reading your long-anticipated borehole logs, only to be left baffled by the contents – or lack of contents? The ground is a complex heterogenous amalgamation of natural and artificial materials, inconsistently mined workings, a criss-cross of seams and veins, and zones of contamination (to name a few), which even the most robust desk study cannot predict with absolute certainty. However, exploratory hole logs can sometimes struggle to paint a complete picture of what they’ve encountered. This becomes problematic with regards to engineering, where recovered data is presented as a factual account. Due to poor recoveries, this factual account is, in reality, often opinion. Logs are formed of both qualitative interpretation of recovered material and quantitative tests. The description presents an individual’s professional opinion of material based on their training and experience. Geology can be a bit of a trickster though, with make-up of materials not being readily visible, or methods by which soils and rocks are recovered also contributing to changing the picture of ground conditions and geomechanical integrity. Taking exploratory hole logs as fact rather than the qualitative opinion they are, and failing to qualify this opinion with supplementary evidence, runs the risk of incorrectly modelling the ground and thus incorrectly designing substructures efficiently, sustainably or even safely. Quantitative results such as in-situ testing and laboratory testing, also have the potential to hide the truth of the ground if the context in which tests are undertaken are inappropriate. This paper presents a series of techniques that aim to bring out a forensic investigator in all of us, to help us understand the risk of data presented from ground investigation logs. In understanding risks, the aim is to increase the accuracy of ground models.

Engineering Geologists in the Drive for Efficient, Net Zero Electrical Infrastructure

***Thomas Kettle*[1]**

1Mott MacDonald

On 26th February 2025, the Climate Change Committee revealed, through their research work for the Seventh Carbon budget, that 27% of the emissions reduction for the next fifteen years, will be sourced from a switch from diesel/petrol fuelled vehicles to purely electric vehicles. Consequently, the demand for electricity supply will grow. Our transmission and distribution system will require significant expansion to keep up with an exponential rise in new renewable energy connections to existing and new substations, across the United Kingdom, to supply the additional electricity supply for adoption of electric vehicles. Connections from new renewable energy projects to feeder substations will require linear routes, comprising both underground cables and overhead lines. The visual impact of an overhead line is generally the greatest drawback of their use. However, if we could demonstrate the cost, emissions and engineering benefit of overhead line linear routes, in comparison to buried cables, using our engineering geology background, appreciation of topography and hydrology of a proposed area optioned for a linear route, then we can input far more as engineering geologists to a linear project. Using the proposed Norwich to Tilbury route as an example, I will seek to detail the many benefits of an overhead line route compared with underground cables, with a focus on contributing to net zero.

SESSION THREE

Playing your Hand - From Geomorphology to the Baize

Peter Phipps

Friday 21st November 2025

SESSION FOUR

Keynote: Keeping feet on the ground: engineering geological and geomorphological mapping as an essential component of landslide hazard assessments and ground engineering – case studies from mountainous terrain in Asia-Pacific'

Jonathan Hart[1]

1GeoRisk Solutions Ltd

Total stress informed engineering geomorphology, and weathering profiles, as tools to better understand hydrological processes to inform landslide modelling in the Idukki region of Kerala, Southern India.

Vanessa J Banks[1], *Nedampullile-Vasu, N.[1], Sajinkumar, A.S.[2] ,Mansour, M.M.[1], Krishnapriya, V.K.[2], Rajaneesh, A.[2], Arnhardt, C.[1] and Dashwood, C.[1]*

1British Geological Survey

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According to Martha et al. (2021) India ranks first in the world in terms of fatal landslides with 14.7% of occurrences in the Western Ghats. The Southern Granulite Terrain that hosts these landslides comprises deformed Precambrian continental crust comprising high-grade metamorphic rocks resulting from the stress history associated with the evolution of a passive continental margin. Extreme rainfall events in August 2018 and August 2019 were associated with flooding and landslides with an estimated impact of 200 million USD (Ramasamy et al., 2018). Funded by UKRI and NERC, the British Geological Survey has been working with collaborators, including the University of Kerala and Geological Survey of India, to better understand rainfall triggering of landslides in the context of climate change. This research is strongly aligned to the approaches recommended by Peter Fookes and his collaborators with regard to total stress history (Fookes et al., 2001); engineering geomorphology (Fookes 1997), whilst additionally adapting weathering profiles in tropical residual soils to conceptualise hydrological processes. These tools were adopted because they flexibly and effectively guide engineering geological thinking and data collection when undertaking new research in extensive landscapes of largely unfamiliar terrain that are associated with low densities of accessible data.

Fookes, P. G. 1997. Geology for Engineers: the Geological Model, Prediction and Performance. First Glossop Lecture. Quarterly Journal of Engineering Geology 30, 293-434. Fookes, P., Baynes, F., and Hutchinson, J. 2001. Total Geological History: a model approach to understanding site conditions. Ground Engineering, March 2001, 42-47. Martha, T.R., Roy, P., Jain, N., Khanna, K., Mrinalni, K., Vinod Kumar, K. and Rao, P.V.N. 2021. Geospatial landslide inventory of India – an insight into occurrence and exposure on a national scale. Landslides 18, 2125-2141. Ramasamy, S.M., Gunasekaran, S., Saravanavel, J., Melwyn Joshua, R., Rajaperumal, R., Kathiravan, R., Palanivel, K. and Muthukumar, M. 2021. Geomorphology and landslide proneness of Kerala, India. A geospatial study. Landslides 18, 1245-1258.

Integrated Approach to Investigate Seawater Intrusion into Coastal Freshwater Aquifers Using Electrical Resistivity Tomography and Vertical Electrical Sounding: A Case Study in Cape Coast, Ghana

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1 Technical Unviersity of Darmstadt

2Community Water and Sanitation Agency

As developing countries grapple with the consequences of increasing population growth, industrialization, and climate change, the over-extraction of groundwater has become a critical issue. This research was conducted using geophysical techniques to assess the vertical and lateral extent of saline intrusion into the coastal freshwater aquifer of Cape Coast. Utilizing the Mangusta System MC 24/120E and a multifunctional digital resistivity/IP meter, 15 Electrical Resistivity Tomography (ERT) and 14 Vertical Electrical Sounding (VES) surveys were carried out along the southeast-northwest direction of the coastline. The ERT survey with profile lengths between 120-240m and a 5m dipole-dipole spacing interval, alongside the VES survey with Schlumberger configurations extending 50-80m. The classification of salinity level proves three resistivity zones exist: low resistivity (≤ 10 ??m) interpreted as saline water; moderate resistivity (10 ??m < x > 20 ??m) suggested as brackish water and high resistivity (≥ 20 ??m) interpreted as freshwater aquifer zone. The research findings indicate that the shallow aquifer zones are compromised by seawater intrusion at 4.25 km away from the shoreline. This is further corroborated by the geo-chemical analysis of groundwater samples, which shows a decreasing trend of salinity moving inland from the coastline. The study's visuals, including 2D/3D pseudo-sections of ERT, 1D resistivity model (VES), and interpolated maps of groundwater sampling parameters, clearly imply these significant findings to the affected areas. Seawater intrusion poses a threat to local water security and the broader ecosystem. To combat these challenges, the adoption of integrated and sustainable water resources management strategies to mitigate the situation was ideal for implementation. These include exploring alternative water sources such as desalination and recycled water, which offer viable solutions to freshwater scarcity. This research underscores the urgency of addressing groundwater contamination and highlights the need for innovative approaches to ensure the sustainability of water resources.

Landslide Hazard Design Event Determination Using Magnitude-Cumulative Frequency Method: Observations from Case Studies in Hong Kong

***Wenzhu Hou*[1], *Jonathan R. Hart*[2]**

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An assessment of the hazards posed by natural terrain landslides in Hong Kong usually involves the determination of landslide design events for notional return periods of 100 years. However, faced with new challenges arising from a warming climate, it is appropriate for practitioners to include considerations for higher magnitude and more frequent landslide activity in landslide hazard assessments (LHA). The Magnitude-Cumulative Frequency (MCF) method has been adopted in studies of natural hazards worldwide since the 1940s. In Hong Kong, Hungr et al (2002) provided discussions on this method and later on it was adopted by the MFJV (2004) during the LHA for the Tsing Shan mountain range, and by Tattersall et al (2009) for the North Lantau Expressway LHA. The MCF method has several limitations – e.g. the grouping of landslides and assigning their age intervals must be based on either empirical experience or mathematical formula, which is usually subject to a trial-and-error approach; an 'anchor point' can only be determined where sufficient correlations exist between landslides and triggering events, which is not always clear. To overcome these limitations, an alternative MCF method was developed in this study during the LHA for two large catchments in HK, which reduced the effects of dataset limitations, the subjectivity in sampling intervals selection, and a lack of suitable anchor points. It includes basic steps to identify and utilise 'rollover' points and an ‘anchor zone’ based on recent landslide records. It was used to derive notional 100-year, 1,000-year and 10,000-year design events for the two case studies along with engineering geological models. We expect that this paper could provide a methodology recap by revisiting several cases, propose a straightforward procedure to apply the methodology, and encourage more landslide practitioners to adopt this analytical method for determining landslide design events at a time of climate change.

Ventnor, Isle of Wight: the challenges of geology, landslides & climate on the town and its residents

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Ventnor, located on the south coast of the Isle of Wight, underwent rapid transformation in the late 19th Century into a fashionable holiday resort largely thanks to its 'Mediterranean' micro-climate and impressive coastal scenery. It still retains its Victorian character in its buildings and winding infrastructure constructed on the many natural terraces located beneath St Boniface chalk down. However, not widely appreciated during its development, Ventnor was constructed on the Undercliff Landslide, described as one of the most active developed urban landslides in NW Europe. Movement of the Undercliff Landslide over many years has adversely affected Ventnor's aging buildings, infrastructure, and utilities. The most recent significant landslide occurred in December 2023 resulting in the formation of a near-vertical rear scarp now only 12m seaward from Leeson Road, the main access into Ventnor from Shanklin to the east. From the west, Undercliff Drive has been shut since 2014 after landslides destroyed road access. Inland access from the north crosses over the rear scarp of the Undercliff Landslide in an area known as the Lowtherville Graben. Here the road requires constant re-levelling, and the buried utilities crossing the slow-moving scarp require regular maintenance and repair. Within the town itself, many retaining walls either above or supporting roads have collapsed or are showing signs of significant distress. Slope failures are not uncommon, and rockfalls from landslide scarps pose a risk to road users and the public. Over the last century around 50 properties have had to be demolished and many more have sustained significant damage as a result of ground movement. None of this is happy news for residents, businesses and tourism. This presentation illustrates, through a number of recent examples, how landslide hazards, including their vulnerability to climate change, can be managed, and lived with.

SESSION FIVE

Keynote: Considering resilience in design for linear infrastructure subject to the effects of natural hazards

Jean D Hutchinson[1]

1Queen's University

In recent years, we have seen increasingly large or extreme weather events that have damaged or destroyed linear infrastructure corridors, reducing capacity and connectivity. Authorities responsible for the safety and optimal function of these corridors have had to respond to emergencies as they arise, at great cost and sometimes with only partially effective solutions developed in the moment. The cost of rebuilding after such events, or trying to plan in advance for potential future events, is high and in some cases may be prohibitive, with decisions being made in an environment full of uncertainty. Methods being developed to improve and to measure infrastructure resilience are as yet unproven in many cases, but it is illustrative to discuss the interplay between expected future conditions, capacity, importance and redundancy of infrastructure corridors, and the potential effectiveness of mitigation efforts. The proposed presentation will focus on case histories from several jurisdictions (Canada, the US, Hong Kong) that illustrate the effects of natural hazards on road and railways, and the engineering measures taken to address these issues. A key consideration is the potential for extensive damage which is dependent on the geological materials and any engineering works the infrastructure is founded on, and the influence of perturbing influences of water and forest fire impacts.

Well gassing during dewatering works in central London

Toby Roberts*[1]*, Gary Holmes (FGS PhD), Aimee Parkinson (MSc), William Powrie (FREng CEng FICE PhD)

1WJ Groundwater

Construction of a 16 m diameter by 50 m deep shaft adjacent to Albert bridge for the Tideway Project required temporary control of groundwater pressures in the Thanet Sand. Support for the shaft was provided by secant piles through the superficial deposits and much of the London Clay with sprayed concrete lining below through the Lambeth Group clays and sands. The shaft excavation bottomed out in the Upnor Formation about 2 m above the Thanet Sand. An array of chalk wells and Thanet Sand wells were installed and pumped on to locally lower the groundwater levels in the Thanet Sand by approximately 20 m to facilitate shaft construction. The Thanet wells were equipped with sealed well heads to enable vacuum assisted pumping if required. No gas was evident during the initial geotechnical investigation or well installation. Soon after pumping commenced, it became apparent that substantial volumes of gas was emanating from several of the Thanet wells. Subsequently gas flow from individual wells was monitored manually using variable area flow meters connected to the sealed well heads. Total gas flows were recorded at up to 60 m3/hr reducing to about 20m3/hr over 8 months. The gassing stopped when pumping stopped and groundwater levels rose. This presentation will explore the nature and source of the gas, the monitoring procedure adopted and the geotechnical and hydrodynamic mechanisms involved in the gas release.

Landslide hazard assessment and mitigation: A case study of pipeline risk reduction from a mudslide in northeast Türkiye

David Waring[1]*, Dr Mark Lee*[2]

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An elongate mudslide in eastern Türkiye was identified as a significant threat to the integrity of a large-diameter hydrocarbon pipeline. The landslide, initially flagged through in-line inspection data from the mid-2000s, was confirmed through desk-based analysis and fieldwork in late 2010. Spanning over 1 km in length and 100 m in width, the landslide exhibited horizontal displacement at a rate of approximately 175 mm/year, with a projected pipeline displacement of 2.71 m by 2020. Field investigations, conducted from late 2010 to mid-2011 and supported by the late Prof. Denys Brunsden and Dr. Mark Lee, included geomorphological, geological, topographic and drainage mapping, intrusive ground investigation, laboratory testing and the installation of monitoring instrumentation. The landslide is in a small, north-south oriented valley, cutting through bedrock and underlain by a sequence of weathered mudstones, siltstones, and sandstones. The deposits consist of clays, silts, sands, gravel, and cobbles, with three distinct mudslides of varying ages and activity stacked upon each other. Inclinometer data from early to mid-2011 revealed active movement in two of the mudslides, with basal shears identified between 5-8 m below ground for Mudslide No.2 and between 3-4 m for Mudslide No.3. Surface and perched groundwater flow significantly influenced landslide movement, with fluctuating water levels causing varying displacement, from slow creep to accelerated shifts. To temporarily mitigate the landslide's impact, short-term risk reduction measures, including geotechnical drainage and pipeline de-stressing, were implemented in early 2012 until a permanent re-route solution was developed. An emergency pipeline repair project commenced in mid-2012, which included an 800 m long, 42-inch re-route section, to the south of the mudslide toe. The project was completed in mid-2013, ensuring continued operations.

Coire Glas – energising rock engineering

Jessica Smith[1]

1SSE

Use of Drones for Enhanced Fieldwork: Revolutionising Field Mapping, Geomorphology and landslide monitoring.

Adam Dargan[1]

1AtkinsRéalis

Drones, also known as Unmanned Aerial Vehicles, have become a transformative tool in Geosciences enhancing data collection in the field. The ability to capture high-resolution imagery as well as photogrammetry, LiDAR and thermal imagery over large areas, makes them ideal for field mapping and geomorphological studies. Through repeat surveys it is a great way of capturing how natural systems, landforms and anthropogenic activities change over time; meaning that they can be used to help monitor landslides. The use of photogrammetry and LiDAR surveys provide a cheap and quick solution to acquire surface level data, compared to traditional topographical surveys which take several days; reducing costs and increasing efficiency. The surveys allow coverage of inaccessible areas due to site hazards, which can remove the risk to those in the field and improving safety. The data can be processed to produce Digital Elevation Models (DEMs) and Orthophotographs which provide a comprehensive perspective of the study area. Additionally, 3D Mesh Surface models can also be produced which allows for completion of a virtual site walkover and are key in explaining the complexities of geohazards and areas at risk to the Client, Contractors, and other stakeholders. Within this presentation I will discuss the use of drones for an Engineering Geologist, highlighting that these are a valuable tool, through a number of project examples. The use of a small drone during geomorphological and terrain mapping in the Albanian Mountains allowed fast coverage of large areas and helped identify key geomorphological features and landslides. Photogrammetry surveys of cliff faces have been completed to assess rockfall. Repeat LiDAR surveys were completed to map and monitor landslides; where the ground movement changes are correlated with measurements from installations within the slope, improving the understanding of failure mechanisms and the areas affected by the landslides.

SESSION SIX

Keynote: Digital Foundations: My Career Journey from Ground Models to Nuclear Digital Solutions

Stephanie Boffey-Rawlings[1]

1AtkinsRéalis

Hollowing out a mountain (again): the Cruachan Expansion project

***Cat Hirst*[1]*, Chris Jack*[1]*, Payal Debroy*[1]*, Lauren Riddell*[1]*, Lucy McKay*[1]*, Toni Wilson-Sturch*[2]

1COWI UK Ltd

2Drax

The 440 MW Cruachan Pumped Storage Hydro Plant is located on the northern banks of Loch Awe, Argyll and Bute. Operated by Drax, the hydro plant has been producing electricity since it was formally opened on 15th May 1965. The plant is unique as the majority of the infrastructure is located inside Ben Cruachan mountain. The turbine hall is located at the end of a ~1 km tunnel driven into the hillside, approximately 400 m below ground level. Affectionately known as the 'Hollow Mountain', the tunnels, shafts, caverns and dam took six years to complete, hewn into the hillside through the Ardrishaig Phyllite Formation and the Quarry Intrusion of the Etive Pluton (quartz diorite). Plans are presently progressing to build a second 600 MW pumped storage hydro plant. The plant would sit alongside the existing system in a series of new excavations, tunnels and shafts, tying into the same upper reservoir as the existing system. The addition of this new pumped storage hydro plant will increase the overall generating capacity at Cruachan to 1 GW. In order to design and build a new pumped storage hydro scheme, an 3D understanding of the geological and hydrogeological condition is required. This information is critical in identifying risks that could impact on the construction and operation of a new plant. Whilst much can be gleaned from review of the existing power station infrastructure (as many tunnels remain unlined), ground investigation is still required to obtain information in the vicinity of the proposed new powerhouse cavern and associated infrastructure. COWI and ARX (formally Pini) are currently involved in the Cruachan Expansion project, advising on the required engineering geological and geotechnical ground investigations that have been carried out to date. The information from these ground investigations will feed into the design of the proposed new plant and as such, needs to be implemented and managed to obtain as much pertinent information for the in situ ground conditions. This talk presents the findings of the ground investigations so far and will draw out a narrative on how to temper enthusiastic geologist expectations versus client requirements of what is a very geologically interesting project.

Applying Total Geological History to Offshore Windfarm Development & Design-focused Ground Modelling

Andrew Hart*[1]*, Sebastian Rowe[1], Veronica Rumbos Ruedas[1], Simon Price[1], Vicki Freeman[1], Edward Henden[1], Claire McGhee[1], Cai Ferguson[1]

1AtkinsRéalis

Engineering Geology in Tunnelling – More than Just Numbers?

Mark Diederichs[1]

1Queen's University

Rock Engineering and Engineering Geology have evolved since the middle of the last century to be somewhat distinct disciplines. The former is a fusion of Civil Engineering, Mining Engineering and Science of Rock Mechanics. Engineering Geology is the expertise associated with creating the geological (and geotechnical/geoenvironmental) model for any engineering project. The primary link between these disciplines is the collection of rock and rockmass property data to be passed on to Engineers. Modern projects are too complex for the ongoing separation of these two fields. Dr. Evert Hoek was quoted as promoting "Putting Numbers to Geology". In this paper, the author advocates for "Putting Geology Back in the Numbers". In essence, this is what, in Canada, is designated as Geological Engineering. The three-dimensional and even four-dimensional geology associated with a project area or volume cannot be reduced to numbers in a table and the implications of doing so can include some of the largest cost and time overruns in underground rock engineering. Tunnelling guidelines in Europe, for example, have begun to consider geological risk in addition to rock mechanics risk. Case histories from Canada, South America and Australia are used to promote the link between quantitative rock mechanics and heuristic engineering geology for major surface and underground projects.

How did Peter Fookes shape your career?

Gareth Hearn[1], Mark Lee[2]

1Hearn Geoserve

2Ebor

POSTER PRESENTATIONS

Investigating Thermal-Hydro-Mechanical Coupling in Mudstones under Varied Thermal Cycles

***Amanda Norman*[1]*, Professor William Murphy*[1]*, Dr Mark Thomas*[1]*, Dr Audrey Ougier-Simonin*[2]*, Dr Robert Valdez II*[2]

1University of Leeds

2British Geological Survey

Thermal loading significantly impacts the mechanical properties of mudstone, impacts which are crucial to understand for deep earth engineering applications such as geological disposal of radioactive waste, compressed air storage, geothermal energy, and underground coal gasification. This study analyses the response of Sidmouth Mudstone, part of the Mercia Mudstone Group, under triaxial compression with varied thermal loading conditions. Experiments were conducted at natural moisture contents across one and three thermal loading cycles to 90°C, with confining pressures of 5 MPa, at both 90°C and room temperature. The results indicate that under triaxial compression at 90°C, regardless of the number of thermal cycles, Sidmouth Mudstone exhibits a Poisson's Ratio comparable to water and displays extremely brittle post-peak behaviour compared to room temperature conditions. After three thermal cycles at 90°C, the mudstone shows a higher fracture density. Triaxial strengths of 9 MPa and 24 MPa for tests at 90°C and room temperature, were recorded respectively. The primary mechanism driving the response is proposed to be thermal-hydro-mechanical coupling, where induced pore pressure from thermal expansion causes localised strain and propagating thermally induced fractures. This research contributes to understanding the response of mudstones under thermal loading and the magnitude of thermal-hydro-mechanical coupling effects. (may add whitby results to this))

The use of Digital Geoscience on the C23 Section of the HS2

Gareth Barker[1]

1EKFB

The Eiffage Kier Ferrovial Bam (EKFB) joint venture is delivering the Central 2 and 3 (C23) contracts of the High-Speed Rail (HS2) Phase One project—an ambitious infrastructure initiative connecting London and Birmingham. Spanning 80 km of complex earthworks, the project presents significant geological challenges and requires precision in engineering and environmental management. To address these challenges, we have adopted a digital geo-data mapping approach, transforming how geological information is captured, analysed, and shared. This poster highlights the critical role of construction-stage geological data, emphasising not only accuracy and accessibility but also the importance of auditable data collection and reporting from initial ground investigations through to final project handover. By leveraging digital recording methods, remote sensing, and real-time data integration, we ensure that our geological insights are comprehensive, transparent, and verifiable. The geological variability along the C23 route necessitates a data-driven approach to decision-making. Our approach mitigates design uncertainties, reduces project delays, and optimises costs by harnessing advanced digital tools. Crucially, our system facilitates a transparent, auditable data workflow, ensuring that all geological information is traceable, standardised, and seamlessly transferred to future custodians—whether for asset management, further development, or research purposes. Effective communication is at the heart of our methodology. Through intuitive data visualisation and user-friendly reporting formats, we enable engineers, environmental specialists, and stakeholders to make informed decisions with confidence. This ensures that geological risks are proactively managed, designs are optimised for efficiency, and construction progresses in a streamlined and sustainable manner. By prioritising high-quality, auditable geological data throughout the construction process, the C23 project exemplifies how digital geoscience can revolutionise major infrastructure development. Our approach not only enhances project outcomes but also aligns with the broader objectives of HS2: to deliver a high-speed rail network that is resilient, sustainable, and underpinned by the best possible geological understanding.

Geodigital methods for assessing coastal erosion risk to critical infrastructure at Point Loma, San Diego

***Natalie Stevenson*[1]**, *Claire Czarnomski*[1] & *Paul Fish*[1]

Critical infrastructure built on the coast faces significant risk from coastal erosion, which is forecast to worsen under projected sea level rise. This is the case for Point Loma Wastewater Treatment Plant, the city of San Diego's principle treatment facility; 24/7 access to the clifftop plant is along one undefended road, vulnerable to coastal erosion and cliff collapse. Following a series of cliff failures in 2021, cliff retreat and cave collapse was identified as a major risk to essential road traffic, and, ultimately, to the continued functioning of the plant itself. In order to manage the risk arising from cliff retreat and cave collapse in the time period up to a new, safe route being constructed, a monitoring programme was initiated to record the timing and severity of cliff failure events, and the possible triggers, including storm waves, groundwater, seismicity, and vibration from road traffic. The ultimate aim is to understand threshold trigger levels above which the road can be deemed unsafe to use, before a failure has actually occurred. The programme involves collection of a large amount of information, including real-time metocean, seismic and ground water data, periodic road surveys, and both imagery and LiDAR drone surveys. Dealing with such large amounts of data is challenging and geodigital tools have been used to streamline data processing and to visualize data so spatial/temporal patterns can be more readily identified. This presentation describes how qualitative, expert judgement-based interpretations of cliff erosion from drone imagery surveys have been codified and processed to show patterns in activity. From combined analysis of the cliff activity, rainfall and wave data, we can analyse potential triggers of instability and the influence of geology, enabling early warning to be developed and to better understand areas that require prioritization for monitoring, and eventually mitigation, of continued cliff retreat.

Preliminary feasibility analysis for offshore wind developments in the geologically complex Galerazamba Gap offshore of northern Colombia

Adam Kirby[1]*, Ross Noble*[1]*, David O'Dowd*[1]

1Geowynd

Offshore wind farm (OWF) feasibility assessments have two key objectives, 1) to outline geohazards which could present challenges for developers, and 2) to determine how they can be mitigated. The Galerazamba Gap, situated on the tectonically active Colombian Caribbean margin, hosts complex tectonic, sedimentary and climatic processes (Galindo and Lonergen, 2020; Naranjo-Vesga et al., 2022; RCG-ERM, 2022) which based on preliminary analyses, could be particularly challenging for OWF developments. The Galerazamba Gap sits atop the Southern Caribbean Deformed Belt accretionary prism, which is forming as the Caribbean plate is subducted under South America at ~20 mm/yr. As a result, complex tectonics have caused local fold-thrust belts, strike-slip faults and mud volcanism which directly impact the site, whilst continued regional uplift since the Miocene has led to frequent earthquakes within or close to proposed development sites (Galindo and Lonergen, 2020). Regarding sedimentary processes, the shelf is situated proximally on the Magdalena Fan, a major morphosedimentary feature fed by the Magdalena River. The fan provides a relatively flat, shallow and wide shelf in the nearshore, but due to high sedimentation rates, is prone to distal slope failure and canyon development (Naranjo-Vesga et al., 2022), such unstable ground is unsuitable for OWFs. Open-source bathymetry (GEBCO, 2020) suggests that a network of sub-marine feeder channels covers the shelf, this suggests a diverse range of soil conditions which should be considered for geotechnical investigations and foundation design. In addition, shallow South-westward flowing ocean currents could generate morphosedimentary features further complicating the shallow subsurface. Lastly, tropical region is subject to extreme weather such as hurricanes, whilst such weather conditions are a hazard themselves, the impact they have on seafloor sediments must also be considered (RCG-ERM, 2022). A series of feasibility maps have been developed for fixed and floating OWFs based on analyses conducted at the site.

Case study of an earth structure failure on an ageing canal network

Joshua Blacker[1], Tom Birch[1]

1Canal & River Trust

The Canal & River Trust (CRT) is the charity that manages over 2,000 miles of canal and river network across England and Wales. The canal network was developed over 250 years ago, before the establishment of modern design standards and construction practices, using locally sourced construction materials.

This poster presents a case study of Easenhall Cutting, a true cutting situated on the Oxford Canal near Coventry, formed from Bosworth Clay Member superficial deposits and underlain by Mercia Mudstone Group bedrock. The cutting has historically had numerous slope failures. Most recently in 2024, it suffered a deep rotational failure on the towpath side and a shallower translational slide on the offside slope shortly after Storms Isha and Jocelyn during the winter storm period. Slope failure completely blocked the towpath and navigation with slipped materials. Whilst there are several contributory factors to the instability, the failure mechanism for this event appears to be primarily due to a combination of the over-steep slope geometry of the geological materials and elevated porewater pressures, caused by saturation from the intense rainfall events.

Geological Realism in Slope Stability Analysis: Three-Dimensional Geological Modelling Compared to Worst-case Design Ground Models

***Archie Bunney*[1]**

1SYSTRA (UK & Ireland)

Within my company's current projects, slope stability analysis using the Morgenstern-Price method has been conducted on proposed railway cuttings at sites in both the West Midlands (HS2 North 1 and North 2) and northern England (Trans-Pennine Route Upgrade East). Historically these analyses have used Design Ground Models to generate the cross-sections used. These models assume the worst possible ground conditions present surrounding prospective cuttings based on all available ground investigation data. Cuttings are divided into separate ground models according to geological variations, such as different superficial deposits. However, these Design Ground Models only provide one, worst-case elevation for the lower boundary of each geological unit. This generates cross-sections to analyse slope stability which have horizontal geological units, including geologically unrealistic, perfectly horizontal weathering profiles and alluvial channels. More recently, three-dimensional models of the ground conditions surrounding prospective cuttings have been generated. These are done by software using implicit modelling to interpolate between detailed, local ground investigation data once stratigraphic relationships are defined, with manual editing available to enhance geological realism. The end results are geological models much more representative of the likely ground conditions below a specific cutting. The analyses of these sections have distinctly different worst-case slip surfaces, both in terms of location and likelihood of failure. The more representative worst-case slip surfaces were not unilaterally better when compared those generated using the Design Ground Models, but varied from noticeably better, through fundamentally the same, to noticeably worse. Therefore, using ground investigation data in slope stability analysis gives more nuanced results. One impact of this nuance would be identifying and rectifying discrete areas of slope instability using targeted stabilisation measures, instead of installing measures along an entire cutting. This concept will be demonstrated using a geological setting similar to that typically found in Warwickshire and the eastern West Midlands.

The Origin and Genesis of the Glacial Deposits (Tills) of a Loch Lomond Stadial Glacier, and the Implications for Glacier Reconstructions: Glen Varragill, Isle of Skye

***Tobias Alexander Darke*[1]**

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The sedimentology of Glen Varragill has not been holistically investigated to date. Prior studies by Benn (1989), Ballantyne (1989), Bickerdike et al., (2018b), and Benn (2021) which map glacial geomorphology and characterise the sedimentology of the Isle of Skye are partly contested and overprinted (palimpsest). This project proposes a robust concept of the glacial depositional environment present in Glen Varragill during the Loch Lomond Stadial (LLS) and the glacial dynamics therein. Contemporary and palaeo analogues of process sedimentology and glacial landsystems are considered to holistically assess empirical sedimentological and geomorphological data and so test different hypotheses for glacial and post-glacial landscape evolution A geomorphological map is presented, utilising an LLS geomorphology and glacial limit database adapted from Bickerdike, et al., (2018). This permits a holistic assessment of sedimentology and geomorphology, and thereafter interpret the glacial depositional environment and landsystem. Clast macrofabric, clast form, and sedimentological data is presented for six sites within Glen Varragill. The outcrops exposed at each site record varied sedimentary processes and products; individual lithofacies feature varied primary and secondary structure and when considered alongside the glacial geomorphology, indicate a multi-faceted landsystem. Photomosaics, lithofacies architecture sketches, and vertical profile logs are presented alongside description, which together support the designation of lithofacies associations (LFAs), and primary and secondary structures. Evidence of stratified diamicton (interpreted to be melt-out till) and glacio-fluvial sediments, glacifluvial sands, and glacitectonite indicate instances of localised ice stagnation and ice override respectively. This is in contrast with the standing designation of the glacial landsystem of the Glen Varragill LLS glacier, by but is supported by the presence of hummocky moraines, which are indicators of localised ice stagnation and down-wasting elsewhere within the LLS limits of Varragill Glacier. When considered together these demonstrate periodic localised ice stagnation on the Isle of Skye during the LLS.

Case study of the use of the observational approach to rock excavation for the STEP Abdelmoumen Project in Morocco

Thomas Chauvin*[1]*, *Yann MARTINOL*[1]

1Vinci Construction Grands Project

This paper presents a case study of the use of the observational approach to rock excavation for a hydropower project in Morocco in weathered sandstones and siltstones. The STEP Abdelmoumen Project is a 350 MW pumped hydropower project in Morocco between Agadir and Marrakech, near the Abdelmoumen dam in the Atlas Mountains. The project is dominated by sedimentary rocks of Triassic age and is located in a seismically active area. The project required construction of earthworks to construct 22 km of programme critical access roads and 2km of cuttings for the exposed penstock in sharp mountainous terrain. Access road construction was a critical activity to enable project start with site logistics, enabling works and construction of the main works hinging on the progress of earthworks activities. The volume of earthworks for the access roads was 870,000 m^3 of excavation and 127,000 m^3 of backfill. Due to the access constraints, limited geological investigations had been undertaken prior to construction. To address geological uncertainties and associated risks, the contractor decided to implement the observational approach. This method allowed the site geological team to confirm the ground model to ensure the global stability of the cuttings and assess the requirements for the potential slope protection measures. High intensity rainfall in otherwise dry conditions required slope protection measures. This utilised slope reshaping, gabions, shotcrete or netting. This paper presents use of the observational approach its implementation in the context of slopes and excavations in rock and how this mas managed by the contractor, designer and client and the development of a decision-making matrix to address risks and uncertainties.

Cliffs of Moher Geohazard Assessment

Marie Fleming*[1]*, *Maeve McElligott*[1]

1Arup

Located on the west coast of Ireland, the Cliffs of Moher rise above the Atlantic Ocean as part of the Burren and Cliffs of Moher UNESCO Global Geopark. The impressive 214m high siltstone and sandstone cliffs are one of Ireland's most popular tourist hotspots. Battered by frequent, intense storms caused by climate change, the Cliffs of Moher Visitor Centre and Clare County Council asked Arup to carry out a geohazard assessment to provide insights into the mechanisms and impacts of erosion, identify areas at risk and feed into future development plans at this protected natural site Along with site walkovers and investigations we used a range of digital tools to create a 3D model of the cliffs, with detailed information which allowed us to assess the behaviour of the rockmass at the inaccessible cliff edge and face. The subsequent 3D Ground model created used information and data from a series of visual assessments, field mapping and Unmanned Aerial Vehicles (UAV), topographic and geophysical surveys. Including over 370 million data points, the model provides an overview of the condition and structure of the overburden and rock at the cliff edge and face. This enhanced digital data formed the basis of stereographic, kinematic and slope stability analyses. Our interactive 3D cliff model can be updated through ongoing monitoring, helping the client track and assess the effects of climate change by analysing ongoing erosion, and inform any future potential developments. We also carried out a geohazard assessment to provide insights into the mechanisms and impacts of erosion, identify areas at risk and feed into future development plans at this protected natural site.

The examination of periglacial shear surfaces and discontinuities in weathered mudstones

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Periglacial weathering processes in mudstone bedrock can leave a lasting legacy of periglacial mass movement features in the ground including shears and discontinuities at shallow depth below the current ground surface. These features may present a geohazard to the construction and operation of infrastructure such as road, railway and reservoir earthworks. The new High Speed Railway (HS2) currently under construction between London and Birmingham crosses geology potentially affected by periglacial shears and discontinuities. Risk assessment of potentially periglacially sheared strata was carried out during the desk study, ground investigation and construction stage of the project and where required measures were implemented to mitigate the risk. This paper provides case studies of the inspection of periglacial shears and discontinuities in Jurassic-aged mudstones at specific locations within an ~65 km length of HS2 between Aylesbury (Buckinghamshire) and Southam (Warwickshire) in central England. The inspections took place during the construction of cuttings and embankments for the HS2 railway. This mapping has also increased understanding of the nature and spatial extent of periglacial shear surfaces in these susceptible strata. The full excavation and inspection of weathered profiles suggests that the Spink (1991) schema for Eocene clays is generally applicable to Jurassic mudstone strata. The case studies identify sheared surfaces occurring at a range of scales between the millimetric scale to single discontinuities with a persistence of 10 or more metres. Individual discontinuities occurred within fields of disturbed ground extending up to hundreds of metres and the nature of the shears and prevailing processes of formation were best understood in relation to their depth within the weathering profile.

From concepts and comprehension to chaotic but confident and dynamic terrain evaluation: a quantum of relief

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1LQM

The Military Engineering Experimental Establishment (MEXE) developed a systematic approach to terrain evaluation by simplifying landscape into a hierarchy of seven categories, each defined by a combination of climate, geology and landform: Zones, Divisions, Provinces, Regions, Systems, Facets and Elements. Operationalising this approach needed hardware, software and data unavailable at that time but since realised. Engineering geomorphology - developing independently and in parallel, largely due to the restricted accessibility of the MEXE products (Fookes, pers. Comm.) – recognised the dynamics and changing nature of Earth's surface form. Humanity's interaction with the Earth's surface is bi-directional – we influence it and are influenced by it, directly and indirectly. We have become ever more proficient in predicting where surface event will take place but much less proficient at predicting their timing, scale, extent or impact. The past is increasingly being seen as a poor key to the future on timescales of primary interest to humanity - our geological time machine's (Shilston, 2021) . A combination of epistemic and aleatory uncertainty coupled with non-linear interactions between a changing climate, poorly constrained geology and oft-modified landform. Current efforts on making better sense of existing datasets make use of various machine learning and other artificial intelligence techniques to improve ground characterisation – but forecasting the timing, rate, extent of terrain evolution – let alone the effect on an engineered structure - is elusive. The complexity of the effect recent weather and long term climate have on geological processes, coupled with our far from complete characterisation of even shallow geological conditions makes predicting when a mass movement will occur, the rate of subsidence or heave, the extent of liquefaction – the radical uncertainty (Lee, 2024). Quantum computers offer an enticing future where time-dependent complex behaviour of and bi-directional interaction between natural systems are quantifiable in advance and are able to use near real time dense data to predict when an event will occur or a state threshold will be exceeded. The qubit's ability to be intact and fracture, saturated and dry, stationary and accelerating will enable dynamic decisions to secure resilient land stewardship and affordable hazard management.

Engineering the Anthropocene - From Desk Study to Construction on Historical Landfills - Case Study Slyfield Industrial Estate Access Road

Bridgette Maphosa*[1]*, Steven Harris

1AECOM

A proposal by Guildford Borough Council to construct a new access road at the eastern end of the Slyfield Industrial Estate addresses challenges posed by the site's complex geological history, previously used as a landfill and a storm overflow sludge lagoon. This redevelopment aims to transform the historically derelict area into viable residential and industrial space in response to growing housing demands. The initial phase involves building an internal access road over landfill and sludge lagoon materials, which presents unique geotechnical challenges. Traditional engineering principles cannot be applied due to the unpredictable behaviour of these materials under load, raising concerns about differential settlement that could affect the road's functionality. Preliminary investigations included site walkovers and desk studies to examine the landfill's operational history and waste types. A preliminary assessment estimated potential long-term settlement from construction, guiding further data collection. Ground investigations provided essential data on the fill material's strength and behaviour, along with surveys of historical monitoring boreholes and surface conditions to identify signs of settlement. The Early Contractor Involvement approach was crucial in integrating compaction trials into the design process, refining the ground model to include both landfill materials and underlying natural deposits. This systematic investigation identified hotspot areas with significant plastic waste, earmarked for targeted mitigation strategies like dig and replace. Two design alternatives emerged: a piled road and a floating road. The floating road solution was ultimately chosen, offering an innovative method to manage settlement issues while promoting land reuse. This design is cost-effective, minimises environmental impact, utilises on-site materials, and ensures minimal disturbance to contaminated material. Such projects enhance our understanding of atypical materials under stress, promoting the potential reuse of marginal lands.

Digital Transformation of Ground Data Group

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1AtkinsRéalis

Earlier this summer, representatives from AtkinsRéalis, Arcadis, Arup, GCG, Mott MacDonald, Tony Gee & Partners, COWI, Aecom, GB Card & Partners, A-squared Studio Engineers, Equipe Group, and Jacobs formed the 'Digital Transformation of Ground Data' group. The group envisions a future where ground data is seamlessly shared and connected to collaborative, interoperable, and digitally mature connected data ecosystems that empower all stakeholders with timely, reliable, and context-rich subsurface data and information. The group aims to:

• Promote standardisation of data formats to ensure consistency, quality, and interoperability across platforms and organisations.

• Support open, secure, and scalable data sharing that respects commercial sensitivities while unlocking collective value for the industry.

• Champion creation of the 'golden thread' linking factual data, ground models, and geotechnical designs, ensuring clarity, traceability, and appropriate use of data and information at every stage. • Drive industry-wide education and upskilling, enabling companies of all sizes to adopt best practices in digital ground engineering.

• Influence policy and software development to align with the real-world needs of ground engineering professionals and clients.

• Advance data stewardship and ownership clarity, ensuring that data is treated as a long-term asset for the industry, not a organisations project by-product.

Together, the group aims to raise the baseline of digital capability across the ground engineering sector, reduce duplication, and improve decision-making, to ensure that we can all deliver safer, more sustainable, and more efficient infrastructure. The group would like to present at this conference to raise awareness and ask the audience questions which will inform a future publication. Example questions could include:

• Who do you believe owns the data? (GI Contractor, client, designer, no one?, the BGS on behalf of the crown (some central authority) (e.g. Netherlands?))

• Should we be sharing interpreted data with the BGS?