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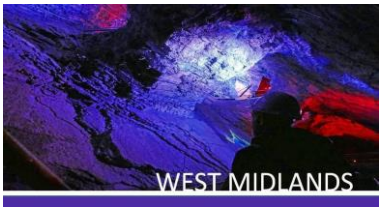

Geological Realism in Slope Stability Analyses: Three-Dimensional Geological Modelling Compared to Worst-case Ground Models

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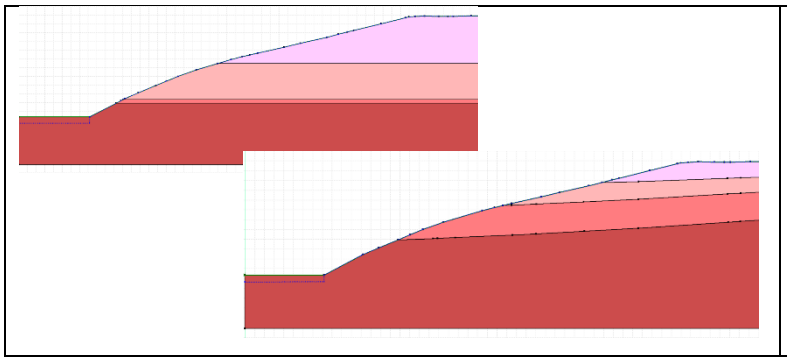
12th May 2026 | Cundall, Floor 4, 15 Colmore Row, Birmingham, B3 2BH| 6:30pm start

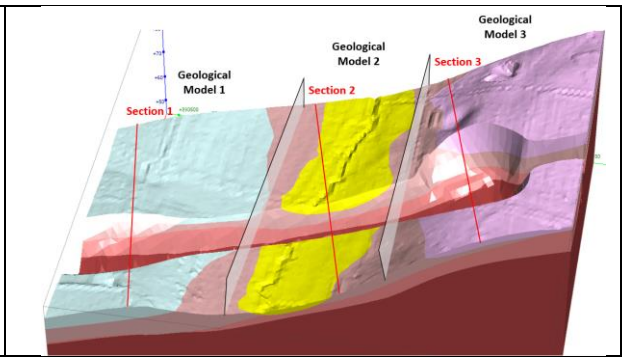
Abstract:

Historically, slope stability analyses on large-scale infrastructure projects have generally used geotechnical Design Ground Models to generate the cross-sections required. These models assume the worst possible ground conditions based on all available ground investigation data. Separate ground models are created 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 for analysis which have horizontal geological units. This could include geologically unrealistic, perfectly horizontal weathering profiles and alluvial channels. More recently, three-dimensional geological models of the ground conditions are able to be generated. These are done by software such as Leapfrog Works. This interpolates between detailed, local ground investigation data, with manual editing available to enhance geological plausibility.

The end results are geological models much more representative of the likely ground conditions below a specific cutting. The analyses of these cross-sections have distinctly different, and consistently less concerning worst-case slope failures. This is both in terms of location and likelihood of failure. Therefore, using ground investigation data in slope stability analysis gives more nuanced results. This concept will be demonstrated using a hypothetical geological setting typical of the eastern West Midlands.





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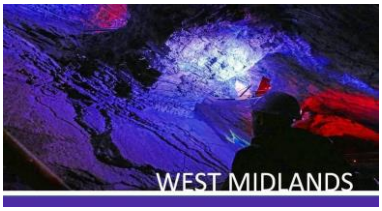

The images above demonstrate the difference in SLOPE/W input cross-sections based on the same data; one (above left) using worst-case levels, and the other (below left) using a 3D geological model, which is also shown (right).

About the Speaker:

Archie Bunney graduated from Cardiff University with a First Class in BSc Geology degree (2019). He then remained at Cardiff University to earn a Distinction in MSc Applied Environmental Geology (2020) and coming top of his cohort. His dissertation, on geotechnical engineering and geoconservation within the Black Country UNESCO Global Geopark, won the Geologists' Association Curry MSc Prize (2020) for the best taught earth science Masters dissertation. Upon entering industry in 2021, Archie worked for two years in the geo-environmental field. This was primarily desk studies and ground investigations for new small- to large-scale residential and industrial developments.

Since 2023, Archie has worked as a Engineering Geologist at SYSTRA on a broad range of infrastructure projects. This has been primarily conventional railways, but also railway station upgrades, highways, and sports facilities. This has involved a greater mix of work expanding from solely ground investigations to geotechnical design including slope stability and parameter derivation, acting as a designer's Geotechnical Site Representative for support during railway construction, and fieldwork to active railways and their surroundings to investigate geological and geomorphological issues affecting the safe running of trains.

Archie has continuously worked to emphasise the importance of geology in geotechnical engineering and design, as well as in construction. Most recently, he has presented at both the British Geotechnical Association's Earthworks 2025 conference and the inaugural Fookes Meeting of the Engineering Group of the Geological Society.

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