3D Geological Modelling for Hydro Power Tunnel Drilling Using A Combined of Generic GIS Tools and AI-Assisted Scripting.

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SUMMARY

Upgrading or exploring new renewable energy potential is crucial to achieving Australia's renewable energy targets. Understanding the geology of the site from geotechnical drilling investigations is one of the most critical works in the construction of hydroelectric power generation. A key part to building the geological model lies in understanding the geological layers from borehole samples. However, preparing 3D geological models and providing long-sections can be challenging using generic GIS tools. Other challenges include incomplete field data, which necessitates continuous model updates, and the single source data policy, requiring continuous data synchronization when exploring new options. In this study, a 3D geological model was produced using generic GIS tools i.e. non-specialized geological software. The model components include faults and geological layers interpreted from borehole data. Faults were triangulated based on their attributes, such as angle and dip, while geological layers were interpolated from borehole readings. Geological layers were interpolated to create 3D surface layers using TIN from contour lines and known point elevations, whereas faults were transformed into 3D surface geometry at angles using 3D object multipatch geometry. To produce long-sections, the design team defined the alignment or long-section lines. Geological layers and fault lines were then imprinted or interpolated into the proposed alignment. A combination of manual and AI-assisted scripting was used to address the challenge of transforming the 2D model i.e. faults and contour lines of geological surfaces in 2D, into a 3D model and subsequently into long-sections. The 3D model enhances audience engagement through 3D visualization, fostering a deeper understanding of geological layers and facilitating the exploration of new options. Although simple, the use of AI in preparing the 3D geological model saves project budgets by eliminating the need for specific geological tools or software. Since the data is stored in geodatabase, all updates automatically synchronize in the 3D web online and related maps, saving time and resources for data transfer between software, re-publishing or re-producing maps for the project.