Leveraging Power BI for Advanced Geotechnical Data Analysis and Visualization in Mining Projects

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Abstract : The mining industry generates vast amounts of data, necessitating robust data management systems and advanced analytics tools to achieve better decision-making processes in the development of mining production and maintaining safety. This paper highlights the advantages of Power BI, a powerful intelligence tool, over traditional Excel-based approaches for effectively managing and harnessing mining data. Power BI enables professionals to connect and integrate multiple data sources, ensuring real-time access to up-to-date information. Its interactive visualizations and dashboards offer an intuitive interface for exploring and analyzing geotechnical data. Advanced analytics is a collection of data analysis techniques to improve decision-making. Leveraging some of the most complex techniques in data science, advanced analytics is used to do everything from detecting data errors and ensuring data accuracy to directing the development of future project phases. However, while Power BI is a robust tool, specific visualizations required by geotechnical engineers may have limitations. This paper studies the capability to use Python or R programming within the Power BI dashboard to enable advanced analytics, additional functionalities, and customized visualizations. This dashboard provides comprehensive tools for analyzing and visualizing key geotechnical data metrics, including spatial representation on maps, field and lab test results, and subsurface rock and soil characteristics. Advanced visualizations like borehole logs and Stereonet were implemented using Python programming within the Power BI dashboard, enhancing the understanding and communication of geotechnical information. Moreover, the dashboard's flexibility allows for the incorporation of additional data and visualizations based on the project scope and available data, such as pit design, rock fall analyses, rock mass characterization, and drone data. This further enhances the dashboard's usefulness in future projects, including operation, development, closure, and rehabilitation phases. Additionally, this helps in minimizing the necessity of utilizing multiple software programs in projects. This geotechnical dashboard in Power BI serves as a user-friendly solution for analyzing, visualizing, and communicating both new and historical geotechnical data, aiding in informed decision-making and efficient project management throughout various project stages. Its ability to generate dynamic reports and share them with clients in a collaborative manner further enhances decision-making processes and facilitates effective communication within geotechnical projects in the mining industry.

Keywords : geotechnical data analysis, power BI, visualization, decision-making, mining industry

Conference Title : ICAMT 2024 : International Conference on Advances in Mining Technologies

Conference Location : Rome, Italy

Conference Dates : April 04-05, 2024