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NUMERICAL INVESTIGATION OF UNLOADING EFFECTS DUE TO EXCAVATION OF GEOMETRICALLY NON-HOMOGENEOUS STRATIFIED ROCK MASSES USING FINITE ELEMENT ANALYSIS

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With the growth of population in the cities and the lack of land nearby, buildings are now reaching heights and depths (basements) demanding larger and deeper foundations. These excavations cause the unloading of the ground in some directions which can lead to creep or sudden failures of the vertical faces. In this research, these conditions are observed for rock masses.

Open-cut excavations have also been the main concerns of projects such as airports in mountainous regions, the Panama Canal, mines, dams, motorways and railways [1]. With time, rock masses accumulate energy through self-compaction and the increasing loads at the surface with the deposition of sediments or man-made structures resting on the earth's surface. Undertaking vertical excavations in these rock masses can lead to the release of the energy which is known as strain energy [2]. Then, displacements through dilation will occur in which foliated rocks would display a higher dilation compared to crystalline rocks [3].

In this research, a realistic stratified rock mass configuration is modelled using different rock materials each having a different Disturbance Factor (D), Ultimate Compressive Strength (UCS), Geological Strength Index (GSI), Poisson's ratio and intact rock parameter. The Finite Element package PLAXIS 2D is used to assess the response of the rock mass to the excavation, looking at stresses and displacements (overall and localised) to predict failure and mitigate it to avoid harming workers and plant. Different rock masses arrangements are compared to target the impact of the location of weaker layers and investigate their influence on the overall stability.

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