World Academy of Science, Engineering and Technology
International Journal of Geotechnical and Geological Engineering
Vol:15, No:10, 2021

Geomechanics Properties of Tuzluca (Eastern. Turkey) Bedded Rock Salt and Geotechnical Safety

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Abstract : Geomechanical properties of Rock Salt Deposits in Tuzluca Salt Mine Area (Eastern Turkey) are studied for modeling the operation- excavation strategy. The purpose of this research focused on calculating the critical value of span height- which will meet the safety requirements. The Mine Site Tuzluca Hills consist of alternating parallel bedding of Salt (NaCl) and Gypsum (CaS04 + 2 H20) rocks. Rock Salt beds are more resistant than narrow Gypsum interlayers. Rock Salt beds formed almost 97 percent of the total height of the Hill. Therefore, the geotechnical safety of Galleries depends on the mechanical criteria of Rock Salt Cores. General deposition of Tuzluca Basin was finally completed by Tuzluca Evaporites, as for the uppermost stratigraphic unit. They are currently running mining operations performed by classic mechanical excavation, room and pillar method. Rooms and Pillars are currently experiencing an initial stage of fracturing in places. Geotechnical safety of the whole mining area evaluated by Rock Mass Rating (RMR), Rock Quality Designation (RQD) spacing of joints, and the interaction of groundwater and fracture system. In general, bedded rock salt Show large lateral deformation capacity (while deformation modulus stays in relative small values, here E= 9.86 GPa). In such litho-stratigraphic environments, creep is a critical mechanism in failure. Rock Salt creep rate in steady-state is greater than interbedding layers. Under long-lasted compressive stresses, creep may cause shear displacements, partly using bedding planes. Eventually, steady-state creep in time returns to accelerated stages. Uniaxial compression creep tests on specimens were performed to have an idea of rock salt strength. To give an idea, on Rock Salt cores, average axial strength and strain are found as 18 - 24 MPa and 0.43-0.45 %, respectively. Uniaxial Compressive strength of 26- 32 MPa, from bedded rock salt cores. Elastic modulus is comparatively low, but lateral deformation of the rock salt is high under the uniaxial compression stress state. Poisson ratio = 0.44, break load = 156 kN, cohesion c= 12.8 kg/cm2, specific gravity SG=2.17 gr/cm3. Fracture System; spacing of fractures, joints, faults, offsets are evaluated under acting geodynamic mechanism. Two sand beds, each 4-6 m thick, exist near to upper level and at the top of the evaporating sequence. They act as aquifers and keep infiltrated water on top for a long duration, which may result in the failure of roofs or pillars. Two major active seismic (N30W and N70E) striking Fault Planes and parallel fracture strands have seismically triggered moderate risk of structural deformation of rock salt bedding sequence. Earthquakes and Floods are two prevailing sources of geohazards in this region—the seismotectonic activity of the Mine Site based on the crossing framework of Kagizman Faults and Igdir Faults. Dominant Hazard Risk sources include; a) Weak mechanical properties of rock salt, gypsum, anhydrite beds-creep. b) Physical discontinuities cutting across the thick parallel layers of Evaporite Mass, c) Intercalated beds of weak cemented or loose sand, clayey sandy sediments. On the other hand, absorbing the effects of salt-gyps parallel bedded deposits on seismic wave amplitudes has a reducing effect on the Rock Mass.

Keywords : bedded rock salt, creep, failure mechanism, geotechnical safety
Conference Title : ICRMGGE 2021 : International Conference on Rock Mechanics, Geomechanics and Geotechnical Engineering
Conference Location : Paris, France
Conference Dates : October 28-29, 2021