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Swelling Assessment of rock Units of Parvadeh Tabas Coal Mine

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Abstract

In excavation tunnels with properties of inflatable sedimentary rocks, the change in floor height and movement of side walls inwards is often observed and causes tension and destruction of the structure. Stones that swell also exhibit viscoelastic behavior, possibly due to the sliding of clay layers. In order to determine the physical and mechanical parameters of shale, mudstone and sandstone which include tunnel No. 3 of the eastern tunnel of Parvadeh Tabas mine, special gravity tests, porosity, water absorption percentage, uniaxial compressive strength, Brazilian resistance test, swellability test, X-ray diffraction (XRD) test, and… Face. The relationship between the parameters of the intervening rock mechanics and the swelling of the rocks containing this tunnel has been paid. The tunnel is composed of fine-grained sandstone, shale and coal-juxtaposed mudstone. Cements are in the form of silica, lime and iron oxides which are important factors in the impact of the resistance of samples. Clay minerals are dominant in ilite and chlorite and to a lesser extent Montmorionite and kaolinite. The inflation coefficient of the studied rocks including shale, mudstone and sandstone were predicted to be 23.64, 17.6 23 and 12.3 percent, respectively.

Keywords: *Swelling, parvadeh coal mine, Sandstone, Shale, Mudstone*

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Extended Abstract:

1. Introduction

Sedimentary rocks with clay minerals with swelling behavior and periodic contraction due to the presence of water and being in the wet cycle and intermittent drying cause engineering disasters such as foundation subsidence and excessive deformation of the railway bed and the elevation of the bed and openings of tunnels and underground mines(Selen et al, 2019).One of the most difficult problems with coal mining in underground tunnels is controlling the stability of the layers .Layer control is not only necessary for the safety of miners and maintaining access to the mine surface, but also to facilitate the transportation of extracted coal and prevent the trapping of valuable equipment, to keep road maintenance work to a minimum (Jin, 2020) .

Inflation is an example of a problem that is widely considered during the construction and design of tunnels in geotechnical engineering, as a result of which this factor has caused many researchers such as (Wang et al., 2014; Liu et al., 2016). It has been developed to describe the basic mechanisms and test methods appropriate to the ISRM standard, which describes the sample as well as the design and analysis that is based on the standard.

Swelling in tunnels is a factor that can occur suddenly or during excavation and construction very slowly. An example such as the Haustian tunnel in Switzerland where inflation has blocked the opening of the underground mine tunnel in a short period of time and suddenly (Taylor et al, 2018). The process of swelling and physical changes is known with reference to mudstones, and formations with clay anhydrite content have received the most attention from researchers in the United Kingdom and the United States. Rocks exhibit a variety of grain sizes, porosity, and texture that can act as a controlling factor for swelling behavior caused by water intrusion. *Some of the people who have done studies on the swelling as well as the engineering geological properties of different rocks are as follows.*

Due to the large spread of sedimentary rocks, it is necessary to pay attention to their petrology, physical and mechanical properties. In the present study, the inflation susceptibility of sandstone, shale and lichen of Parvadeh coal mine has been investigated and the relationship between inflation parameter and other engineering properties *has been investigated.*

2. Material and Methods

In this study, the engineering geological characteristics of the rock masses of the eastern tunnel No. 3 of Tabas coal mine have been investigated with a special attention to the issue of swelling of *rocks*. At first, the library method was used. For this purpose, a number of different sources were collected and studied. In the next stage, field visits have been conducted. In these visits, experts working in the mine were used. During these visits, while getting acquainted with the physical conditions of the project site, other local information is also collected. In the next step, laboratory tests were carried out, in which in addition to determining the physical and mechanical properties of rock samples obtained from the removed boreholes and rock blocks in each experiment, the

investigation of some of the factors affecting the results of the experiments has been put on the agenda .Finally, the relationships between the parameters have been investigated. The tunnel is located at a depth of 575 to 600 meters below the ground and its units include three layers of sandstone, lichen and shelf. In the present study, 34 blocks were selected from the rock samples and different rock mechanics tests were performed on the samples. Rock mechanics test based on ISRM standard (1981) All the experiments were carried out in the Rock Mechanics Laboratory of Ferdowsi University of Mashhad.

3. Discussion and Conclusion

Inflation is a process that increases the volume of materials and changes the internal structure of the structure, especially underground tunnels. There is a potential for swelling in rocks that have a significant percentage of clay minerals. According to field and laboratory evidences, the rock The tunnel consists of lichen, shale, and fine-grained sand, and has abundant clay minerals, illite and chlorite, and insignificant montmorionite and kaolinite clay minerals, which proves the potential for swelling in this area (according to the results of the XRD test). These samples have different thicknesses according to the mineralogical composition of their cementing type, among the samples, shale rock has the highest swelling potential i.e. 23.5% and sandstone has the lowest inflation rate (12.5%) According to the inflation-time strain curve, it can be concluded that the most important factor of inflation is time, and the inflationary strain-inflationary pressure curvecan be used for the construction and design of structures. According to the studies, the percentage of porosity, water absorption and density can affect theamount of inflation, and by increasing the rate of inflation, the resistance of the rocks decreases and the amount of wave speed in the rock samples in this area-decreases.