MINE WATER RISK IN OPEN PIT SLOPE STABILITY

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INTRODUCTION

It has long been recognised that the most important factor which is tending to produce the movement of stable and unstable open pit slope is high water table, e.g. high pore pressure ratio above slip surface. Figures 1 to 3 present three conditions under which pore water pressure causes instability of the open pit mine slopes. The effect of water pressure is to create an uplift force on the potential failure surface and thus reduce the resistance along the slip surface. To eliminate that factor it is necessary to eliminate water pore pressure by adequate drainage. By drainage or adequate removal of water from soil mass, the pore pressure regime can be reduced in its capacity to produce instability of open pit slopes.

Figure 1. Open pit slope with groundwater, case 1.

BASIC CONSIDERATIONS OF WATER PRESSURE IN OPEN PIT SLOPE

In all open pit slopes stability problems it is necessary to determine the pore water pressure from a prescribed phreatic surface. Phreatic surface in the open pit slope area is not constant and it depends on different factors. In order to include the effects of
Figures 2 and 3. Open pit slope with groundwater, case 2.

In stability analysis, we use the pore pressure ratio \( r_u \). The pore pressure ratio is defined as the ratio between the total upward force due to water pressure and the total downward force due to the weight or overburden pressure. According to Archimedes' principle, the upward force is equal to the weight of water displaced or the volume of sliding mass under water multiplied by the unit weight of water. The downward force is equal to the weight of sliding mass. The pore pressure ratio can be determined by:

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r_u = \frac{\text{Volume of sliding mass under water} \times \text{Unit weight of water}}{\text{Volume of sliding mass} \times \text{Unit weight of soil}}
\]

Figures 2 and 3. Open pit slope with groundwater, case 3.

In all the simplified methods of stability analysis, the pore pressure ratio is used to reduce the effective stress along the failure surface by a factor of \( 1 - r_u \).