

Rock mechanics characteristics of fault zones and their effect for designing underground facilities

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Understanding the nature of the host rock, especially the structural geology features, is one of the keys to the successful design and construction of all underground facilities located in rock masses. The most important features are the faults because these are major discontinuities in the rock mass continuum — affecting the local rock stresses, providing high permeability paths for water flow, and potentially adversely affecting the rock mass stability. Accordingly, it is essential to understand the formation, geometry and mechanical properties of the faults, especially for major construction projects.

This paper gives overview how the fault zones are considered in the design of the underground projects. The design aspects mainly involve the characterisation and properties of the zones for stability analyses and support and grouting design. Special attention has here laid on the properties the brittle deformation zones at the Olkiluoto nuclear repository site in western Finland which play critical roles in the strength and hydrology of the host rock mass. In Olkiluoto a procedure was implemented for incorporating information on deformation zones obtained through boreholes into quantitative engineering design. Ductile and brittle deformation zones are classified based on their characteristics in drillhole cores as brittle joint clusters, brittle fault zones, or semi-brittle fault zones, with an awareness of the geologic processes that caused the zones to develop as they did.

Finally, the paper describes how the mechanical properties of the fault zones can be calculated or estimated by one of the several methods, each of which has advantages and disadvantages.