MASTER THESIS

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Evaluation of the hydraulic splitting at Bjørnstokk HPP

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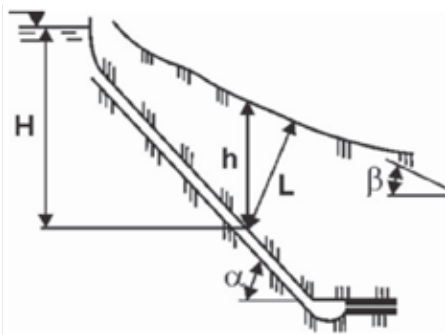
Background

"Hydraulic splitting" is the initial fracture propagation in homogeneous rocks due to induced hydraulic pressure. Several failure cases, such as Byrte (1969) and Åskåra (1970), have proved that the potential for hydraulic splitting poses a challenge in the application of unlined pressure tunnels. It occurs when the water pressure exceeds the minor principal stress (3) in the surrounding rock mass.

Hydraulic splitting has occurred in the unlined tunnels at Bjørnstokk Hydropower Project (HPP). Thus it is of interest to assess the potential for hydraulic splitting.

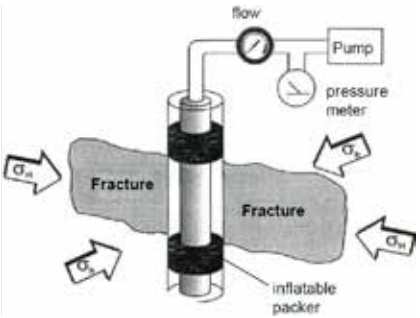


The illustration is related to the so-called Rules of thumb. The analytical stability assessment includes an assessment based on these design criteria (Panthi, 2014)

Objectives

The main objective of the Master's thesis is to carry out a stability assessment, analytically and numerically (Phase2), of the tunnel system at Bjørnstokk HPP with focus on hydraulic splitting.

- Theoretical review on in situ stresses, stress measurement techniques, and rock mechanical properties
- Review on design principles for unlined/lined pressure tunnels, as well as previous failure cases
- Carry out laboratory tests of collected samples covering mineralogy (XRD) and rock mechanical properties (UCS, tensile strength, etc.)
- Discuss case-specific engineering geological aspects



Stress measurement techniques. Hydraulic fracturing (Li, 2016)