Large Scale Ground Settlements Above Tunnels in Fractured Crystalline Rocks

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5) Organizational unit: Departement Erdwissenschaften, Geologisches Institut, Löw, Simon, simon.loew@erdw.ethz.ch, LZ=03465

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10) Partner organizations: no entry
11) Short Summary: no entry

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13) Project description:
Measurements of surface displacements in the area of the Gotthard Pass above the A2-Tunnel have shown up to 10 cm of subsidence since 1978, which is related to pore pressure reduction, fault reactivation, and large scale rock mass compaction from fluid drainage (Zangerl et al. 2008a,b,c). Subsidence of this magnitude could affect surface structures (e.g. dams) above the underground opening.

In relation to the construction of the Gotthard Base Tunnel and the safe operation of hydropower systems in the Gotthard Massif, a new large scale surface deformation monitoring system has been established, which is composed of high precision levellings, automated local geodetic networks, and differential GPS. The system has been set-up many years before the excavation of the Gotthard Base Tunnel and allows to study the tunnel induced and natural surface deformations in this region (Loew et al. 2007).

The monitoring system confirms the general interrelationships between deep tunnel drainage and large scale rock mass deformations in crystalline rocks, but also shows large variations in transient hydro-mechanical coupled response. The transient deformations last longer than initially expected and reach several kilometers. The observed transient deformation patterns are used to derive large scale hydraulic and mechanical properties of fractured rocks such as compressibility, hydraulic conductivity and storativity.

In addition this study also focuses on a detailed understanding of the mechanisms of the observed phenomena. This includes comprehensive geological, rock mechanical and hydrological field mapping at all geodetic monitoring locations, and the compilation of geotechnical measurements at the tunnel elevation. Existing numerical and newly developed mathematical models are applied to investigate the natural and tunnel induced surface deformation mechanisms.

14) Popular description: no entry

15) Graphics: no entry

16) Publications:
above deep tunnels in fractured crystalline rock: numerical analysis of coupled hydromechanical mechanisms. International Conference on Coupled T-H-M-P Processes in Geosystems, Stockholm, Sweden, Stephansson, O.


17) Links to important web pages: no entry