

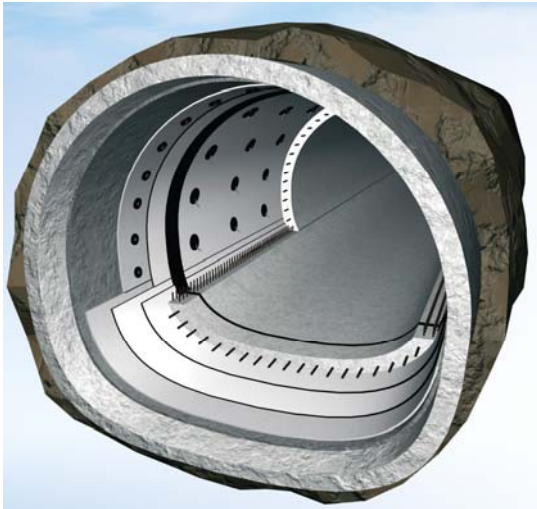
## ADVANCED LINING SYSTEMS AND SEALING APPLICATIONS ON SHOTCRETE SURFACE

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Shotcrete forms the basis of lining systems for sealing purposes, in tunnel applications as well as on excavated slopes of reservoirs etc. Levelling uneven subsurfaces of rock or gravelly fills, shotcrete provides a surface of a certain quality, meeting static requirements. Nevertheless, depending on the type of construction, hydraulic aspects require additional measures to fulfill the requirements on sealing purposes and thus the long-term performance of the entire structure. Membranes made from polyethylene, which are perfectly suited for long-term performance, are of high sensitivity against puncture stress resulting from uneven surfaces. Besides the improvement of shotcrete surfaces themselves, protection liners are often required to reduce extra costs for grouting and injection as well as for maintenance in the medium and long term.

The paper outlines international experience and state of the art of designing and constructing tunnel sealing systems including injection, grouting and protection issues as used in Central Europe, based on shotcrete surfaces. Advanced anchorage systems for sealing without penetration are highlighted as well. Beside tunnel applications, the design of excavated and shotcrete-stabilized slopes by using geosynthetic elements for sealing purposes is addressed.



*Figure 1 – Cross section of a lining system fixed on shotcrete surface*



*Figure 2 – Advanced self-healing and lateral flow preventing protection layer*