Proceedings

Shotcrete for Underground Support XI

Engineering Conferences International	*Year* 2009

TUNNELLING IN SQUEEZING AND SWELLING ROCK BY USING HIGH DEFORMABLE CONCRETE ELEMENTS

Patrick Steiner

Solexperts AG, Switzerland, patrick.steiner@solexperts.com

▮▬▮ Sprayed concrete support of high bearing capacity hiDCon - high deformable concrete

Yielding support is the state of the art technique for tunnelling in heavily squeezing rock. hiDCon elements are being used successfully as yielding support in a number of projects.

Example project: Saint Martin la Porte access tunnel - LTF (Lyon - Turin - Ferroviaire) Base Tunnel
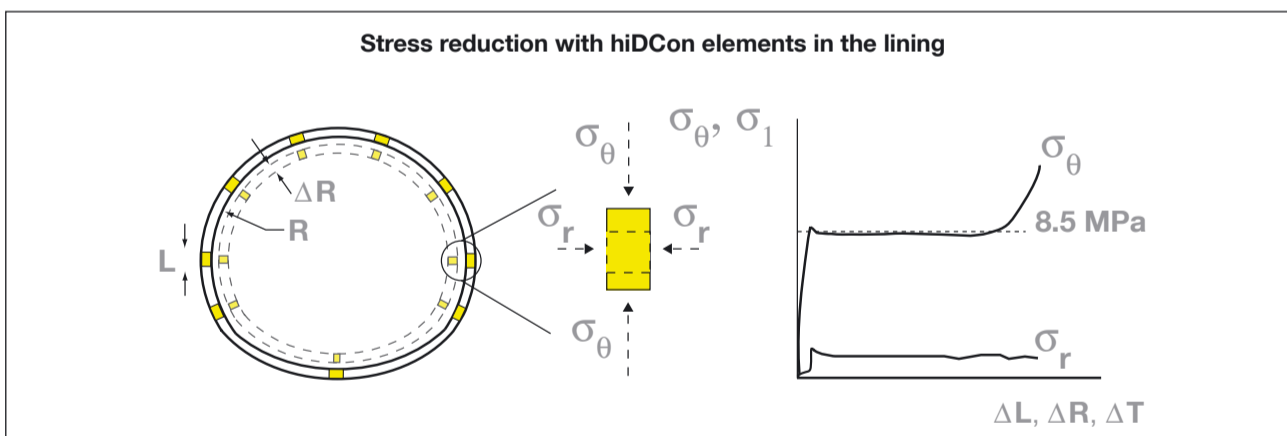

Saint Martin la Porte access tunnel, change from stiff to yielding support (source: Razel / Bilfinger Berger / Pizzarotti)

Difference between stiff and yielding support
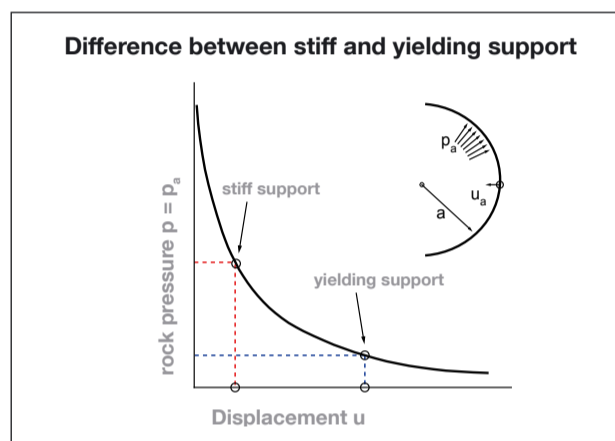
> « With each fraction of millimetre with which the rock mass moves, the amount of pressure acting on the lining decreases. »
>
> Wiesmann (1914)

Tunnel support system:

Stress reduction with hiDCon elements in the lining

8.5 MPa

St. Martin la Porte access tunnel: Detail of hiDCon elements within the yielding tunnel support

The tunnel support system was changed to yielding shotcrete to manage the difficult, heavily squeezing rock conditions. This support system consists of steel ribs or lattice girders, hiDCon elements and shotcrete. The final lining is cast in place 80 – 100 m behind the face.

hiDCon properties

Different hiDCon mixtures

Stress σ in N/mm²
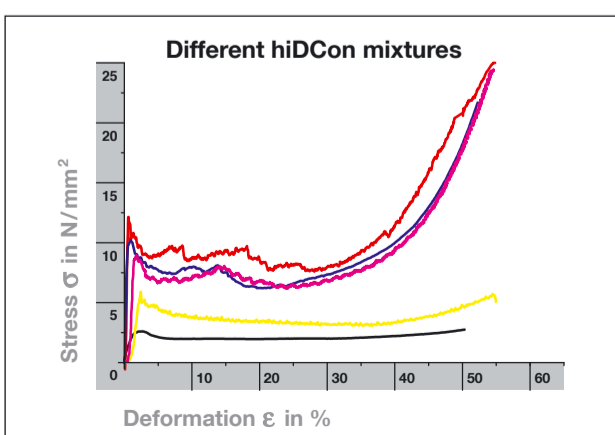
Deformation ε in %

- Yielding stress level between 2.5 – 18 N/mm² and deformation 35 – 55 %
- Precasted elements: wide range of element shapes
- Resistant to shear stress
- Uniform load transmission to the shotcrete

hiDCon®

hiDCon element in yielding tunnel support system, 15% deformation