

In-situ stress amplification in tunnels from Spain, Iran and Chile estimated by TSI and SAF indices

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ABSTRACT

This paper presents the in-situ stress values estimated in six tunnels from Spain, Iran and Chile applying the Tectonic Stress Index (TSI) and the Stress Amplification Factor (SAF). TSI considers the tectonic stress and provides an average value of K (σ_H/σ_v) at regional scale (González de Vallejo and Hijazo, 2008), while SAF estimates the increment of the principal horizontal stress in a tunnel rock mass due to geological and geomechanical local anisotropies (Hijazo and González de Vallejo, 2012). TSI and SAF have been calculated in four railway tunnels of the Pajares high speed corridor in North of Spain, in the Qazvin railway tunnels in Iran and in the San Cristóbal road tunnel in Chile. The results have shown that for high values of SAF, deformations in the tunnel sections were much higher than those expected in the design. The increments of the horizontal stress due to local anisotropies have ranged from 1.1 to 2.9 over the mean regional horizontal stress (Fig. 1). The most influencing rock mass anisotropies include faults, geomechanical anisotropies and folds with steeply dipping flanks. The importance of geological and geomechanical anisotropies as potential zones of instabilities is shown.

Stress amplification zones can be identified and evaluated by TSI and SAF indices. The application of these procedures can provide representative geomechanical models for tunnel design and excavation purposes in regions with complex geological conditions and high in-situ stress. Tunnel zoning in terms of K values (Fig. 2), can help to anticipate potential zones of instability.

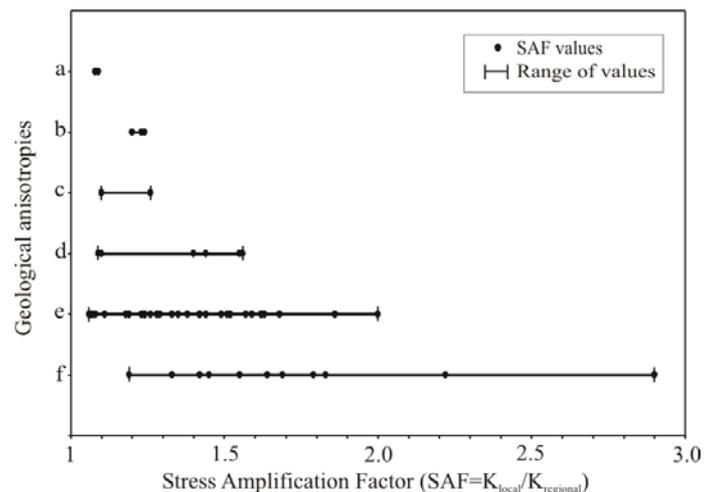


Figure 1. Range of SAF values. a: folds and geomechanical anisotropies; b: faults and geomechanical anisotropies; c: folds; d: faults and folds; e: faults; f: geomechanical anisotropies.

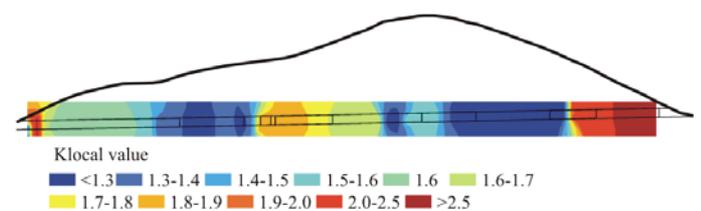


Figure 2. Tunnel zoning in terms of K values of Buen Suceso I tunnel.

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