

Shallow tunnels

Tests undertaken at the LRM in the domain of geotechnical aspects of shallow tunnels include the following subjects:

Tunnel stability in the standard section

The influences of the characteristics of the rock mass (jointing, strength of intact rock) and the support systems put in place (passive bolts of variable length), respectively, were studied using different approaches - physical tests using a base friction apparatus, simulation using numerical calculations (finite element and distinct element methods), rough modelling using analytical calculations, fitting using results obtained through monitoring in existing tunnels (Figure 1).

Face stability

The cases of completely cohesive or completely granular conditions were the subject of a detailed bibliographic study; tests on two and three dimensional geotechnical models (base friction frame, test box), especially with pre-face bolting, are currently carried out.

Surface settlements

This aspect, which is especially important for the construction of urban tunnels, was treated using model tests and numerical simulations (Figure 2). A bibliographic study and review of commonly used empirical formulas was carried out.

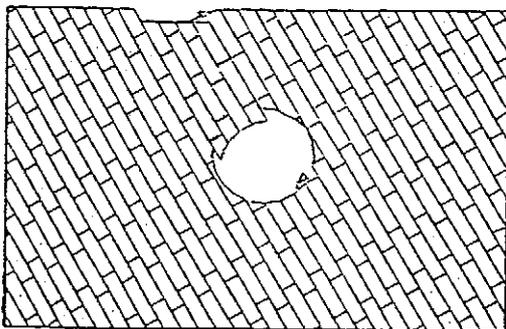


Fig 1. Displacements around a tunnel excavated in a layered and fissured mass

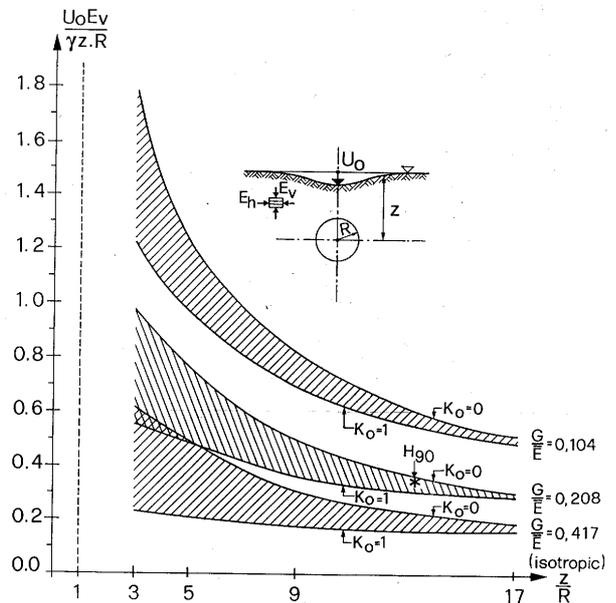


Fig 2. Surface settlements U_0 as a function of the tunnel depth z , the shear modulus G and the at rest earth pressure coefficient K_0 .

H_{90} = settlement above the Heschl II tunnel (depth = 90 m)

Publications

- Egger P., 1989. Examples of uncommon settlements in urban tunnelling, *C.R. Congrès intern. Geoengineering, Vol. 2*, Turin: 955-961
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- Karaca M., Aydan Ö., Egger P., Sezaki M., 1995. Mechanics of failure around shallow tunnels in jointed rock, *C.R. MJFR-2*, Vienna: 771-776
- Egger P., 1995. Excavation and Stability of Underground Openings, *Keynote address 8th Int. Congr. ISRM, Tokyo, Vol. 3* : 1055-1060