



Rail4Future

Projekttitel:	Resilient Digital Railway Systems to enhance performance
Projektnummer:	882504
Deliverable:	3.2.1 Report on material tests and structural monitoring data

This deliverable refers to (i) results from innovative material testing of cementitious binders used in tunneling, and (ii) state-of-the-art structural monitoring of both segmental linings used in mechanized tunneling and shotcrete shells used in the New Austrian Tunneling Method.

A novel method for the characterization of early-age reaction kinetics of cementitious binders, based on the innovative equipment extension of a quasi-isothermal differential calorimeter is described. Related data provide valuable insight into the dissolution of the cementitious binder into the pore water, and into the precipitation of hydration products from the oversaturated solution. This coupled dissolution-precipitation process drives the mechanical property evolution of (precast as well as sprayed) concrete, the material which constitutes most of the volume of tunnel linings which are exposed to mechanical loads over service periods extending up to 150 years.

In order to analyze the time-dependent viscoelastic material behavior of concrete tunnels, creep models will be developed. Experimental data from (i) creep and shrinkage tests performed on Koralm tunnel site and (ii) a collection of creep tests from the scientific literature are used for the calibration these models.

Monitoring data of tunnel Stein (Koralmbahn), i.e. of a measurement cross-section with five measurement points in the top heading, and with one measurement point per bench; like geodetic spatial absolute displacement measurements for each measurement point, as well as the material and geometric data of the measurement cross-section. In the Koralm Tunnel KAT3, monitoring data from vibrating wire strain sensors are compiled for structural analysis. Additional monitoring data from the Suzhou metro and a Belgian tunnel allow a comprehensive investigation of the behaviour of segment linings.

Overall, the present report pays focused attention to the necessity of meticulous monitoring and analysis for ensuring the safety and serviceability of tunnel structures, underscoring the demand for ongoing study in this area, in order to enhance our comprehension and capacity to forecast the behavior of these crucial infrastructure components.