

FIRST INFORMATION ABOUT THE SRDA PROEJCT: EXPERIMENTAL INVESTIGATION AND COMPUTER MODELLING OF AIRFLOW DURING ROAD TUNNEL FIRE

Peter Danišovič

Faculty of Civil Engineering, University of Žilina, Žilina, Slovak Republic

The project is supported by the Slovak Research and Development Agency SRDA-24-0429 and began in autumn 2025. Researchers from the **Institute of Informatics of the Slovak Academy of Sciences** and the **University of Žilina** are collaborating on the project. Project primarily deals with the interaction of emergency ventilation, meteorological factors and fire in a real tunnel, with the aim of creating a series of computer simulations of fires in two highway tunnels. Essentially this project follows on from the previous project SRDA-15-0340 entitled "Models of formation and spread of fire to increase safety of road tunnels" (2016-2019).

TUNNEL TRAFFIC & OPERATION SIMULATOR



Virtual **two-tube** highway tunnel **1 km** long with possibility of various **simulations of emergency events** and standard and non-standard phenomena, failures/malfunctions/losses of remote control of technological equipment.

SIMULATIONS OF EMERGENCY EVENTS



A lot of possible changes of simulation environment: physical values, of traffic intensity, operational parameters, video simulation development in the form of emergency and other calls, technological equipment status (malfunction or other error of cameras, sensors, traffic signs, power supply, etc.).

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EXPERIMENTS IN SITU AND MEASURING DEVICES



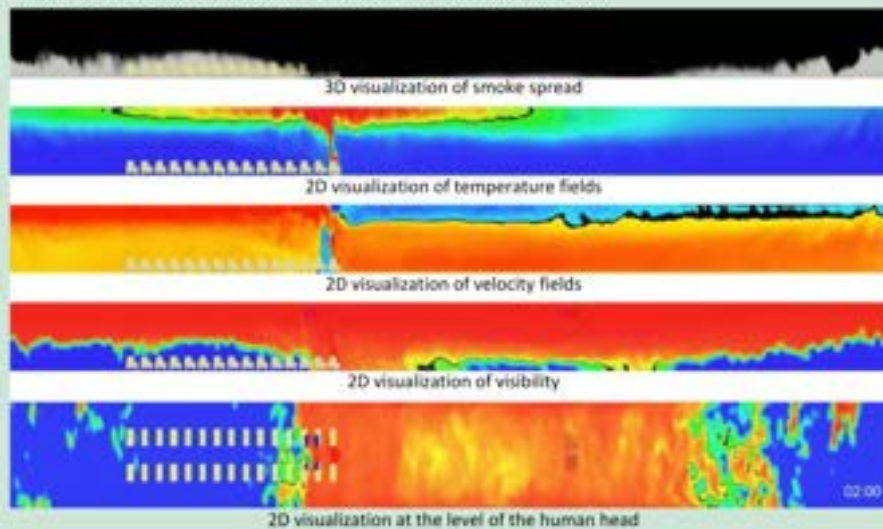
- network measurement of airflow in Poľana tunnel with investigation of smoke stratification (cold smoke),
- other independent measurement at the portals of Poľana, Považský Chlmec, Otvársko and Vilnové tunnel,
- measurement of airflow in the ventilation duct of Branisko tunnel during a tactical training of emergency rescue services and tunnel manager.

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SMOKE SPREAD SIMULATIONS FOR THE VIRTUAL TUNNELSOF SIMULATOR



NEW PROJECT – GOALS:

- realization of in situ experiments in two highway tunnels with the aim of observing and monitoring the impact of emergency ventilation and meteorological factors on the airflow velocity and smoke spread in the tunnel,
- creation of computer simulations of tested scenarios (preparation of input data, parallelization design, creation of simulation on an HPC system, evaluation and visualization of simulation results and their validation using experimental data,
- modification/expansion of the simulator in accordance with the requirements of current legislation,
- evidence and evaluation of emergency events from Slovak tunnels,
- creation of visualizations of fire scenarios and their integration into the simulator.

