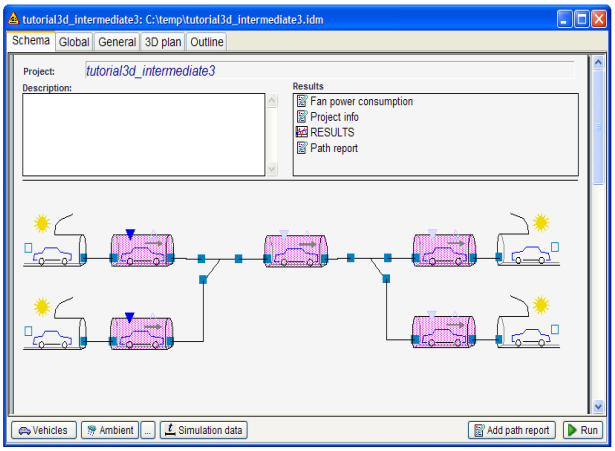
IDA Road Tunnel Ventilation 3.0

Road Tunnel Ventilation and Fire Simulation Software

Background

The first version of IDA Road Tunnel Ventilation (IDA RTV) was developed in 1995 to address the ventilation and fire design tasks of the Stockholm ring road projects.



A model in the schema view

Version 3.0 is a complete re-implementation of IDA RTV in the Modelica language with sufficient functionality to cover the full range of road tunnel ventilation design tasks.

EQUA's tunnel ventilation software is used by leading European tunnel design companies such as HBI Haerter, Gruner, Halcrow, WSP, Norconsult, Rambøll, Pöyry and Sweco and has been applied in full scale projects since 1995. Two examples of road tunnel design projects where the software has been used are Södra Länken in Stockholm and Cross City Tunnel in Sydney.

Technical facts: Road

IDA Road Tunnel Ventilation calculates air pressure, flow rates and pollution concentrations in complex tunnel networks. The program handles both longitudinally and transversally ventilated tunnels, with possible bi-directional multilane traffic. A dynamic traffic model is available for realistic studies of congestion and traffic-control scenarios.

The user enters a geometrical description of the tunnel, i.e. height coordinates and cross-sectional areas along the length of each tunnel branch. Other input data cover ambient conditions (including portal wind pressure), traffic inflow, emission characteristics and coefficients of drag and friction. PIARC and similar emission tables are also included. Tables can be linearly combined and scaled with suitable age, weight and other factors.

Ventilation may be longitudinal or transversal, with air supply and exhaust terminal devices distributed along the tunnel. For momentum jet fans the user specifies cross-sectional area, efficiency and air velocity.

Smoke front in the 3D view

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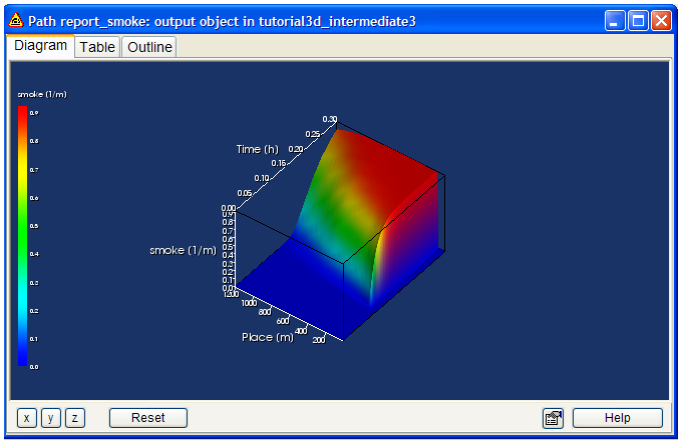
Tunnel fire scenarios can be simulated where a user-specified heatflux is added in a limited section of the tunnel. Models for smoke production depending on fire type and combustion materials are available as well as fire size limitations in accordance to available oxygen levels. Temperature profile into the wall and smoke radiation is modeled.

Three road traffic models are available: standing, moving and dynamic. The dynamic traffic model is able to predict many of the phenomena associated with real traffic such as congestion, multi-lane traffic, vehicle and slope dependent maximum speeds.

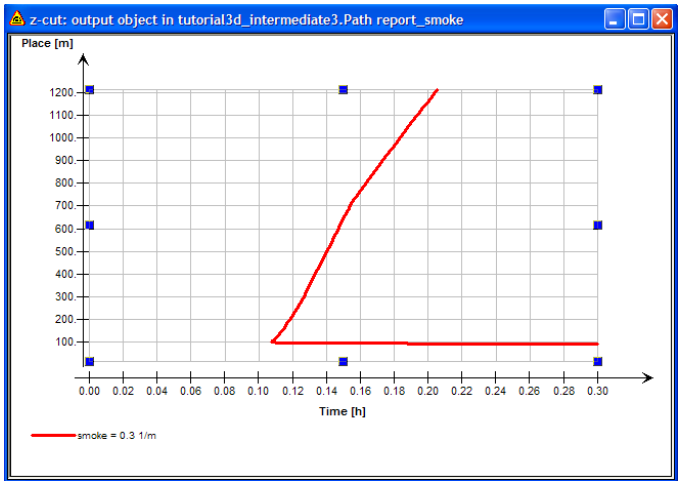
IDA Road Tunnel Ventilation is the road tunnel subset of the full suite: IDA Tunnel, a comprehensive tunnel environment simulation software suite from EQUA.

IDA RTV has optional add-ins for 3D tunnel modeling and feedback controls.

IDA Tunnel simulators are also available for real-time hardware-in-the-loop studies.



Smoke spread during 0.3 hours



Smoke front as a function of time and space

Features and Modules

	IDA Road Tunnel Ventilation	+ IDA Control Toolbox	+ IDA 3D Tunnel Editor	IDA Tunnel	+ IDA HIL Console
Bi-directional, multi-lane, dynamically congested road traffic	√			√	
1D prediction of air-flow, pressure, temperature, CO, NO_2, and smoke	√			√	
Fire and critical velocity	√			√	
Longitudinal ventilation with jet fans	√			√	
Transversal ventilation	√			√	
Air-in and -out stations, axial fans	√			√	
Saccardo nozzles	√			√	
Wall temperature profile (heat sink)	√			√	
PIARC emission tables	√			√	
Arbitrarily complex tunnel systems	√			√	
3D plots (value vs. time and path length)	√			√	
80+ feedback control components		√		√	
3D tunnel system editor with traffic lanes			√	√	
3D animation of traffic flows			√	√	
3D animation of computed results			√	√	
3D tunnel system editor with rail lines				√	
Discrete vehicle electric and diesel rail traffic				√	
Variable train headways and stochastic traffic patterns				√	
1D prediction of moisture, CO_2, age of air, HC and PM_{10}				√	
Long-term temperatures, incl. radial water seepage				√	
Tunnel-to-ground and tunnel-to-tunnel thermal coupling				√	
Ice and mould (mildew) build-up				√	
Realistic schedules and measured climate files				√	
Library of HVAC components				√	
Platform passenger comfort (PPD)				√	
Import and SI conversion of SES input files				√	
Hardware-in-the-loop (HIL), real-time console					√
OPC client for PLC communication					√
Operator training simulator toolkit					√

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