Tunnel Environment Technologies

Analysis of Road Tunnel Emission Structures

3-D Numerical Analysis of Subway Train Wind

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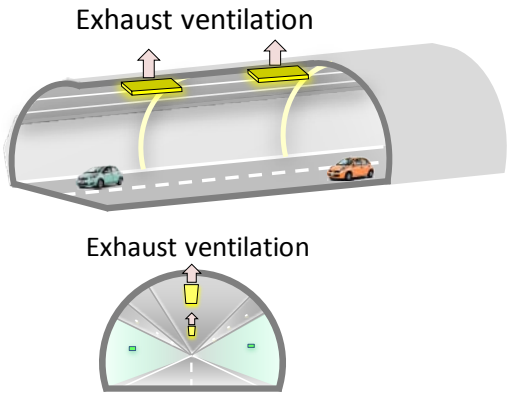
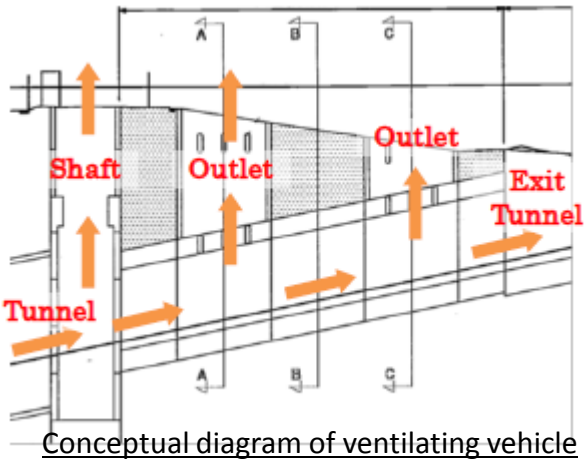
Analysis of Road Tunnel Emission Structures



An image of the structures ventilating vehicle gases in a road tunnel

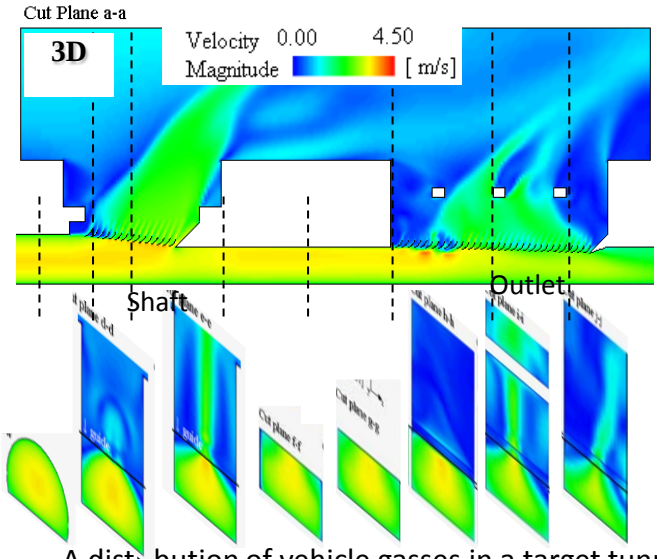


Conceptual diagram of ventilating vehicle gases in a road tunnel

Vehicle exhaust gases discharged from the exit of a road tunnel occasionally reach high concentrations that exceed the environmental standards.

The shafts and outlets ventilate the gases from the tunnel can be countermeasures for reducing the high concentrations

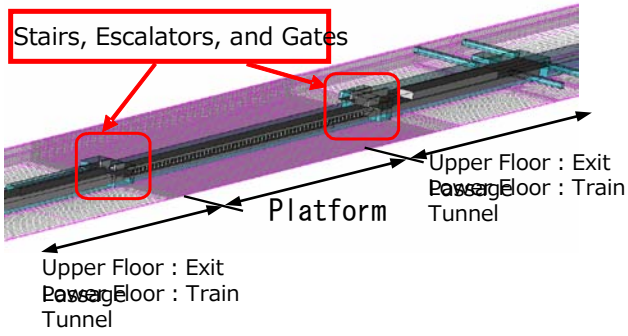
To design the effective countermeasures, we estimate the air pollution concentrations in the tunnel using the 3-D CFD analysis.



A distribution of vehicle gasses in a target tunnel

Country	Project
Japan	An analysis of road tunnel emission structures
Japan	3-D Numerical Analysis of Subway Train Winds

3-D Numerical Analysis of Subway Train Wind

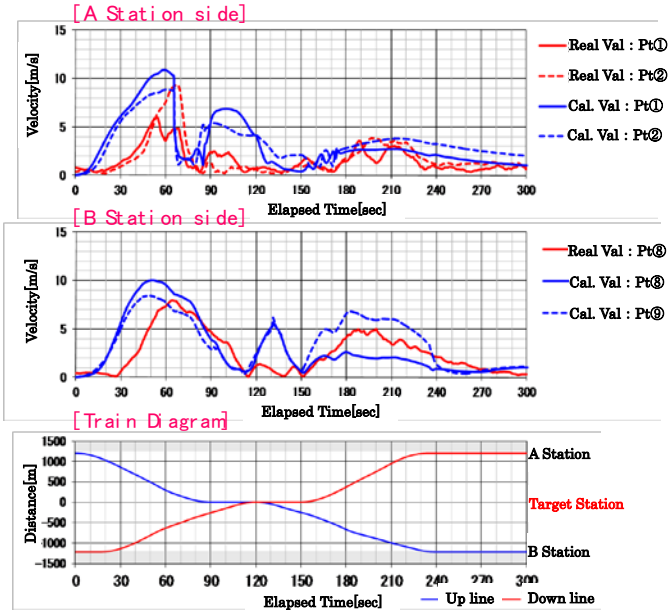


General view of the target subway station

To provide a safer and more comfortable air environment, a subway railway company is working on mitigating train wind.

A 3-dimensional numerical simulation based on fluid dynamics is available for predicting the train wind around the structures on a subway platform such as platform screen doors, guard fence , pillars, etc.

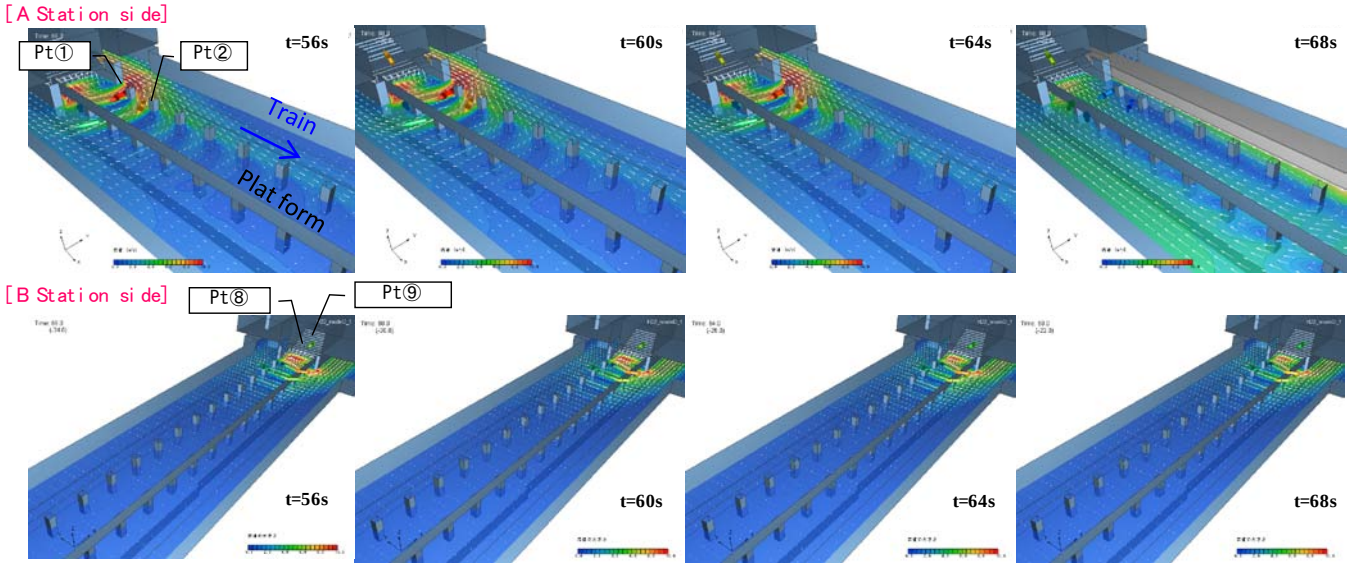
We have simulated the behavior of actual train wind to examine the applicability of the 3-dimensional numerical analysis.



Time-changes in train winds (comparison between simulated and observed wind velocities)

Numerical simulation methods

- Incompressible fluid dynamics equations are discretized with the Finite Volume Method (FVM), and the train was treated as moving element.
- The fluid turbulence model, whose representation is smaller than its mesh size, is used in the standard k-ε model.
- The velocity of the train is calculated using the opening ratio and fluid volume fraction.
- The computed wind velocities are compared with the observed ones, and their peak appearance and time-changes are reproduced well with the 3-D numerical simulation model.



Changes in winds when a train comes into the subway station