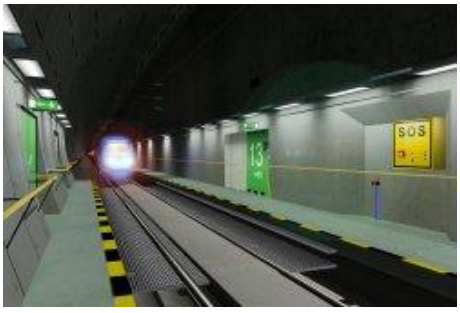
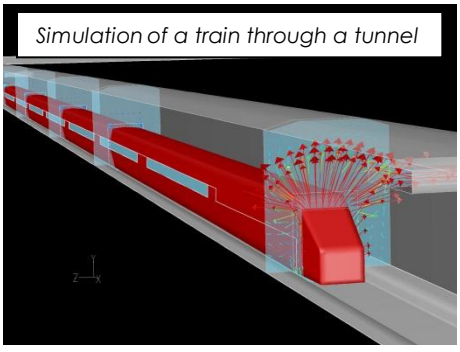
No ice in the train tunnel

Following signature of a Memorandum of Understanding in May 2001, Infraspeed BV in December 2001 signed a contract with the Ministry of Transport, Public Works and Water Management and the Ministry of Finance of the Netherlands for provision and maintenance of the superstructure of the new high-speed rail link between Amsterdam and the Belgian border (the HSL Zuid Line).

Each of the industrial sponsors which form Infraspeed will bring to the project its extensive experience in developing and managing rail projects. Siemens will be responsible for the delivery of the power supply system, the ETCS (European Train Control System) signalling system, the GSM-R communication systems and the ancillary equipment. BAM NBM will supply the track system and the noise barriers and Fluor will provide project management. The HSL Zuid line will be available on the Rotterdam to Antwerp route by mid 2006 and on the Amsterdam/Schiphol to Rotterdam route by the end of 2006. The total route length is 100 kilometres.





Simulation of a train through a tunnel

Incorporated in the line are several tunnels. The simple fact that tunnels are underground, has major consequences for the accessibility of any incident location inside the tunnel. Because of this many emergency provisions in the tunnel are aimed at enabling passengers to seek safety independently before the arrival of rescue workers. For example, the ventilation system in the tunnel directs smoke away from the accident site. In addition the tunnel is equipped with several other emergency systems like a fire fighter system which includes a wet pipe fire water supply.

The design of the fire fighter system takes into account availability under all weather conditions. One of the requirements is sufficient protection against frost for the wet pipe fire water supply. Under this requirement it is assumed that the average air temperature inside the tunnel will be -10ºC when the outside air temperature is -20ºC. The question has risen whether this assumption is still valid in case every 6 minutes a train passes through a tunnel tube. It can be expected that with each train passage air from outside will be supplied which could lower the tunnel air temperature.

FlowMotion has been consulted by Infraspeed to investigate the air flow inside the tunnel during the interval in which a train passes through one of the HSL Zuid tunnels. For this purpose a dynamic CFD model (Computational Fluid Dynamics) has been developed which not only takes into account the high speed of the train (over 80 m/s) which leads to compressibility effects, but also contains sufficient geometric details of the tunnel to account for the effect of air shafts and pressure relief openings in the tunnel.

The simulations have been able to show that a train passage creates considerable air movement through a tunnel, which continues until the next train arrives. As expected this air movement causes fresh air to flow into the tunnel through the tunnel entries and the air shafts.

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