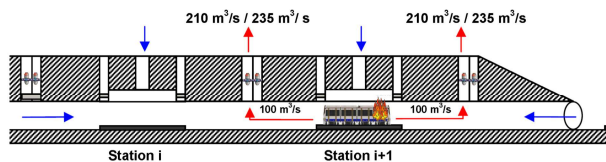




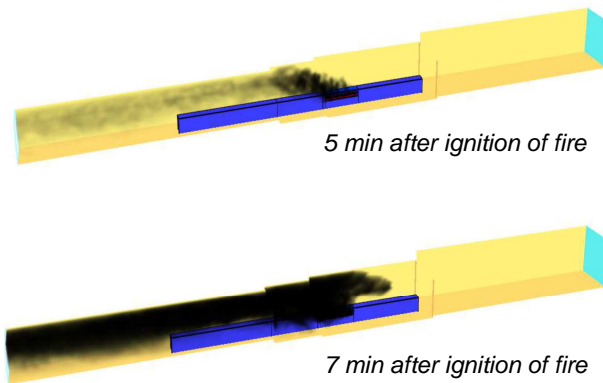
Typical twin-track, single-tube section ready for commissioning



Typical transition from station to tunnel



Tunnel ventilation concept with mid-tunnel shafts



Simulated three-dimensional smoke propagation in a cut-and-cover section of the metro line

## Description

Metro Panamá Line 1 is a 14 km long metro system comprising 14 stations. The underground part is about 7.5 km long. The tunnels are built as a twin-track, single-tube system. For the first stage of operation, 6 underground stations have been built and commissioned. The underground stations are designed with side platforms. Conventional rail/metro trains with a standard length of 87 m shall be operated.

For an acceptable tunnel environment and for fire safety, the stations and tunnels are equipped with ventilation systems. Due to the hot, tropical climate and the substantial heat release from trains, the heat control of the tunnels and stations is a key challenge of the tunnel ventilation system (TVS). In addition, the TVS allows for safe smoke control during a fire. Key elements of the TVS are inter-station tunnel shafts housing the fans, jet fans in tunnels, draught relief shafts and smoke curtain systems at the station stairwells.

The building owner of the project is METRO DE PANAMÁ. The CONSORCIO LÍNEA UNO consisting of the civil contractors NORBERTO ODEBRECHT and FCC together with the designer SENER is responsible for the civil works including tunnel ventilation.

## Services

HBI provided the following services to SENER:

- Collection of fundamentals and requirements related to the TVS
- Elaboration of TVS concepts for all modes of operation
- Numerical analysis of ventilation performance (simulation tools used: THERMOTUN, THERMO, SES, FDS, BuildingExodus)
- Egress analysis and simulation of egress conditions in the stations and in the cut-and-cover ramp sections at portals
- Sensitivity studies and cost estimates of TVS components
- Sizing and inventory of ventilation equipment for final design
- Elaboration of control schemes
- Definition of interface schedules (ventilation shaft design, specification of smoke curtains, etc.)