

PORTO MARAVILHA – VENTILATION & SAFETY

Porto Maravilha, Tunnels Rio450 and Prefeito Marcello Alencar, Rio de Janeiro, Brazil

Ventilation and Safety

Tunnel Rio450

- Length, 1250 m
- Single tube tunnel
- Unidirectional traffic on three traffic lanes
- Safety tunnel and connections to tunnel Prefeito Marcello Alencar

Tunnel Prefeito Marcello Alencar

- Length 2'700 m
- Double tube tunnel
- Unidirectional traffic on 2 x 3 lanes

Challenges

- Complex project environment in the core of the city of Rio de Janeiro, extremely dense urbanised area
- Tight time schedule
- Large gradient
- High risk of congestion

Amberg services

- Tunnel ventilation (longitudinal ventilation with jet fans)
- Safety design (safety tunnel, cross passages, thermal protection, hydrant system etc.)
- Extensive one- and three-dimensional simulations (CFD) of fire scenarios
- Quantitative Risk Analysis QRA
- Consulting for construction and commissioning
- Elaboration of tunnel safety documentation
- Training of personal and safety teams





■ Layout Rio450 tunnel entrance



■ View of densely populated project area



■ The client

AMBERG FACTS

Contracted value Amberg

- Total 0.6 Mio. CHF

Project phases & duration

- | | |
|----------------------------|------------|
| ■ Design | since 2013 |
| ■ Commissioning Rio450 | 01.03.2015 |
| ■ Commissioning PMA tube 1 | 17.06.2016 |
| ■ Commissioning PMA tube 2 | 21.07.2016 |

Project details

Technical Data Rio450

- Length 1250 m
- Single tube
- Unidirectional traffic
- Gradient up to -9%
- Safety tunnel with 7 emergency exits
- One exit direct to the surface
- One direct connection to Tunnel Prefeito Marcello Alencar
- Longitudinal ventilation with jet fans
- 14 jet fans, 30 & 52 kW

Technical Data Tunnel Prefeito Marcello Alencar

- Length 2700 m
- Double tube
- Unidirectional traffic
- 9 cross passages
- Longitudinal ventilation with jet fans
- East tube, 22 jet fans, 13 & 52 kW
- West tube, 22 jet fans, 13 & 52 kW

CLIENT FACTS

Overall Costs

- Porto Maravilha 1.7 billion US\$

Overview project

General objectives

- Transfer of traffic from the surface to the underground
- Increase traffic fluidity
- Revitalization of Rio's port area

Technical objectives

- Optimum tunnel design for normal operation and for maximum safety in case of incident or accident
- Design verification through scenario analysis and QRA
- Safety organization and training of Porto Novo's staff

Contact person

Concessionária Porto Novo SA

Mr Gabriel Cavalcanti

Tunnel Manager

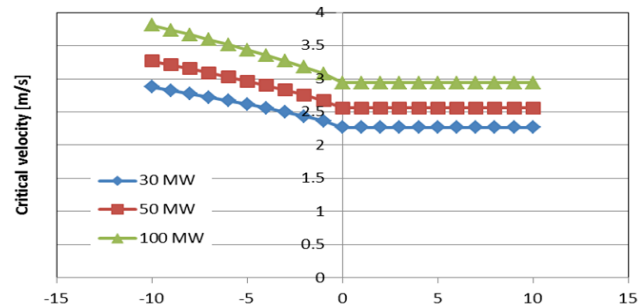
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CHALLENGES



■ Excavation of Rio450 tunnel

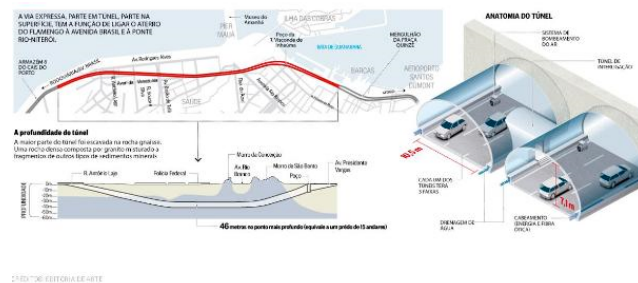


■ Ventilation design

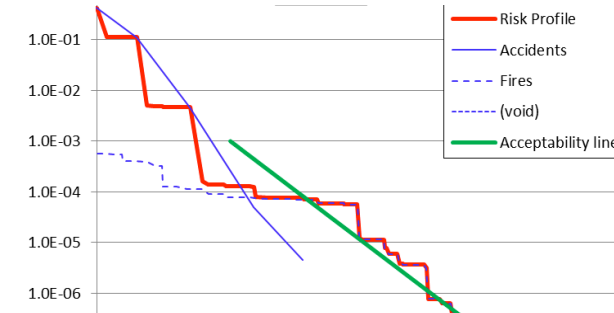


■ Entrance of Rio450 tunnel

ENGINEERING APPROACHE



■ Layout of tunnel Prefeito Marcello Alencar



■ Quantitative risk analysis (QRA)

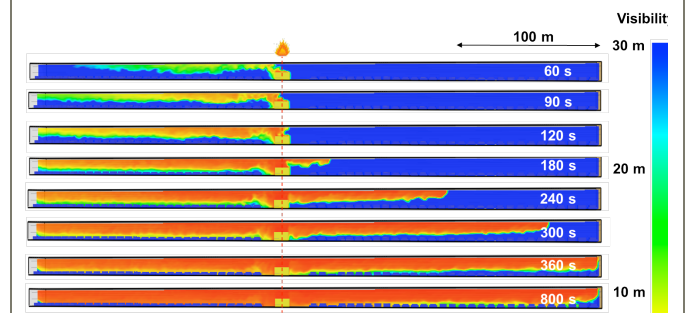


■ Portal view of Rio450

TECHNICAL SOLUTIONS



■ Analysis of fire scenarios



■ Fire engineering by computed flow dynamics CFD



■ Rio de Janeiro seen from the Pan de Azucar