

# Tunnel Inspections

Graduated Engineer Markus Haubrich

Infrastructure and Engineered Structures  
Lisbon, November 13th, 2008



Infrastructure and Engineered Structures  
Lisbon 13th November 2008  
TÜV Rheinland Industrie Service GmbH



# Topics.

- Directive 2004/54/EC – General Information
- Evaluation of all the documentation
- Safety Plan / Safety register
- Electrical installations
- Ventilation
- Structural Diagnosis
- Discussion



# Directive 2004/54/EC.

## General Information.

- Full Name: DIRECTIVE 2004/54/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 29<sup>th</sup> April 2004 on minimum safety requirements for tunnels in the Trans-European Road Network
- For all Tunnels > 500 m, weather in operation, under construction or at design state
- It came into effect on 1<sup>st</sup> May 2006
- The member states of the EU are obliged to improve existing tunnels that do not comply with the Directive by 2015, or in exceptional cases by 2019.
- Minimum safety requirements are laid down in Annex I



# Evaluation of all documentation. Design stage.

The safety documentation for a tunnel at the design stage shall include:

- a description of the planned structure and access to it, together with the plans necessary for understanding its design and anticipated operating arrangements.
- a traffic forecast study specifying and justifying the conditions expected for the transport of dangerous goods, together with the risk analysis requested by point 3.7 of Annex I



# Evaluation of all documentation.

## Design stage.

- a specific hazard investigation describing possible accidents which clearly affect safety of road users in tunnels which might occur during the operating stage and the nature and magnitude of their possible consequences; this investigation must specify and substantiate measures for reducing the likelihood of accidents and their consequences,
- an opinion on safety from an expert or organisation specialising in this field, which could be the Inspection Entity.



# Evaluation of all documentation.

## Commission stage.

The safety documentation for a tunnel which is at the commissioning stage shall include in addition to the documentation required at the design stage:

- a description of the organisation, human and material resources and instructions specified by the Tunnel Manager to ensure operation and maintenance of the tunnel
- an emergency response plan drawn up jointly with the emergency services which also takes into account people with reduced mobility and disabled people
- a description of the system of permanent feedback of experience through which significant incidents and accidents can be recorded and analysed.



# Evaluation of all documentation. Operations.

The safety documentation for a tunnel in operation shall include additionally to the documentation required at the commissioning stage:

- a report and analysis on significant incidents and accidents, which have taken place since the entry into force of this Directive
- a list of the safety exercises carried out and an analysis of the lessons learned from them.



# Safety plan and safety register.

A safety plan should contain the following themes:

- Overview of the responsibilities and the sequence of the notification in case of emergency
- List of all safety devices and their interaction (emergency-matrix)
- Maps with all entrances for rescue squads and spaces for rescue vehicles
- Fire-brigade plans
- List of hospitals for emergency purposes (e.g. smoke poisoning, striking burns)
- Plans for rescue exercises
- Service and control plans



# Electrical installations.

- All tunnels shall have an emergency power supply capable of ensuring the operation of safety equipment until all users have evacuated the tunnel.
- Lighting
  - Normal lighting shall be provided so as to ensure appropriate visibility day and night for drivers in the entrance zone as well as in the interior of the tunnel.
  - Safety lighting shall be provided to allow a minimum visibility for tunnel users to evacuate the tunnel in their vehicles in the event of a breakdown of the power supply.
  - Evacuation lighting, such as evacuation marker lights, at a height of no more than 1,5 m shall be provided to guide tunnel users to evacuate the tunnel on foot, in the event of emergency.



# Ventilation.

- The design, construction and operation of the ventilation system shall take into account:
  - the control of pollutants emitted by road vehicles, under normal and peak traffic flow
  - the control of pollutants emitted by road vehicles where traffic is stopped due to an incident or an accident,
  - the control of heat and smoke in the event of a fire.
- A mechanical ventilation system shall be installed in all tunnels longer than 1 000 m with a traffic volume higher than 2 000 vehicles per lane.



# Safety installations.

## Emergency stations and monitoring systems.

- Emergency stations
  - Emergency stations are intended to provide various items of safety equipment, in particular emergency telephones and extinguishers, but are not intended to protect road users from the effects of fire.
  - Emergency stations shall be provided near the portals and inside at intervals which for new tunnels shall not exceed 150 m and which in existing tunnels shall not exceed 250 m.
  
- Monitoring systems
  - Video monitoring systems and a system able to automatically detect traffic incidents (such as stopping vehicles) and/or fires shall be installed in all tunnels with a control centre.
  - Automatic fire detection systems shall be installed in all tunnels which do not have a control centre



# Safety installations.

## Communication systems.

- Communication systems
  - Radio re-broadcasting equipment for emergency service use shall be installed in all tunnels longer than 1 000 m with a traffic volume higher than 2 000 vehicles per lane.
  - Where there is a control centre, it must be possible to interrupt radio re-broadcasting of channels intended for tunnel users, if available, in order to give emergency messages.
  - Shelters and other facilities where evacuating tunnel users must wait before they can reach the outside shall be equipped with loudspeakers to give information to users.
  
- Tunnel closing equipment
  - In all tunnels longer than 1 000 m, traffic signals shall be installed before the entrances so that the tunnel can be closed in case of an emergency.



# Structural diagnosis.

- This topic will be covered in the next presentation.



**Your advantage: Our attention to detail.**  
Thank you for your attention.

