RBDG-MAN-028-0101

Design guidelines

Mechanical Electrical Plumbing in tunnel

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1. Introduction

1.1. Scope of work

The MEP – Mechanical, Electrical and Plumbing include the following systems:

- Electrical LV System,
- Smoke Management System,
- Fire Fighting System,

1.2. Standards

The standards applied for the project for the tunnel safety is the following:

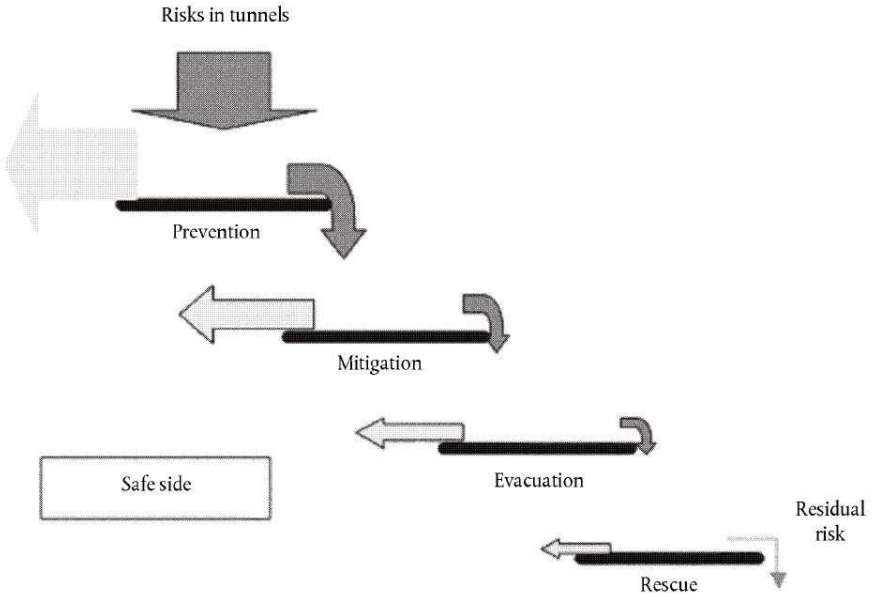
- European Standards - Technical Specifications for Interoperability (SRT TSI), "Safety in railway tunnels" field, mainly regarding the "Infrastructure" subsystem (SRT TSI Tunnels).

2. Design criteria requirements

2.1. General

Tunnel safety is the result of an optimal combination of infrastructure, operation and rolling stock measures. The line of defence for tunnel safety breaks down into four layers:

- Prevention: Limit the probability of occurrence of an incident.
- Mitigation: Limit the consequences of an incident when it occurs.
- Evacuation: Allow the protection and evacuation of people (passengers, staff).
- Rescue: Promote the intervention of emergency (alarm, evacuation pathway, means of firefighting ...).
- Security measures combine to produce a low level of residual risk.



1. FIGURE 1 : RISK MANAGEMENT IN TUNNELS (SRT TSI TUNNEL, - CHAPTER 2.1 GENERALITIES)

2.2. Electrical LV System requirements

2.2.1. Requirements for electric cables (SRT TSI - chapter - chapter 4.2.2.4)

The design shall use cables with low levels of flammability, flame spread, toxicity and smoke density (according to current standards).
The cables used for the supply and connection of equipment present throughout the tunnel shall fulfil as a minimum the requirements of classification B2CA, s1a, a1, as per Commission Decision 2006/751/EC.

2.2.2. Emergency lighting on escape routes (SRT TSI - chapter 4.2.1.5.4)

Illuminations shall be provided on the side of the walkway. The position shall be:

- above the walkway, as low as possible, so as not to interfere with the free space for the passage of persons,

  or

- built into the handrails.

The design shall provide maintained illuminance shall be at least 1 lux at a horizontal plane at walkway level.

Regarding the autonomy and reliability, the design shall provide an alternative power supply. It shall be available for an appropriate period of time after failure of the main power supply. The time required shall be consistent with the evacuation scenarios and reported in the Emergency Plan.

2.2.3. Escape signage (SRT TSI - chapter 4.2.1.5.5)

The design shall provide an escape signage on the path side signboards every 50-m maximum. It shall indicate:

- emergency exits.
- the direction of the next refuge.
- the distance to the next refuge.
- signs of safety equipment.

All doors leading to emergency exits or cross-passage shall be marked.

2.2.4. Electricity supply (SRT TSI - chapter 4.2.2.3)

The electricity power distribution system in the tunnel shall be suitable for the emergency response services equipment in accordance with the emergency plan for the tunnel. Some national emergency response services groups may be self-sufficient in relation to power supply. In this case, the option of not providing power supply facilities for the use of such groups may be appropriate. Such a decision, however, must be described in the emergency plan.

2.2.5. Reliability of electrical installations (TSI - chapter 4.2.2.5)

Electrical installations relevant for safety (Fire detection, emergency lighting, emergency communication and any other system identified by the Infrastructure Manager or contracting entity as vital to the safety of passengers in the tunnel) shall be protected against damage arising from mechanical impact, heat or fire.

The distribution system shall be designed to enable the system to tolerate unavoidable damage by (for example) energizing alternative links.

Autonomy and reliability: A back-up power supply shall be available for an appropriate period of time after the fault of the main power supply. The lapse of time shall be compatible with the evacuation scenarios provided for and mentioned in the emergency plan.

If flooding risks are identified in the risk analysis, then electrical equipment shall be designed considering the relevant mitigation measures including water level detector.

2.3. Smoke Management System requirements

2.3.1. Tunnel smoke management system

No requirements.

2.3.2. Fire detection (SRT TSI - chapter 4.2.1.4)

The design shall equip all the technical rooms with fire detection that alert the infrastructure manager in case of fire.

2.3.3. Escape walkways (SRT TSI - chapter 4.2.1.6)

For single bored tunnels, the design shall provide:

- Two paths (one on each side of the tracks).
- Minimum width 0.8 m, minimum height 2.25 m.
- Level of tracking shall be above the rail level.
- Handrails shall be placed outside the required minimum clearance of the walkway.
- Handrails shall be angled at 30° to 40° to the longitudinal axis of the tunnel at the entrance to and exit from an obstacle.

2.3.4. Evacuation facilities (SRT TSI - chapter 4.2.1.5)

2.3.4.1. *Safe area (SRT TSI - chapter 4.2.1.5.1)*

The safe area shall maintain survivable conditions for passengers and staff during the time needed for the complete evacuation from the safe area to a final place of safety.

The lay-out of an underground safe area and its equipment shall take into account the control of smoke, in particular to protect people who use the self-evacuation facilities.

2.3.4.2. *Access to the safe area (SRT TSI - chapter 4.2.1.5.2)*

One of the following solutions shall be selected for access points from a train to the safe area:

- Lateral and/or vertical emergency exits to the surface. These exits shall be provided at least every 1 000 m.
- Cross-passages between adjacent independent tunnel tubes, which enable the adjacent tunnel tube to be employed as a safe area. Cross-passages shall be provided at least every 500 m.
- Alternative technical solutions providing a safe area with a minimum equivalent safety level are permitted. The equivalent level of safety for passengers and staff shall be demonstrated using the Common Safety Method on risk assessment.

Doors giving access from the escape walkway to the safe area shall have a minimum clear opening of 1,4 m wide and 2,0 m high. Alternatively, it is permitted to use multiple doors next to each other which are less wide as long as the flow capacity of people is demonstrated to be equivalent or higher.

After passing the doors, the clear width shall continue to be at least 1,5 m wide and 2,25 m high.

2.4. Fire Fighting System requirements

Regarding the firefighting point (SRT TSI - chapter 4.2.1.7), the design shall provide a reserve of water at the tunnel entrance for tunnel superior to 1 km. The minimum flow rate shall be 800 litres /minute for two hours.
The minimum volume of water shall be 100 m3.