EUROPEAN UNION AGENCY FOR RAILWAYS

Moving Europe towards a sustainable and safe railway system without frontiers.

Guide for the application of the SRT TSI

In accordance with Article 19(3) of Regulation (EU) 2016/796 of the European Parliament and of the Council of 11 May 2016

Released by European Union Agency for Railways

This guide does not contain any legally binding advice. It may serve as a clarification tool without however dictating in any manner compulsory procedures to be followed and without establishing any legally binding practice. The guide provides explanations on the provisions contained in the TSIs and should be helpful for understanding the approaches and rules described therein. However, it does not substitute for them.
The guide is publicly available and it will be regularly updated to reflect progress with European standards and changes to the TSIs.
The reader should refer to the website of the European Union Agency for Railways for information about its latest available edition.

Amendment record

Version date	*Author(s)*	*Version*	*Section number*	*Modification description*
12 Jun 2019		0.2		Including comments from WP meeting of 29 May 2019. Version ready for publication on ERA website
13 Dec 2019		0.3	2.3.6	Clarification on the class of cables satisfying the functional requirements expressed in the TSI
6 Jul 2020		0.4	2.3.3 2.3.6	Clarification that the needs expressed by emergency response services can be considered on the basis of a risk assessment Removal of clarifications due to the persisting lack of agreement on any formulation
8 Dec 2023		1.0	All	Version 2023

Table of Contents

1. SCOPE OF THIS GUIDE

1.1. Content of the guide

1.1.1. Scope

This document is an annex to the Guide for the application of TSIs. It provides information on the application of the Technical Specification for Interoperability on Safety in Railway Tunnels adopted by Commission Regulation (EU) No 1303/2014 of 18 November 2014.

The guide should be read and used only in conjunction with the SRT TSI. It is intended to facilitate its application but does not replace it.

The general part of the 'Guide for the application of TSIs' should also be considered.

1.1.2. Content of the guide

In section 2 of this document, extracts of the original text of the SRT TSI are provided, in a shaded text box, and these are followed by text that provides guidance.

Guidance is not provided for points where the SRT TSI requires no further explanation.

Guidance is provided for voluntary application. It does not mandate any requirement in addition to those set out in the SRT TSI.

Guidance is given by means of further explanatory text and, where relevant, by reference to standards that demonstrate compliance with the SRT TSI; relevant standards are listed in section 3 of this document.

1.2. Document references

Document references can be found in the general part of the guide for the application of TSIs

1.3. Definitions and abbreviations

Definitions and abbreviations are given in the SRT TSI, point 2.4 and in the general part of the 'Guide for the application of TSIs'.

2. GUIDANCE ON THE APPLICATION OF THE SRT TSI

2.1. Scope and definition of the subsystem

A few clarifications are given here below:

> *2.4 Definitions*
>
> *(a) Railway tunnel: A railway tunnel is an excavation or a construction around the track provided to allow the railway to pass for example higher land, buildings or water. The length of a tunnel is defined as the length of the fully enclosed section, measured at rail level. A tunnel in the context of this TSI is 0.1km or longer.*

Reference to a tunnel length being measured as the length of the fully enclosed section may lead to questions where a construction with openings (i.e. not fully enclosed) can be considered a tunnel subject to the application of the SRT TSI. In this case, the risk will be different compared to a fully enclosed section.

There can be no universal right or wrong answer to this question: the applicant should reflect on the risks of the evacuation and rescue operations following a railway incident occurring in the structure and on the measures which could mitigate the risks identified. This is equivalent to applying the CSM-RA for the fixed installations, as permitted by the TSI.

Note: this principle is also valid for tunnels with particular geometry not directly covered by the TSI, e.g.

- a single tube tunnel that splits into two tubes below the ground (in the area where the tunnel splits in two);
- two double tube tunnels crossing at different heights below ground;
- and other particular tunnel geometries

(d) Technical rooms: Technical rooms are enclosed spaces with doors for access/egress inside or outside the tunnel with safety installations which are necessary for at least one of the following functions: self-rescue, evacuation, emergency communication, rescue and fire fighting, signalling and communication equipment, and traction power supply.

According to this definition, technical rooms are purpose-built spaces which are not exposed to the tunnel environment (i.e. being enclosed separately and independently inside the tunnel). In some projects, it is planned to include ‘safety installations' within cross passages and this may raise the question whether this constitutes a 'technical room' or not. If:

1. the equipment to be placed in the cross passage belongs to one of the categories listed in the definition for 'technical rooms', and
2. the equipment is not enclosed separately inside the cross-passage,

then the cross passage itself is considered a technical room and needs to fulfil the requirement of point 4.2.1.4 of the TSI.

Note: for compliance with the requirements 4.2.1.1 (a) of the TSI, one can consider that people having access to a cross passage are either authorized staff working in the tunnel or passengers evacuating a train that can be considered as authorized to enter the cross-passage.

In the definition, the terms “safety installations which are necessary for at least one of the following functions:” are to be understood as the installations that are necessary for operating the functions listed. For instance, whereas lighting is necessary for evacuation, only the electrical cabinets with switches and fuses are necessary for operating it; consequently, the requirement does not apply to each lighting device.

2.2. Essential requirements

The essential requirements cover:

- safety,
- reliability and availability,
- health,
- environmental protection,
- technical compatibility.
- accessibility

and are addressed in chapter 3 of the TSI.

Being an essential requirement accessibility is listed in chapter 3 of the TSI, even if no basic parameter corresponds to this requirement.

3 ESSENTIAL REQUIREMENTS

(a) The following table indicates basic parameters of this TSI and their correspondence to the essential requirements as set out and numbered in Annex III to Directive (EU) 2016/797 2008/57/EC.

(b) For meeting the essential requirements, the corresponding parameters of sections 4.2.1, 4.2.2 and 4.2.3 shall apply.

3.1. Infrastructure and energy subsystems

(a) In order to meet the essential requirement 'Safety' applying to the Infrastructure and Energy subsystems, the CSM on risk assessment may be applied as an alternative to the corresponding parameters of sections 4.2.1 and 4.2.2.

(b) Accordingly, for the risks identified in point 1.1.4 and the scenarios listed in point 2.2, the risk can be assessed by:

(1) a comparison with a reference system,

(2) an explicit risk estimation and evaluation.

(c) For meeting the essential requirements other than 'Safety', the corresponding parameters of sections 4.2.1 and 4.2.2 shall apply.

The general rule, which is recalled in the first points (a) and (b) of section 3 of the TSI, is that for meeting all the essential requirements listed in the table, the corresponding parameters of the TSI shall apply.

However, for the Infrastructure and Energy subsystems, the TSI permits the use of the risk acceptance principles listed in the CSM-RA as an alternative for the fulfilment of the essential requirement 'Safety' in the table of section 3 of the TSI. As specified in point 3.1 (c) of the TSI, this alternative isn't permitted for the other essential requirements (i.e. health, technical compatibility, etc.)

The CSM-RA lists the following risk acceptance principles for evaluation of the risk acceptability of a system:

- the application of a code of practice, or
- a comparison with similar systems, or
- an explicit risk estimation.

It is understood that the basic parameters of sections 4.2.1 and 4.2.2 of the TSI represent the code of practice. According to the principles of the CSM-RA, for the risks identified in point 1.1.4 of the TSI and the scenarios listed in point 2.2, the risk can alternatively be assessed by a comparison with a reference system or through an explicit risk estimation and evaluation.

The principle of applying the CSM-RA is illustrated on the Figure 1 below.

On the figure, the risk acceptability level and the criteria for comparison are to be agreed between the applicant and the National Safety Authority.

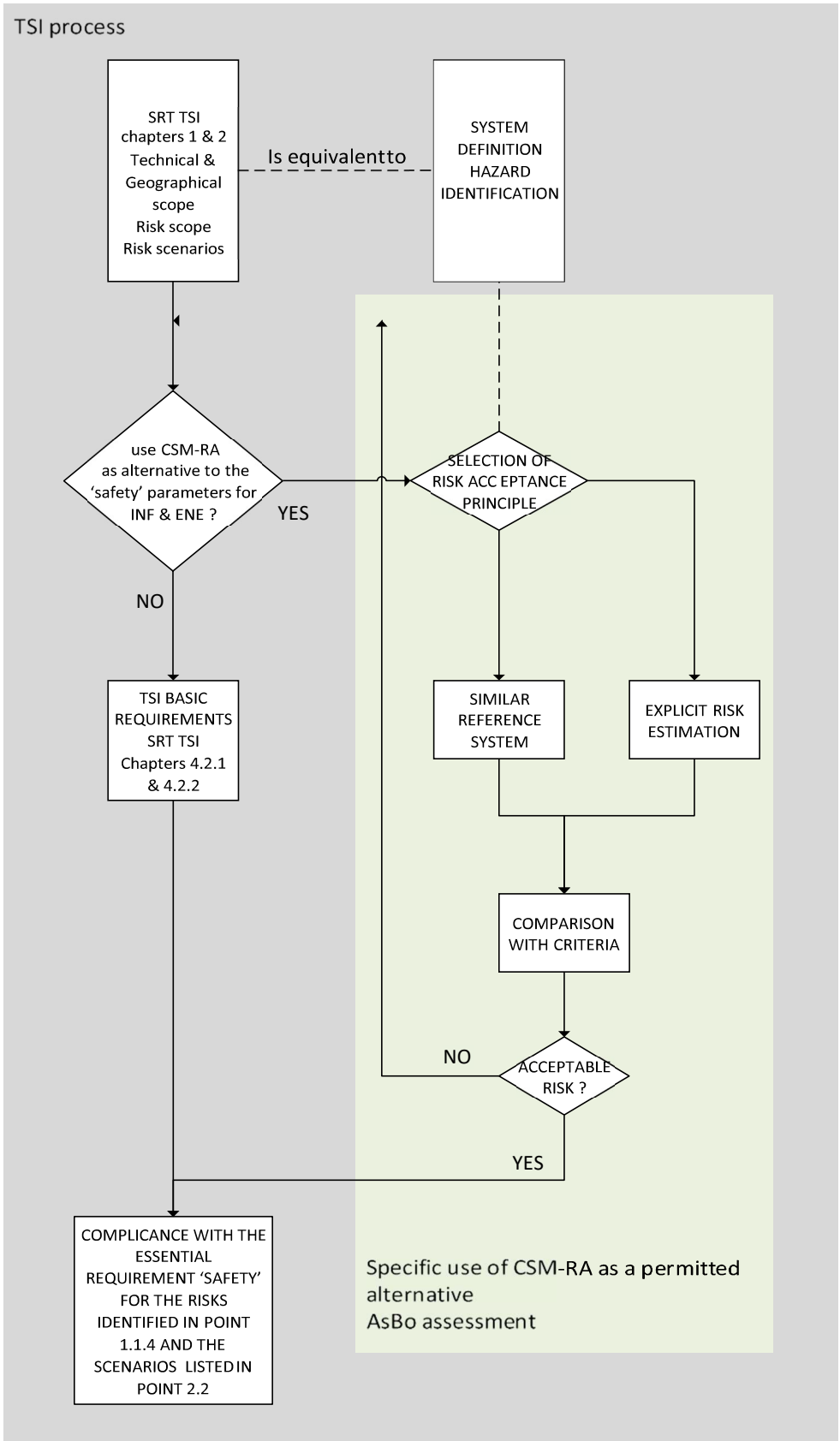


Figure 1 Principle for the application of the CSM-RA for fixed installations

2.3. Characterisation of the subsystem

The following points refer to the chapters, sections and clauses of the TSI referenced within this chapter.

2.3.1. Scope related to tunnels (clause 1.1.1)

(b) Stations that are in tunnels shall be in conformity with the national rules on fire safety. When they are used as safe areas, they shall comply only with the specifications of clauses 4.2.1.5.1, 4.2.1.5.2 and 4.2.1.5.3. of this TSI. When they are used as evacuation and rescue points, they shall comply only with the specifications of clauses 4.2.1.7 (c) and 4.2.1.7 (e) of this TSI.

National rules include requirements for evacuation and fire safety in underground stations. The boundaries between the tunnel structure and the station area are best decided on a project-specific basis (i.e. case by case).

The length of an underground station contributes to the total tunnel length. For example, if an underground station with 400m platforms is placed between two tunnels of 350 m length, then the result is a single tunnel of 1100 m.

2.3.2. Risk scope (clause 1.1.4)

1.1.4.1. Risks covered by this TSI
(a) This TSI covers only specific risks to the safety of passengers and on-board staff in tunnels for the subsystems above.
(b) Where a risk analysis comes to the conclusion that other tunnel incidents might be of relevance, specific measures to deal with these scenarios shall be defined.

The IM and the RU are required to control the tunnel-specific risks as part of their safety management system (SMS). Consequently, the TSI does not require the IM to perform a risk analysis for every single tunnel.

1.1.4.2. Risks not covered by this TSI
(a) Risks not covered by this TSI are asfollows:

(..)
(5) Risks for people in the neighbourhood of a tunnel where collapse of the structure could have catastrophic consequences."

The risks for people in the neighborhood of a tunnel where collapse of the structure could have catastrophic consequences was covered by the previous version of the TSI.

With the amendment [4], the TSI focus is on the safety of passengers and on-board staff. This risks for people in the neighborhood of a tunnel are normally covered by National rules.

2.3.3. The role of emergency response services (clause 2.3)

(f) If the expectations of the emergency response services expressed in emergency plans go beyond the assumptions described above, the need for additional measures or tunnel equipment can be considered.

The needs expressed by emergency response services can be considered based on a risk assessment when are within the scope of the TSI and when they cover the risks expressed in point 1.1.4.1.

2.3.4. Prevent unauthorised access to emergency exits and technical rooms (clause 4.2.1.1)

This specification applies to all tunnels.

[…]

(b) Where emergency exits are locked for security purposes, it shall always be possible to open them from inside.

All emergency escape doors should be fitted with an easy to open exit device (sometimes referred to as anti-panic locks) from the inside without the use of a key or a tool.

2.3.5. Fire resistance of tunnel structures (clause 4.2.1.2)

This specification applies to all tunnels.

In the event of fire, the integrity of the tunnel lining shall be maintained for a period of time sufficiently long to permit self-rescue, evacuation of passengers and staff and intervention of emergency response services.

This requirement applies to the load-bearing structure of the main tube(s) of the tunnel through which trains operate.

This specification applies to all tunnels.

(..) That period of time shall be in accordance with the evacuation scenario and reported in the Emergency Plan.

An emergency plan, including the description of the foreseen emergency scenarios (clauses 2.2 and 4.4.2 (c) of the TSI), is required only for tunnels of more than 1km in length. Consequently, for tunnels shorter than 1km in length:

- no report is necessary as there is no Emergency Plan;
- however, the period of time which is 'sufficiently long to permit self-rescue, evacuation of passengers and staff and intervention of emergency response services' needs to be evaluated.

2.3.6. Fire reaction of building material (clause 4.2.1.3)

This specification applies to construction products and building elements inside tunnels.
These products shall fulfil the requirements of Commission Regulation (EU) 2016/364:

(1) Tunnel building material shall fulfil the requirements of classification A2

(2) Non-structural panels and other equipment shall fulfil the requirements of classification B

(3) Exposed cables shall have the characteristics of low flammability, low fire spread, low toxicity and low smoke density. These requirements are fulfilled when the cables fulfil at least the requirements of classification B2ca,s1a,a1. If the classification is lower than B2ca,s1a,a1, the class of cables may be determined by the infrastructure manager after a risk assessment, taking into account the characteristics of the tunnel and the intended operational regime. For the avoidance of doubt, different classifications of cable may be used for different installations within the same tunnel provided that the requirements of this paragraph are met.

(b) Materials that would not contribute significantly to a fire load shall be listed. They are allowed not to comply with the above.

The following European harmonised standards support Regulation (EU) 2016/364:

- EN 13501-1:2018 Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests
- EN 13501-6:2018 Fire classification of construction products and building elements - Part 6: Classification using data from reaction to fire tests on power, control and communication cables

Regarding cables, they are considered to be exposed when they could potentially be directly exposed to an external ignition source.

Using exposed cables of class B2ca, s1a, a1 ensures that the characteristics of low flammability, low fire spread, low toxicity and low smoke density are satisfied without the need for further risk assessment.

Using another class for exposed cables is permitted: the class may be determined after a risk assessment taking into account the characteristics of the tunnel and the intended operational regime. As indicated in the TSI, different classifications of cable may be used for different installations within the same tunnel. For instance, cables located in specific areas such as evacuation and rescue points may be of a higher class of reaction to fire compared to cables located in a normal tunnel section.

The requirements of the paragraph of the TSI to be met are the requirements for low flammability, low fire spread, low toxicity and low smoke density.

The Applicant should identify the products which are captured by the requirements of clause (b).

Some examples of materials which do not contribute significantly to the fire load are:

- anti-panic devices in doors,
- lighting bulbs, LEDs, switches,
- escape signage,
- signaling system balises, ordinary signals,
- polymer rail pads,
- polymer sleeper boots, or under sleeper pads,
- polymer under ballast mats,
- cable patchcords, radiating cables, telecommunication cabinets, antennas,
- wooden sleepers compliant with EN 13145:2001+A1:2011…

2.3.7. Evacuation facilities (clause 4.2.1.5)

The PRM TSI specifies the technical characteristics that apply to stations in order to enhance their accessibility for persons with disabilities and persons with reduced mobility. The technical requirements prescribed in the PRM TSI do not apply to tunnels.

2.3.8. Access to the safe area (clause 4.2.1.5.2)

This specification applies to all tunnels of more than 1 km in length.

[…]

(b) One of the following solutions shall be selected for access points from a train to the safe areas:

(1) Lateral and/or vertical emergency exits to the surface. These exits shall be provided at least every 1 000 m.

(2) 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.

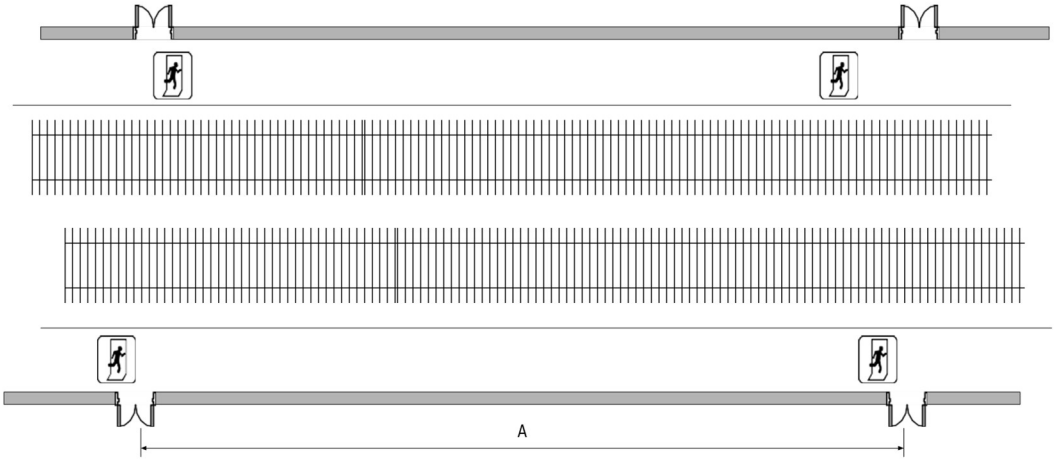
[…]

The previous versions of the SRT TSI included a clause (3) *Alternative technical solutions providing a safe area with a minimum equivalent safety level are permitted. The equivalent level of safety to passengers and staff shall be demonstrated using the Common Safety Methods on risk assessment*. This clause has been removed as it is covered by the possibility to cover all parameters relative to the essential requirement 'Safety' with a risk assessment (see point 2.2 of this guide).

The distance between doors giving access to a safe area should be measured as follows:

- between the doors centers and
- parallel to the tunnel lining.

In the example on Figure 2 below, A is the distance between the doors giving access to the safe area.



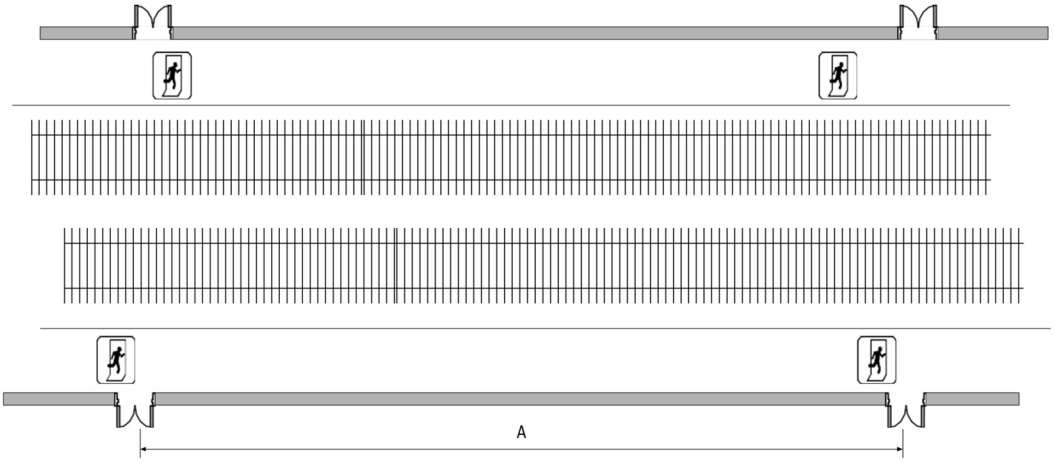


Figure 2 Example of measurement of the distance between doors giving access to a safe area

[...]

(c) Doors giving access from the escape walkway to the safe area shall have a minimum clear opening of 1,4m wide and 2,0m 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.

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

(e) The way the emergency response services access the safe area shall be described in the emergency plan.

The evacuation route includes in particular the width of the walkway and the cross passages between the walkway and the safe area as they are necessary for evacuation.

The clearway defined by a width of 1.5m and a height of 2.25m in point (d) above is sufficient for the evacuation of passengers and if needed the intervention of the emergency response services. However, in the case of evacuation routes with complex geometry (e.g. bends, chicanes) additional clear width and height may be beneficial to permit evacuation of people on stretchers if necessary. This additional clearance should be adopted by the applicant on a voluntary basis.

2.3.9. Communication means in safe areas (clause 4.2.1.5.3)

[...]

(a) Communication shall be possible, either by mobile phone or by fixed connection from underground safe areas to the control centre of the Infrastructure Manager.

The communication to the control center of the IM can be established by the RU, the emergency response services or the IM, either directly, or through a telephone operator, as is the case for emergency telephone numbers.

If the tunnel on a line is fitted with GSM-R, it should be possible to communicate with the control center of the IM through the GSM-R mobile phone system. The passengers are not expected to contact the IM control center as this will be subject to the emergency procedures agreed between the RU, IM and the emergency response services.

2.3.10. Emergency lighting (clause 4.2.1.5.4)

[...]

(b) Illumination shall comply with the following requirements:

(3) Position of lights:

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

built into the handrails.

(4) The maintained illuminance shall be at least 1 lux at a horizontal plane at walkway level.

In case of smoke in the tunnel, the smoke plume will concentrate at the ceiling and will progressively get lower: for that reason, it is permitted by the TSI to locate the emergency lighting into the handrail, i.e. low above the floor of the escape route. Emergency lights would then trace the way to escape.

In particular situations where it is expected that the smoke will behave differently due to the particular tunnel geometry, or where a ventilation system (not a requirement of the TSI) has been provided, it may be possible for lights to be located above the handrails.

This specification applies to all tunnels of more than 0,5 km in length.

(c) Autonomy and reliability: an alternative electricity supply shall be available for an appropriate period of time after failure of the main supply. The time required shall be consistent with the evacuation scenarios and reported in the Emergency Plan.

An emergency plan, including the description of the foreseen emergency scenarios (clauses 2.2 and 4.4.2 (c) of the TSI), is required only for tunnels of more than 1km in length.

Consequently, for tunnels between 0.5km and 1km in length:

- no report is necessary as there is no Emergency Plan;
- however, the time during which the alternative electricity supply will remain available needs to be evaluated.

(d) If the emergency light is switched off under normal operating conditions, it shall be possible to switch it on by both of the following means:

(1) manually from inside the tunnel at intervals of 250 m

250m represents a maximum switch interval. Intervals of less than 250m are acceptable.

2.3.11. Escape signage (clause 4.2.1.5.5)

This specification applies to all

tunnels. […]

(e) Signs shall be provided in the tunnel to indicate the position of emergency equipment, where such equipment is present.

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

To prevent people entering a technical area with no exit during self-evacuation, it is recommended that the doors leading to the technical rooms are marked accordingly.

Note that for signage requiring electric power supply in order to fulfil Directive 92/58/EC the paragraph 4.2.1.10 about reliability applies unless luminous signage is used.

2.3.12. Escape walkways (clause 4.2.1.6)

(a) Walkways shall be constructed in a single track tunnel tube on at least one side of the track and in a multiple track tunnel tube on both sides of the tunnel tube. In tunnel tubes with more than two tracks, access to a walkway shall be possible from each track.

In single tube tunnels equipped with at least 2 tracks supported by a concrete slab, it may be acceptable to

use the adjacent track as a walkway, provided the slab track meets the requirements for walkways in the TSI.

In such cases, the conditions of use of the slab track as an escape walkway should be described in the emergency plan.

(3) The height of the walkway shall be at bottom-of-rail level or higher.

For measuring the height of the walkway, the reference rail to be considered is the one nearest to the walkway.

2.3.13. Evacuation and rescue points (clause 4.2.1.7)

This specification applies to all tunnels of more than 1 km in length.

(a) For the purpose of this clause, two or more consecutive tunnels will be considered as a single tunnel unless both of the following conditions are met:

(1) The separation between tunnels in open air is longer than the maximum length of the passenger train intended to be operated on the line + 100 m and

(2) The open air area and track situation around the separation between tunnels allow passengers to move away from the train. The open air area shall contain all passengers of the maximum capacity of the train intended to be operated on the line.

(b) Evacuation and rescue points shall be created

(1) Outside both portals of every tunnel of

>1km and

(2) Inside the tunnel, according to the category of rolling stock that is planned to be operated, as summarized in the table below:

Rolling stock category according to paragraph 4.2.3	*Maximum distance from the portals to an evacuation and rescue point and between evacuation and rescue points*
Category A	*5 km*
Category B	*20 km*

[...]

This guidance is intended to clarify the requirements for the distribution of evacuation and rescue points within tunnels, including the case for a line for passenger or mixed traffic fitted with consecutive tunnels.

Table 1 below illustrates the category of passenger rolling stock that can be operating in new tunnels according to the length of the tunnel and the distribution of ERPs.

	New Rolling Stock category *(including when relevant the dispositions corresponding to specific cases)*	
New Tunnels	**Cat A**	**Cat B**
Length < 5 km without ERP inside the tunnel	OK	OK
Length from 5 km to 20 km without ERP inside the tunnel	Not OK	OK
Length from 5 km to 20 km with ERP every 5 km inside the tunnel	OK	OK
Length > 20 km with ERP every 20 km inside the tunnel	Not OK	OK
Length > 20 km with ERP every 5 km inside the tunnel	OK	OK

Table 1 – Passenger Rolling stock operating in new tunnels.

New tunnels shorter than 1km may require evacuation and rescue points at one of their portals when they are followed by another tunnel and:

- the sum of the lengths of both tunnels is greater than 1km, and
- the open-air area between consecutive tunnels is not sufficient for a safe evacuation.

However, new tunnels longer than 1km may not require an evacuation and rescue point at both portals when they are followed by another tunnel and the open-air area in between them is not sufficient for a safe evacuation.

Some examples of TSI compliant configurations of evacuation and rescue points and tunnels are given below. Evacuation and rescue points do not have to be provided when the requirements of either 4.2.1.7 (a) (1) or (a) (2) are not satisfied.

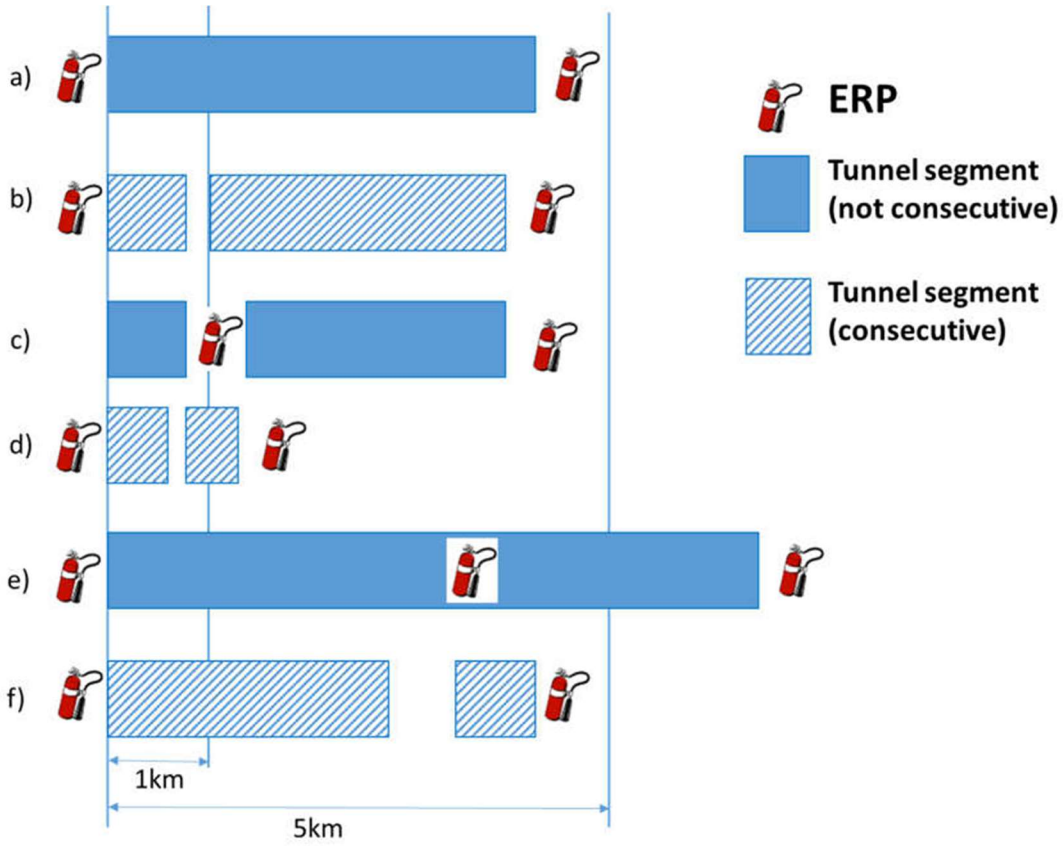


Figure 3 Examples of configurations of evacuation and rescue points (ERP) and tunnels for lines accepting category A and B trains:

a) The tunnel is longer than 1km and shorter than 5km: there are ERPs at both portals.
b) The first tunnel is shorter than 1km, but the separation in open air between both tunnels does not fulfil the requirement of either 4.2.1.7 (a) (1) or 4.2.1.7. (a) (2). Consequently, both tunnels are consideredas one and in practice this case is the same as case a).
c) The first tunnel is shorter than 1km, and the separation in open air between both tunnels fulfils the requirement of 4.2.1.7 (a) (1) and 4.2.1.7. (a) (2). The first tunnel has no ERP but the second one has ERPs at both portals.
d) Both tunnels are shorter than 1km, but the separation in open air between them does not fulfil the requirement of either 4.2.1.7 (a) (1) or 4.2.1.7. (a) (2). Consequently, both tunnels are considered as one tunnel of more than 1km, and there are ERPs at both portals.
e) The tunnel is longer than 5km and, in order to accept category A trains, it needs to be equipped with an ERP inside the tunnel in addition to the ERPs at both portals.
f) The second tunnel is shorter than 1km and the separation in open air between both tunnels is longer than the maximum length of the passenger train intended to be operated on the line + 100 m (requirement 4.2.1.7 (a) (1)), but the open air area and track situation around the separation between tunnels does not allow passengers to move away from the train (requirement 4.2.1.7. (a) (2)). Consequently, both tunnels are considered as one and in practice this case is the same as case b).

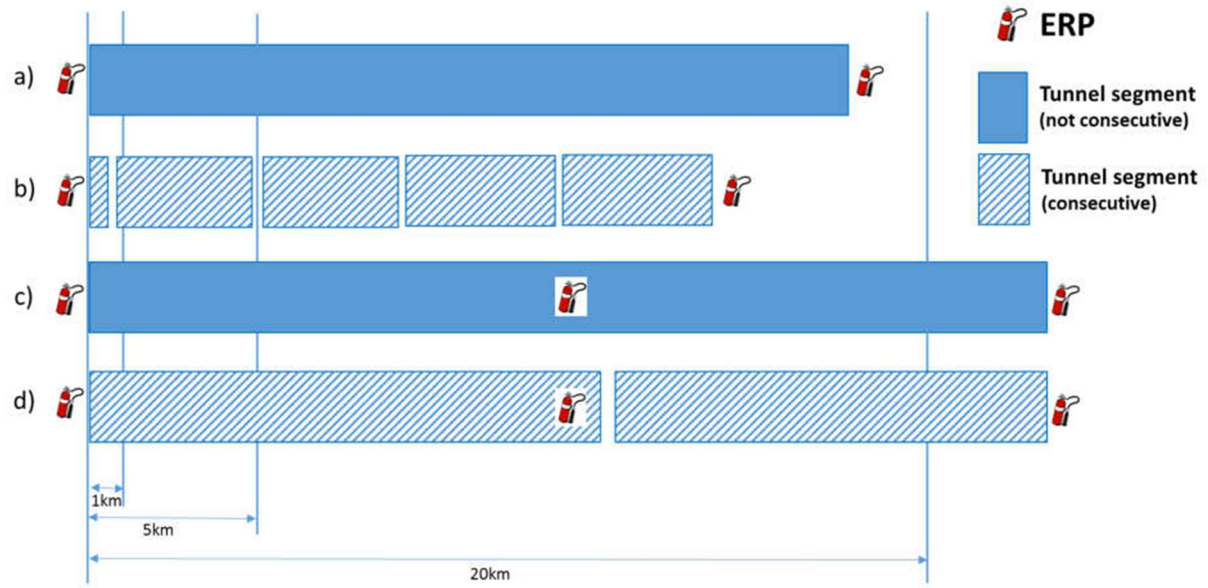


Figure 4 Examples of configurations of evacuation and rescue points and tunnels for lines accepting only category B trains

a) The tunnel is longer than 1km and shorter than 20km: there are ERPs at both portals.
b) The first tunnel is shorter than 1km and the next ones are all shorter than 5km. However, the separation in open air between consecutive tunnels does not fulfil the requirement of either 4.2.1.7
(a) (1) or 4.2.1.7. (a) (2). Consequently, all tunnels are considered as one tunnel of more than 5km, and there are ERPs at both portals.
c) The tunnel is longer than 20km and, in order to accept category B trains, it needs to be equipped with an ERP inside the tunnel in addition to the ERPs at both portals.
d) The open air between both tunnels does not fulfil the requirement of either 4.2.1.7 (a) (1) or 4.2.1.7. (a) (2). Consequently, both tunnels are considered as one tunnel of more than 20km and the case is equivalent to case c).

The separation between consecutive tunnels defined in point 4.2.1.7 (a) (1) is linked to the maximum length of the passenger trains that will operate in the tunnel. This is required to ensure that all passenger and staff exits of any train travelling on a line fitted with several tunnels, will remain outside a tunnel if the train is evacuated in the separation gap between consecutive tunnels. Therefore,

- Only the longest train operating with passengers should be taken into consideration. Passenger trains with no passengers on board should not be considered (e.g. a passenger train being towed by another after a breakdown)
- The maximum train length is no longer defined in the revised LOC&PAS TSI. Therefore, the IM may take into account the maximum train length already imposed by other requirements for operation of trains on the line where the consecutive tunnels are fitted, e.g. length of the platforms at the stations.

[...]

(b) Evacuation and rescue points shall be created

(1)Outside both portals of every tunnel of >1km

and

(2) Inside the tunnel, according to the category of rolling stock that is planned to be operated, as summarized in the table below: [...]

The evacuation and rescue point locations outside the tunnel portals do not have to coincide exactly with the portal position. They may be placed further away from the portal position outside the tunnel due to topographical reasons, the length of the train, or urban environmental constraints, for example.

In all cases, the distances between evacuation and rescue points defined in table 4.2.1.7 (b) (2), must be respected.

The decision on "*the category of rolling stock that is planned to be operated*" is particularly important for tunnels of a length between 5km and 20km. This decision between passenger rolling stock of category A or B should be made as soon as the phase of design of the tunnel starts and should take into account a long- term vision (see also clause Operational rules related to trains running in tunnels (clause 4.4.6)).

[...]

(c) Requirements for all evacuation and rescue points:

(1) The evacuation and rescue points shall be equipped with water supply (minimum 800l/ min during 2 hours) close to the intended stopping point of the train. The method of supplying the water shall be described in the emergency plan.

[...]

The water flow of 800 l/min is a minimum value. Local and operational aspects such as the response time of the emergency response services, the type of water source, and the method of supplying the water, should be considered by the applicant.

The water source can be a hydrant or any water supply such as a basin, river or other means.

[...](c) Requirements for all evacuation and rescue

points: [...]

(2) The intended stopping position of the affected train shall be indicated to the train driver. This shall not require specific on-board equipment (all TSI compliant trains must be able to use the tunnel)

Indicating the intended stopping position does not necessarily require a specific sign to be placed at relevant positions in a tunnel.

(c) Requirements for all evacuation and rescue

points: [...]

(4) It shall be possible to switch off and earth the contact line, either locally or remotely..

This may be achieved either by direct operation or by a remote control system activated from a control centre at the request from:

- the train staff, from the train cab,
- the train staff, IM staff or the emergency response services, from communication equipment inside the tunnel.

(d) Requirements for evacuation and rescue points outside the portals of the tunnel

In addition to the requirements in 4.2.1.7 (c), evacuation and rescue points outside the portals of the tunnel shall comply with the following requirements:

(1) The open air area around the evacuation and rescue point shall offer a minimum surface of 500 m².

The open-air area around the evacuation and rescue point may consist of roads, parks or other areas suitable for evacuation and rescue operations. It does not need to be a dedicated area as long as it complies with points 4.2.1.7 (c) and 4.2.1.7 (d).

(e) Requirements for evacuation and rescue points inside the tunnel

In addition to requirements in 4.2.1.7 (c), evacuation and rescue points inside the tunnel shall comply with the following requirements

(1) A safe area shall be accessible from the stopping position of the train. Dimensions of the evacuation route to the safe area shall consider the evacuation time (as specified in clause 4.2.3.4.1) and the planned capacity of the trains (referred to in clause 4.2.1.5.1) intended to be operated in the tunnel. The adequacy of the sizing of the evacuation route shall be demonstrated.

(2) The safe area that is paired with the evacuation and rescue point shall offer a sufficient standing surface relatively to the time passengers are expected to wait until they are evacuated to a final place of safety.

The TSI does not specify a minimum surface area per person ratio in the safe area which is coupled with the internal evacuation and rescue point. This is because this ratio depends on many factors, such as the layout of the tunnel, the response time of the emergency response services, etc., and therefore a suitable value may be determined on a case-by-case basis.

For example, the standing surface per person can be evaluated by taking into account the expected waiting time before the evacuation to a final place of safety starts. The standing surface per person can be different according to the specific situation. Facilities such as toilets, water, seats, etc. may be provided according to the waiting time derived from the evacuation scenarios and reported in the Emergency Plan.

For a particular tunnel project, where 'alternative technical solutions' are adopted for provision of access to the safe area, the adequacy of the standing surface area may be demonstrated through application of the Common Safety Methods on Risk Assessment.

(3) There shall be an access to the affected train for emergency response services without

going through the occupied safe area.

If a parallel tunnel or parallel service tunnel is used as a safe area it is allowed to the emergency service to use these tunnels as access to the affected train. Similarly, emergency response services can access to the affected train through the safe area after its occupants have been evacuated.

2.3.14. Emergency communication (clause 4.2.1.8)

[...](b) Radio continuity shall be provided for permitting the emergency response services to communicate with their on-site command facilities. The system shall allow the emergency response services to use their own communication equipment.

Radio continuity should be provided in stations, tunnels and safe areas.

Where there is agreement between the IM and the emergency response services, the emergency communication equipment could be GSM-R.

2.3.15. Requirements relative to electrical systems (clauses 4.2.1.9, 4.2.1.10 and 4.2.1.11)

The requirements of clauses 4.2.1.9, 4.2.1.10 and 4.2.1.11 are not new requirements in the SRT TSI, they have been transferred from other chapters of the TSI: in the SRT TSI 2008 and 2014, they were in the chapter about the Energy subsystem, they are now in the chapter about the Infrastructure subsystem.

The reason for the transfer is that according to its definition in the Interoperability Directive, the Energy sub-system should consist only of the electrification system, including overhead lines, and the trackside electricity consumption measuring and charging system. Electrification system here is understood as the electricity supply to the train. Electricity supply to the systems in the tunnel (lighting, ventilation if any, etc.) does not correspond to the definition for the electrification system.

For the assessment of the requirements of clauses 4.2.1.9, 4.2.1.10 and 4.2.1.11, no electrical expertise is needed: the assessment consists of a verification that the required functionalities of the electrical supply system are fulfilled.

2.3.16. Reliability of electrical systems (clause 4.2.1.10)

This specification applies to all tunnels of more than 1 km in length.

(a) Electrical systems identified by the Infrastructure Manager as vital to the safety of passengers in the tunnel shall be kept in use as long as necessary according to the evacuation scenarios considered in the emergency plan.

(b) Autonomy and reliability: an alternative electricity supply shall be available for an appropriate period of time after failure of the main supply. The time required shall be consistent with the evacuation scenarios considered and included in the emergency plan.

The alternative power supply can be a backup supply from batteries or powerpacks or it can be provided via a redundant or two-sided power supply.

2.3.17. Sectioning of contact line (clause 4.2.2.1)

This specification applies to all tunnels of more than 1 km length.
(a) The traction power supply system in tunnels may be divided into sections.
(b) In such case, it shall be possible to switch off each section of the contact line, either locally or remotely.

The traction power supply system in tunnels can be divided into sections when appropriate. This can be the case when, for instance, the signaling system permits the presence of more than one train in the tunnel on one track simultaneously, i.e. when two or more trains are running on the same track in the tunnel.

It's considered that the requirement on sectioning should allow flexibility, depending on the expected operation of the tunnel and on the rules applicable by rescue services: for instance, in some countries there is an agreement to guarantee the total earthing of a tunnel for the emergency response services. When this is the case, sectioning is not necessary.

When divided into sections, the length of each section could be determined according to the operational conditions in the tunnel and the signaling system.

2.4. Operational rules

2.4.1. Emergency rule (clause 4.4.1)

These rules apply to all tunnels.

In light of the essential requirements in Chapter 3, the operating rules specific to tunnel safety are:

(a) The operational rule is to monitor the train condition before entering a tunnel in order to detect any defect detrimental to its running behaviour and take appropriate action.

[...]

The monitoring of the train before entering the tunnel may be achieved by:

- trackside monitoring and/or
- on-board monitoring

The definition of the appropriate equipment and operational measures is the responsibility of the IM and RUs through their respective Safety Management Systems.

From a rolling stock perspective, the requirements of the LOC&PAS TSI, point 4.2.3.3.2 "Axle bearing condition monitoring" when they apply are sufficient to fulfil the requirement.

For wagons, there is no harmonised specification on the design of on-board axle bearing condition monitoring equipment (Open point listed in the WAG TSI on clause 4.2.3.4 Axle bearing condition monitoring)

When installed, track side detection systems should not impose additional requirements or equipment for the rolling stock on top of those already required in the LOC&PAS TSI and in the WAG TSI.

2.4.2. Tunnel emergency plan (clause 4.4.2)

These rules apply to tunnels of more than 1 km in length

(a) An emergency plan shall be developed under the direction of the Infrastructure Manager(s), in co-operation with the emergency response services and the relevant authorities for each tunnel. Station managers shall be equally involved if one or more stations are used as a safe area or an evacuation and rescue point. Railway Undertakings already operating in the tunnel must be consulted. In case the emergency plan concerns a new tunnel, Railway Undertakings planning to operate in the tunnel may be consulted

(b) The emergency plan shall be consistent with the self-rescue, evacuation, fire-fighting and rescue facilities available.

(c) Detailed tunnel-specific incident scenarios adapted to the local tunnel conditions shall be developed for the emergency plan.

(d) Once developed, the emergency plan shall be communicated to Railway Undertakings intending to use the tunnel

This requirement applies only to the emergency plan developed under the direction of the Infrastructure Manager(s), in co-operation with the emergency response services and the relevant authorities for each tunnel. Emergency Response Services may have their own complementary plans, that are not in the scope of the Interoperability Directives and therefore, not in the scope of the SRT TSI.

According to the TSI, an Infrastructure Manager emergency plan is required to contain at least the following:

- description of the foreseen emergency scenarios (clauses 2.2 and 4.4.2 (c) of the TSI);
- period of time for which the integrity of the tunnel lining is maintained in case of fire (clause 4.2.1.2);
- the way the emergency response services access the safe area (clause 4.2.1.5.2 (e));
- period of time of availability of the alternative electricity supply for emergency lighting on escape routes after failure of the main supply. (clause 4.2.1.5.4 (c));
- the method of supplying the water to the Evacuation and Rescue Points (Clause 4.2.1.7. (c) (1));
- the way the emergency response services access the Evacuation and Rescue Point and deploy equipment (clause 4.2.1.7. (c) (3));
- electricity supply facilities provided for the emergency response services (clause 4.2.1.9 (a));
- period of time of availability of an alternative electricity supply after failure of the main supply (clause 4.2.1.10 (b));
- procedures to improve the familiarity of all organisations with the infrastructure and the frequency of visits to the tunnel and table top or other exercises (clause 4.4.3 (b));
- the responsibility and procedure for earthing (clause 4.4.4. (c)).

Note: a few requirements mentioning information to report in the emergency plan apply to tunnels of less that 1km in length (e.g. 4.2.1.2. Fire resistance of tunnel structures); for such requirements, the information needs to be reported only for tunnels of 1km in length or more.

An emergency plan may also contain:

- the responsibilities, names, addresses and telephone numbers, of all relevant organisations; any changes in this respect should be reported immediately and the emergency plan updated accordingly by the IM;
- the identification of the tunnel (which must be unique), and a precise description and plan of the access routes for the emergency response services;
- the measures provided and the strategy for ensuring the safety of passengers in the tunnel and for their evacuation, in the event of occurrence of the foreseen emergency scenarios;
- the available evacuation time for the complete evacuation of people to a safe place (considering also the time to evacuate the passengers from the train – see TSI LOC&PAS point 4.2.10.5.1 for TSI-compliant rolling stock);
- information about the facilities provided in the safe area paired with the internal evacuation and rescue point.

The list above is not exhaustive.

(a) (…) Railway Undertakings already operating in the tunnel must be consulted. In

case the emergency plan concerns a new tunnel, Railway Undertakings planning to operate in the tunnel may be consulted

The consultation of railway undertakings required in those paragraphs is intended to inform them on the content of the emergency plans. IMs should take note of the RU's questions and remarks and manage them, especially if they identify major deficiencies in the documentation and the need for modification of the emergency plans.

In case of modification of an existing plan such consultation may be necessary if significant changes potentially impacting RUs are made.

(d) Once developed, the emergency plan shall be communicated to Railway Undertakings intending to use the tunnel

It is permitted to communicate the Emergency plans with a reference in the Network Statement of the IM. This is acceptable to both newly developed and modified Plans.

2.4.3. Exercises (clause 4.4.3)

These rules apply to tunnels of > 1 km.

(a) Prior to the opening of a single tunnel or a series of tunnels, a full-scale exercise comprising evacuation and rescue procedures, involving all categories of personnel defined within the emergency plan, shall take place.

The Authorisation of Placing in Service of the infrastructure and energy subsystems of a tunnel can be issued by the NSAs even without carrying out the exercise indicated in point a), with the limitation to carry out the exercise before the opening to rail traffic.

Note: in case a tunnel is upgraded or extended or when an additional tube is added to a tunnel, the need for new exercises should be considered.

2.4.4. Provision of on-train safety and emergency information to passengers (clause 4.4.5)

(a) Railway undertaking shall inform passengers of on board emergency and safety procedures related to tunnels.

(b) When such information is in written or spoken form, it shall be presented in the language of the country the train is running in as a minimum, plus English.

(c) An operating rule shall be in place describing how the train crew ensures the complete evacuation of the train when this is necessary, including those people with hearing impairments that may be in closed areas.

The core content of the information may include:

- in case of fire, and if you are able to do so, try to extinguish the fire by using the on-board extinguishers;
- alerting the train crew;
- if there is no immediate danger, await instructions from the train crew;
- if necessary, or if instructed, passengers to move to another coach;
- once the train is stationary, follow the instructions given by the train crew;
- if leaving the train in the event of an emergency follow the emergency exit signs;
- beware of trains travelling on adjacent tracks.

The list above is neither exhaustive nor mandatory.

The information may be supplied in spoken form (train staff, recorded messages in the Public Address system) or in written form (leaflets, pictograms, etc...)

2.4.5. Operational rules related to trains running in tunnels (clause 4.4.6)

(a) Vehicles in conformity with the TSI as defined in clause 4.2.3 shall be permitted to operate in tunnels in accordance with the following principles:

(1) Category A passenger rolling stock shall be deemed to comply with the tunnel safety requirements for rolling stock on lines where the distance between evacuation and rescue points, or the length of tunnels does not exceed 5km.

(2) Category B passenger rolling stock shall be deemed to comply with the tunnel safety requirements for rolling stock on all lines.

Passenger Rolling Stock are categorised as A or B according to their running capability, i.e. their capacity to continue running with a fire on-board so as to leave the tunnel or reach an internal Evacuation and Rescue Point.

Passenger Rolling Stock of category A have a running capability of 5 km. They are designed to ensure that they can continue running for a minimum of 4min at an average speed of 80km/h (without automatic application of the brakes).

Passenger Rolling Stock of category B have a running capability of 20 km. They are designed to ensure that they can continue running for a minimum of 15min at an average speed of 80km/h (traction power remains available and without automatic application of the brakes).

Compliance is demonstrated according to the requirements detailed in the LOC&PAS TSI (see point 4.1.4 and 4.2.10.4.4).

2.5. Implementation

2.5.1. Upgrade and renewal measures for tunnels (clause 7.2.2)

Preliminary note: the principles expressed in point 3 of the TSI SRT and clarified in point 2.2 of this document are also applicable in the case of a tunnel upgrade/renewal or extension; accordingly, the TSI permits the use of the risk acceptance principles listed in the CSM-RA as an alternative for the fulfilment of the essential requirement 'Safety' in the table of section 3 of the TSI.

7.2.2.1. Upgrade or renewal of a tunnel
(a) A tunnel is considered to be upgraded or renewed in the context of this TSI when any major modification or substitution work are carried out on a subsystem (or part of it) composing the tunnel.
(b) Assemblies and components that are not included in the scope of a particular upgrade or renewal programme do not have to be made compliant at the time of such a programme.
(c) When upgrading or renewal works are carried out, the following parameters apply if they are in the scope of work:

- *4.2.1.1. Prevent unauthorised access to emergency exits and technical*
- *4.2.1.3. Fire reaction of building material*
- *4.2.1.4. Fire detection in technical rooms*
- *4.2.1.5.4 Emergency lighting: when provided, it is not necessary to apply detailed requirements*
- *4.2.1.5.5 Escape signage*

4.2.1.8. Emergency communication

According to the Article 18 of Directive 797/2016, major modification is understood as any work which improves the overall performance of the tunnel. Due to the variety of existing tunnels, the decision for an authorization or not will remain to the National Safety Authority on a case-by-case basis.

There are many tunnels already in service. Obviously, they cannot be adapted at reasonable costs to the requirements applicable to new tunnels. But safety in railway tunnels does not depend only on structural measures — it could be enhanced also through operational measures.

In case of upgrade/renewal, the applicant decides what will be included in the scope of work, i.e. which assemblies and components will be renewed/upgraded and for which part of the tunnel they will be renewed/upgraded.

It is always possible to apply the requirements of parameters not covered by 7.2.2.1 (c) if they are in the scope of the proposed works.

In the case where an existing tunnel is upgraded or renewed by the addition of lighting, it may be that there is no walkway or handrails, making it impossible to assess the conformity of the installed lighting system with the above requirements. For that reason, in the case of tunnel upgrade/renewal, it is not required to check the conformity of lighting with the requirements in 4.2.1.5.4 (b).

7.2.2.2. Extension of a tunnel

(a) A tunnel is considered to be extended in the context of this TSI when its geometry is affected (e.g. extension in length, connection to another tunnel).

(b) When a tunnel extension is carried out, then the following measures shall be implemented for assemblies and components included in the extension. For their application, the tunnel length to consider is the total tunnel length after extension

4.2.1.1. Prevent unauthorised access to emergency exits and technical rooms
4.2.1.2. Fire resistance of tunnel structures
4.2.1.3. Fire reaction of building material
4.2.1.4. Fire detection in technical rooms
4.2.1.5.4 Emergency lighting
4.2.1.5.5 Escape signage
4.2.1.6. Escape walkways
4.2.1.8. Emergency communication
4.2.1.9. Electricity supply for emergency response services
4.2.1.10. Reliability of electrical systems
4.2.1.11 Communication and lighting at switching locations
4.2.2.1. Sectioning of contact line
4.2.2.2. Earthing of contact line

In the context of this TSI, the extension of a tunnel is the act of making it longer by the creation of an additional length of tunnel continuous to the existing one.

There are many possibilities for tunnel extension. Therefore, the TSI gives only general rules for extension:

a) to determine the applicable requirements, the length of the tunnel to consider is the length of the tunnel after it has been extended,

b) the extension shall apply the requirements listed in clause 7.2.2.2 (b) of the TSI,

c) for the creation of access to safe areas and of evacuation and rescue points, the CSM on risk

assessment shall be implemented to demonstrate an acceptable level of safety; when it is not economically feasible to fulfil the TSI requirements on safe areas and evacuation and rescue points, proposals for modification should be accepted if it can be shown that basic parameters are improved in the direction of the TSI defined performance.

The overall safety level of the existing tunnel should not be reduced by the tunnel after extension.

The Figure 5 shows two cases of tunnel extension.

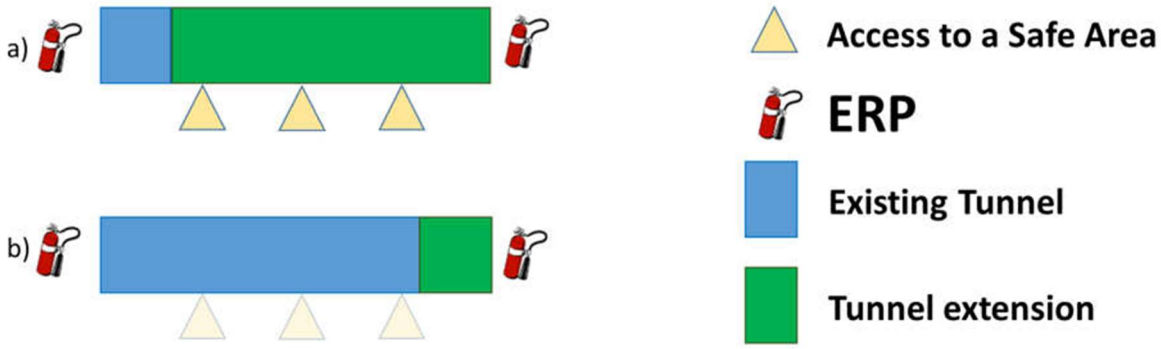


Figure 5 Examples of tunnel extension

a) The short tunnel is subject to a long extension, which needs to fulfil the requirements listed in clause 7.2.2.2 (b) of the TSI. According to clause 4.2.1.5 of the TSI, the resulting tunnel should be fitted with 3 accesses to a safe area, all located within the extension length, and with ERPs at both portals. The CSM-RA shall be implemented. Given that most of the tunnel is new, it can be expected that the TSI requirements on safe areas and evacuation and rescue points will be fulfilled.

b) In this case, the existing tunnel is long and the extension is short. According to clause 4.2.1.5 of the TSI, the resulting tunnel should be fitted with 3 accesses to a safe area, all located in the existing part of the tunnel, and with ERPs at both portals. The CSM-RA shall be implemented, and the economic feasibility is a criteria to consider to fulfil the TSI requirements on safe areas and evacuation and rescue points.

When creating a new tunnel near an existing tunnel, the new tunnel needs to fulfil all applicable TSI requirements of clauses 4.2.1 and 4.2.2. The distance between the existing and the new tunnel should be considered. In some cases, for the conformity to the requirements of point 4.2.1.7, the new tunnel may be considered an extension of the existing tunnel: this is the case when the separation in open air between the new tunnel and the existing tunnel does not fulfil the requirement of either 4.2.1.7 (a) (1) or 4.2.1.7. (a) (2). For such configurations, an ERP according to the requirements of point 4.2.1.7 should be created at the portal of the new tunnel. To determine the most appropriate location and characteristics of the other external ERP, the CSM-RA shall be implemented.

Note: in case the new tunnel is shorter than 1km but the separation in open air between the new tunnel and the existing tunnel does not fulfil the requirement of either 4.2.1.7 (a) (1) or 4.2.1.7. (a) (2), both tunnels are considered as one tunnel of more than 1km in length, for the purpose of the clause 4.2.1.7.

7.2.2.2. Extension of a tunnel

(d) When applicable, the tunnel emergency plan shall be revised

An emergency plan also needs to be created when the total length of the tunnel after extension exceeds 1 km.

2.5.2. Operation of new rolling stock in existing tunnels (clause 7.2.4)

The Table 2 below provides some guidance regarding the compatibility between new rolling stock and existing tunnels.

	New Rolling Stock category *(including when relevant the dispositions corresponding to specific cases)*	
Characteristics of tunnel	**Cat A**	**Cat B**
Existing tunnels		
Length < 5 km	OK	OK
Length from 5 km to 20 km	OK under conditions described in clause 7.2.4	OK
Length > 20 km		

Table 2 Compatibility between new rolling stock and existing tunnels

3. APPLICABLE SPECIFICATIONS AND STANDARDS

For a general guidance on standards please refer to the general part of the guide for application of the TSI. Standards of voluntary use which have been identified during the drafting process of the TSI are listed in the Table 3. As far as possible, the clause of the standard which is relevant for the conformity assessment of the TSI requirement should be identified.

For consistency, the Table 3 should be read with consideration of the Appendix A of the TSI, titled “Standards or normative documents referred to in this TSI”, which lists “Mandatory ref to clause(s) of Standard”; both annexes have the same structure. Standards listed in the Appendix A of the TSI are not always repeated in the Table 3 of this application guide, even if additional clauses to those identified as mandatory may be used on a voluntarybasis.

Index No.	Reference	Clauses	Document name	Version	BP(s) concerned
1	EN 1125:2008	Relevant clauses. Doors Grade A or B to be selected	Building hardware. Panic exit devices operated by a horizontal bar, for use on escape routes. Requirements and test methods	March 2008	4.2.1.1. (b)

2	EN 13501-1:2018	Relevant clauses	Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests	December 2018	4.2.1.3
3	EN 13501-6:2018	Relevant clauses	Fire classification of construction products and building elements - Part 6: Classification using data from reaction to fire tests on power, control and communication cables	December 2018	4.2.1.3
4	EN 12665:2018	Relevant clauses	Light and lighting — Basic terms and criteria for specifying lighting requirements	June 2018	4.2.1.5.4
5	EN 50172:2004	Chapters 1 to 5	Emergency escape lighting systems	March 2004	4.2.1.5.4

Table 3 List of standards of voluntary application

4. Annex 1 – table summarising the applicable requirements according to the length of the tunnel

<table>
<tr><td colspan="5">TUNNEL LENGTH</td></tr>
<tr><td>0.1-0.5 km</td><td>>0.5-1 km</td><td>>1 – 5 km</td><td>> 5 – 20 km</td><td>> 20 km</td></tr>
<tr><td colspan="5">4.2.1.1. Prevent unauthorised access to emergency exits and technical rooms</td></tr>
<tr><td colspan="5">4.2.1.2. Fire resistance of tunnel structures</td></tr>
<tr><td colspan="5">4.2.1.3. Fire reaction of building material</td></tr>
<tr><td></td><td></td><td colspan="3">4.2.1.4. Fire detection in technical rooms</td></tr>
<tr><td></td><td></td><td colspan="3">4.2.1.5.1 Safe area</td></tr>
<tr><td></td><td></td><td colspan="3">4.2.1.5.2 Access to the safe area</td></tr>
<tr><td></td><td></td><td colspan="3">4.2.1.5.3 Communication means in safe areas</td></tr>
<tr><td></td><td colspan="4">4.2.1.5.4 Emergency lighting</td></tr>
<tr><td colspan="5">4.2.1.5.5 Escape signage</td></tr>
<tr><td></td><td colspan="4">4.2.1.6. Escape walkways</td></tr>
<tr><td></td><td></td><td colspan="3">4.2.1.7. Evacuation and rescue points</td></tr>
</table>

<table>
<tr><td colspan="5">TUNNEL LENGTH</td></tr>
<tr><td>0.1-0.5 km</td><td>>0.5-1 km</td><td>>1 – 5 km</td><td>> 5 – 20 km</td><td>> 20 km</td></tr>
<tr><td></td><td></td><td colspan="3">(1) Outside both portals of every tunnel of >1km and</td></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td colspan="2">(2) Inside the tunnel, according to the category of rolling stock that is planned to be operated:

Category A 5 km</td></tr>
<tr><td></td><td>Category B 20 km</td></tr>
<tr><td></td><td></td><td colspan="3">4.2.1.8. Emergency communication</td></tr>
<tr><td></td><td></td><td colspan="3">4.2.1.9. Electricity supply for emergency response services</td></tr>
<tr><td></td><td></td><td colspan="3">4.2.1.10. Reliability of electrical systems</td></tr>
<tr><td></td><td></td><td colspan="3">4.2.1.11. Communication and lighting at switching locations</td></tr>
<tr><td></td><td></td><td colspan="3">4.2.2.1. Sectioning of contact line</td></tr>
<tr><td></td><td></td><td colspan="3">4.2.2.2. Earthing of contact line</td></tr>
</table>

5. Annex 2 – summary of the main evolutions between Regulation 1303/2014 and amendment (EU) 2019/776

The table below summarizes the main changes brought to the SRT TSI during the drafting of the amendment. It does not list the editorial changes nor the reference updates.

Clause of the TSI	*Characteristics*	*Evolution from the TSI 2014*	*Reason for the evolution*	*Comment*
1. Introduction				
1.1.4. Risk scope, risks that are not covered by this TSI	Risks for people in the neighbourhood of a tunnel where collapse of the structure could have catastrophic consequences	That type of risks is removed from the scope covered by the TSI	The TSI is covering the risks for passengers and on-board staff.	Such risks are covered by Eurocodes and national regulations. They are not in the scope of Interoperability
2. Definition of aspect/scope				
2.2.3 Prolonged stop	Prolonged stop may lead to panic and spontaneous uncontrolled evacuation	Removal of the term 'panic'	'Panic' is not clear and not factual	
2.4. Definitions	Definition of a "fire-fighting point"	The term "fire-fighting point" is replaced by "evacuation and rescue point"	Return of experience showed that "fire-fighting point" was creating a lot of confusion and did not correspond to the definition given.	

Clause of the TSI	*Characteristics*	*Evolution from the TSI 2014*	*Reason for the evolution*	*Comment*
	Definition of "final place of safety"	The term 'final place of safety" used in the TSI is defined	As this concept is used in the TSI, it was necessary to define it. Discussions in the WP showed that there were different understandings	
3. Essential requirements				
3.1. Infrastructure and energy subsystems	Essential requirement 'Safety' applying to the Infrastructure and Energy subsystems.	The use of the CSM on risk assessment is introduced as an alternative to the corresponding parameters of sections 4.2.1 and 4.2.2.	Promote a risk-based approach to meet the Essential Requirement 'Safety'.	This evolution gives more flexiblity to the applicants
4. Characterisation of the subsystem				
4.2.1. Subsystem Infrastructure				
4.2.1.2. Fire resistance of tunnel structures	Resistance of the main tunnel structure during evacuation of the neighbourhing structures	The requirement has been removed.	Consistency with the risks in 1.1.4 and with the scope of the TSI (safety of passengers and on-board staff)	Simplification for the applicants
4.2.1.3. Fire reaction of building material	Reaction to fire of electric cables	Requirement updated and moved to the Infrastructure section	Assessment is done by the NoBo for the subsystem Infrastructure and not Energy.	

Clause of the TSI	*Characteristics*	*Evolution from the TSI 2014*	*Reason for the evolution*	*Comment*
4.2.1.5.2 Access to safe area	Alternative technical solutions providing a safe area with a minimum equivalent safety level are permitted.	This 3rd alternative has been deleted.	The point is covered by the general possibility to use the CSM-RA for all parameters.	For historical background on the reason for the differentiation between single tube and double tube tunnels, see note[1]
4.2.1.5.4 Emergency lighting on escape routes	(3) Position of lights: • above the walkway, as low as possible,…	Removal of the term 'as low as possible'	This unclear requirement is very difficult to assess	

[1] The differentiation made between emergency exits to the surface and cross-passages between adjacent independent tunnel tubes dates back 2001-2002, when a working party combining the expertise of infrastructure managers and operators of most European railway tunnels produced a compendium of possible measures to increase safety in tunnels: this compendium became UIC 779-9 "Safety In Railway Tunnels".

The rationale behind the possible measures was to define a maximum distance to safe places (portal, emergency exit, cross passage) in the tunnel in order to enable self-rescue. It was proposed that the distance be no more than 1,000 m. However, cross passages between two parallel tubes being cost-effective compared to exits to the surface, it was considered reasonable to reduce the maximum distance between two cross-passages to 500 m based on that cost-effectiveness criteria.

In its report from December 2005 on the presentation of the first SRT TSI, the European Association for Railway Interoperability (AEIF) added that:

> *"in comparison with twin tube tunnels, a single bore double track tunnel is relatively high. As a result, in the event of a fire, the plume of smoke and hot combustion gases will rise to a higher level so that it will take longer for the smoke to descend to the level of evacuating passengers. This provides more time for passengers to evacuate under the smoke layer. Consequently the conditions are more tenable in single bore double track tunnels than in smaller bore twin tube tunnels allowing the greater distance of 1000m between emergency exits to be adopted. The option exists to construct cross passages to other transportation system tunnels (eg road and subway tunnels) if these exist or are planned in the locality".*

Clause of the TSI	*Characteristics*	*Evolution from the TSI 2014*	*Reason for the evolution*	*Comment*
4.2.1.6 Escape walkway	The height of the walkway shall be at top-of-rail level or higher	The height of the walkway shall be at bottom of rail level or higher	The top of rail level resulted from errors in translations and did not reflect the actual situation	Keeping the 'top of rail' requirement would have resulted in the creation of one or more specific cases
4.2.1.7 Fire fighting points (replaced by Evacuation and rescue points)	For consecutive tunnels to be considered as two tunnels, the separation in open air shall be longer than '*the maximum length of the train*'	Clarification that it's the maximum length of the *'passenger train'* that should be considered	Freight trains carrying no passenger, they should not be considered for rules on evacuation.	
NEW 4.2.1.9. Electricity supply for emergency response services 4.2.1.10. Reliability of electrical installations 4.2.1.11. Communication and lighting at switching locations	Requirements formerly numbered 4.2.2.3, 4.2.2.5 and 4.2.2.1 in the TSI 2014	Requirements are moved from the chapter on the 'Energy' subsystem to the chapter on the 'Infrastructure' subsystem	The assessment should rather be done by the NoBo for the subsystem Infrastructure and not Energy.	Clarification
4.2.2. Subsystem Energy				

Clause of the TSI	*Characteristics*	*Evolution from the TSI 2014*	*Reason for the evolution*	*Comment*
4.2.2.1. Sectioning of contact line	Requirement to to divide the energy supply system into sections of 5km	The requirement is replaced by a possibility given to the IM to have such sections	The requirement was too strictand, in many cases, not justified.	Simplification for the applicants
4.4. Operating rules				
4.4.2. Tunnel emergency plan	Involvement of Railway Undertakings in the development of adaptation of the Emergency Plan	It is clarified that RUs shall be informed, and may be involved in the development of the plan	The requirement to involve RUs in the development of the plan was too complex with many RUs to involve, not all known at the time of the development of the plan.	Simplification for the IMs
DELETED 4.8 Infrastructure and Rolling Stock registers		The paragraphs are removed	No need to duplicate – registers are supported by their own regulations	
6. Assessment of conformity and/or suitability for use of the constituents and verification of the subsystem				
6.2. Subsystems				
DELETED 6.2.6 Assessment of operational rules	This point is deleted		No need to duplicate requirements that are specified in other texts	

Clause of the TSI	*Characteristics*	*Evolution from the TSI 2014*	*Reason for the evolution*	*Comment*
NEW 6.2.6. Assessment of conformity for the Safety requirements applying to the Infrastructure and Energy subsystems	This paragraph details the roles of the actors for the assessment of the essential requirement 'Safety' when applying the CSM-RA	New requirement in line with the introduction of the CSM-RA in clause 3.1		
DELETED 6.2.7.1 Prevent unauthorised access to emergency exits and equipment rooms			These points do not bring valuable information for the Notified Bodies to perform the assessment	
DELETED 6.2.7.5 Access and equipment for emergency response services			The notified Bodies do not perform such assessment	
NEW 6.2.7.5. Emergency lighting in upgraded/renewed tunnels	In case of upgraded/renewed tunnels, the assessment consists in the verification of the existence of the lighting	Existing tunnels generally do not have the characteristics enabling the assessment of the lighting system (e.g. no walkway)		
7. Implementation				
7.2. Application of this TSI to subsystems already in service				

Clause of the TSI	*Characteristics*	*Evolution from the TSI 2014*	*Reason for the evolution*	*Comment*
7.2.2 Upgrade or renewal of a tunnel	The minimum requirements to apply for an upgrade or renewal project are listed	Replacement of a general statement with detailed specification	Applicants need consistency and some certainty on what needs to be done	Simplification for the applicants
NEW 7.2.2.2. Extension of a tunnel	The minimum requirements to apply for the extension of an existing tunnel are listed	The case of a tunnel extension is more complex as it combines an upgrade/renewal with a new part of tunnel.	Return of experience show that such extension projects raise many questions.	
Appendix				
Appendix B: Assessment of the Subsystems	The role of the NoBo in the assessment on site is enlarged.		The principles of a 3rd party inspection require the verification of conformity to an approved design.	Additional site inspection generating additional cost