

Directive 2004/54/EC of the European Parliament and of the Council of 29 April 2004  
on minimum safety requirements for tunnels in the Trans-European Road Network

## ANNEX I

## Safety measures as referred to in Article 3

1. Basis for deciding on safety measures
  - 1.1. Safety parameters
    - 1.1.1. Safety measures to be implemented in a tunnel shall be based on a systematic consideration of all aspects of the system composed of the infrastructure, operation, users and vehicles.
    - 1.1.2. The following parameters shall be taken into account:
      - tunnel length,
      - number of tubes,
      - number of lanes,
      - cross-sectional geometry,
      - vertical and horizontal alignment,
      - type of construction,
      - uni-directional or bi-directional traffic,
      - traffic volume per tube (including its time distribution),
      - risk of congestion (daily or seasonal),
      - access time for the emergency services,
      - presence and percentage of heavy goods vehicles,
      - presence, percentage and type of dangerous goods traffic,
      - characteristics of the access roads,
      - lane width,
      - speed considerations,
      - geographical and meteorological environment.
    - 1.1.3. Where a tunnel has a special characteristic as regards the aforementioned parameters, a risk analysis shall be carried out in accordance with Article 13 to establish whether additional safety measures and/or supplementary equipment is necessary to ensure a high level of tunnel safety. This risk analysis shall take into consideration possible accidents, which clearly affect the safety of road users in tunnels and which might occur during the operating stage and the nature and magnitude of their possible consequences.
  - 1.2. Minimum requirements
    - 1.2.1. The safety measures required by the following paragraphs shall be implemented at a minimum in order to ensure a minimum level of safety in all the tunnels covered by the Directive. Limited derogations from these requirements may be allowed provided that the following procedure is completed successfully. Member States or the Administrative Authority shall send to the Commission information on the following:  
the limited derogation(s) envisaged,
      - the imperative reasons underlying the limited derogation envisaged,
      - the alternative risk reduction measures which are to be used or reinforced in order to ensure at least an equivalent level of safety, including proof therefor in the form of an analysis of relevant risks.

The Commission shall transmit any request for a limited derogation to the Member States as soon as possible, and in any case within one month of receipt.

If, within a period of three months after receipt of the request by the Commission, neither the Commission nor a Member State formulates objections, the limited derogation shall be deemed granted and the Commission shall inform all Member States accordingly. If objections are expressed, the Commission shall make a proposal in accordance with the procedure referred to in Article 17(2). Where the decision is negative, the limited derogation shall not be allowed.

1.2.2. In order to provide a unified interface in all tunnels to which this Directive applies, no derogation from the requirements of the following paragraphs shall be allowed regarding the design of the safety facilities at the disposal of the tunnel users (emergency stations, signs, lay-bys, emergency exits, radio re-broadcasting when required).

1.3. Traffic volume

1.3.1. Where "traffic volume" is mentioned in this Annex, it refers to the annual average daily traffic through a tunnel per lane. For the purpose of determining the traffic volume, each motor vehicle shall be counted as one unit.

1.3.2. Where the number of heavy goods vehicles over 3,5 t exceeds 15% of the annual average daily traffic, or seasonal daily traffic significantly exceeds the annual average daily traffic, the additional risk will be assessed and taken into account by increasing the traffic volume of the tunnel for the application of the following paragraphs.

2. Infrastructure measures

2.1. Number of tubes and lanes

2.1.1. The main criteria for deciding whether to build a single or a twin-tube tunnel shall be projected traffic volume and safety, taking into account aspects such as the percentage of heavy goods vehicles, gradient and length.

2.1.2. In any case, where, for tunnels at the design stage, a 15-year forecast shows that the traffic volume will exceed 10 000 vehicles per day per lane, a twin-tube tunnel with unidirectional traffic shall be in place at the time when this value will be exceeded.

2.1.3. With the exception of the emergency lane, the same number of lanes shall be maintained inside and outside the tunnel. Any change in the number of lanes shall occur at a sufficient distance in front of the tunnel portal; this distance shall be at least the distance covered in 10 seconds by a vehicle travelling at the speed limit. When geographic circumstances prevent this, additional and/or reinforced measures shall be taken to enhance safety.

2.2. Tunnel geometry

2.2.1. Special consideration shall be given to safety when designing the cross-sectional geometry and the horizontal and vertical alignment of a tunnel and its access roads, as these parameters have a significant influence on the probability and severity of accidents.

2.2.2. Longitudinal gradients above 5% shall not be permitted in new tunnels, unless no other solution is geographically possible.

2.2.3. In tunnels with gradients higher than 3%, additional and/or reinforced measures shall be taken to enhance safety on the basis of a risk analysis.

- 2.2.4. Where the width of the slow lane is less than 3,5 m and heavy goods vehicles are allowed, additional and/or reinforced measures shall be taken to enhance safety, on the basis of a risk analysis.
- 2.3. Escape routes and emergency exits
- 2.3.1. In new tunnels without an emergency lane, emergency walkways, elevated or not, shall be provided for use by tunnel users in the event of a breakdown or an accident. This provision does not apply if the construction characteristics of the tunnel do not allow it or allow it only at disproportional cost and the tunnel is unidirectional and is equipped with a permanent surveillance and lane closure system.
- 2.3.2. In existing tunnels where there is neither an emergency lane nor an emergency walkway, additional and/or reinforced measures shall be taken to ensure safety.
- 2.3.3. Emergency exits allow tunnel users to leave the tunnel without their vehicles and reach a safe place in the event of an accident or a fire and also provide access on foot to the tunnel for emergency services. Examples of such emergency exits are:
- direct exits from the tunnel to the outside,
  - cross-connections between tunnel tubes,
  - exits to an emergency gallery,
  - shelters with an escape route separate from the tunnel tube.
- 2.3.4. Shelters without an exit leading to escape routes to the open shall not be built.
- 2.3.5. Emergency exits shall be provided if an analysis of relevant risks, including how far and how quickly smoke travels under local conditions, shows that the ventilation and other safety provisions are insufficient to ensure the safety of road users.
- 2.3.6. In any event, in new tunnels, emergency exits shall be provided where the traffic volume is higher than 2 000 vehicles per lane.
- 2.3.7. In existing tunnels longer than 1 000 m, with a traffic volume higher than 2 000 vehicles per lane, the feasibility and effectiveness of the implementation of new emergency exits shall be evaluated.
- 2.3.8. Where emergency exits are provided, the distance between two emergency exits shall not exceed 500 m.
- 2.3.9. Appropriate means, such as doors, shall be used to prevent smoke and heat from reaching the escape routes behind the emergency exit, so that the tunnel users can safely reach the outside and the emergency services can have access to the tunnel.
- 2.4. Access for emergency services
- 2.4.1. In twin-tube tunnels where the tubes are at the same level or nearly, cross-connections suitable for the use of emergency services shall be provided at least every 1 500 m.
- 2.4.2. Wherever geographically possible, crossing of the central reserve (median strip) shall be made possible outside each portal of a twin- or multi-tube tunnel. This measure will allow emergency services to gain immediate access to either tube.
- 2.5. Lay-bys

- 2.5.1. For new bi-directional tunnels longer than 1 500 m where traffic volume is higher than 2 000 vehicles per lane, lay-bys shall be provided at distances which do not exceed 1 000 m, if emergency lanes are not provided.
- 2.5.2. In existing bi-directional tunnels longer than 1 500 m with a traffic volume higher than 2 000 vehicles per lane but no emergency lane, the feasibility and effectiveness of the implementation of lay-bys shall be evaluated.
- 2.5.3. If the construction characteristics of the tunnel do not allow it or allow it only at disproportionate cost, lay-bys do not have to be provided if the total tunnel width which is accessible to vehicles, excluding elevated parts and normal traffic lanes, is at least equal to the width of one normal traffic lane.

2.5.4. Lay-bys shall include an emergency station.

## 2.6. Drainage

2.6.1. Where the transport of dangerous goods is permitted, the drainage of flammable and toxic liquids shall be provided for through well-designed slot gutters or other measures within the tunnel cross sections. Additionally, the drainage system shall be designed and maintained to prevent fire and flammable and toxic liquids from spreading inside tubes and between tubes.

2.6.2. If in existing tunnels that requirement cannot be met or can be met only at disproportionate cost, this shall be taken into consideration when deciding whether to allow the transport of dangerous goods on the basis of an analysis of relevant risks.

## 2.7. Fire resistance of structures

The main structure of all tunnels where a local collapse of the structure could have catastrophic consequences, e.g. immersed tunnels or tunnels which can cause the collapse of important neighbouring structures, shall ensure a sufficient level of fire resistance.

## 2.8. Lighting

2.8.1. 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.

2.8.2. 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.

2.8.3. 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.

## 2.9. Ventilation

2.9.1. 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.

2.9.2. 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.

2.9.3. In tunnels with bi-directional and/or congested unidirectional traffic, longitudinal ventilation shall be allowed only if a risk analysis according to Article 13 shows it is acceptable and/or specific measures are taken, such as appropriate traffic management, shorter emergency exit distances, smoke exhausts at intervals.

2.9.4. Transverse or semi-transverse ventilation systems shall be used in tunnels where a mechanical ventilation system is necessary and longitudinal ventilation is not allowed under point 2.9.3. These systems must be capable of evacuating smoke in the event of a fire.

2.9.5. For tunnels with bi-directional traffic, with a traffic volume higher than 2 000 vehicles per lane, longer than 3 000 m and with a control centre and transverse and/or semi-transverse ventilation, the following minimum measures shall be taken as regards ventilation:

- air and smoke extraction dampers shall be installed which can be operated separately or in groups,
- the longitudinal air velocity shall be monitored constantly and the steering process of the ventilation system (dampers, fans, etc.) adjusted accordingly.

2.10. Emergency stations

2.10.1. 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.

2.10.2. Emergency stations can consist of a box on the sidewall or preferably a recess in the sidewall. They shall be equipped with at least an emergency telephone and two fire extinguishers.

2.10.3. 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.

2.11. Water supply

A water supply shall be provided for all tunnels. Hydrants shall be provided near the portals and inside at intervals which shall not exceed 250 m. If a water supply is not available, it is mandatory to verify that sufficient water is provided otherwise.

2.12. Road signs

Specific signs shall be used for all safety facilities provided for tunnel users. Signs and panels for use in tunnels are given in Annex III.

2.13. Control centre

2.13.1. A control centre shall be provided for all tunnels longer than 3 000 m with a traffic volume higher than 2 000 vehicles per lane.

2.13.2. Surveillance of several tunnels may be centralised at a single control centre.

2.14. Monitoring systems

2.14.1. 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.

2.14.2. Automatic fire detection systems shall be installed in all tunnels which do not have a control centre where the operation of mechanical ventilation for smoke control is different from the automatic operation of ventilation for the control of pollutants.

2.15. Tunnel closing equipment

2.15.1. 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. Additional means, such as variable message signs and barriers, can be provided to ensure that instructions are obeyed.

2.15.2. Inside all tunnels longer than 3 000 m, with a control centre and a traffic volume higher than 2 000 vehicles per lane, equipment to stop vehicles in the event of an emergency is recommended at intervals not exceeding 1 000 m. This equipment shall consist of traffic signals and possibly additional means, such as loudspeakers, variable message signs and barriers.

2.16. Communication systems

2.16.1. 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.

2.16.2. 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.

2.16.3. Shelters and other facilities where evacuating tunnel users must wait before they can reach the outside shall be equipped with loudspeakers for the provision of information to users.

2.17. Power supply and electrical circuits

2.17.1. All tunnels shall have an emergency power supply capable of ensuring the operation of safety equipment indispensable for evacuation until all users have evacuated the tunnel.

2.17.2. Electrical, measurement and control circuits shall be designed in such a way that a local failure, such as one due to a fire, does not affect unimpaired circuits.

2.18. Fire resistance of equipment

The level of fire resistance of all tunnel equipment shall take into account the technological possibilities and aim at maintaining the necessary safety functions in the event of a fire.

2.19. Table displaying informative summary of minimum requirements

The table set out hereafter gives a summary of the minimum requirements laid down in the previous paragraphs. The minimum requirements are those set out in the operative text of this Annex.

Status: This is the original version (as it was originally adopted).

- mandatory for all tunnels      ○ not mandatory  
\* mandatory with exceptions      ◉ recommended

SUMMARY OF MINIMUM REQUIREMENTS			Traffic ≤ 2 000 veh. per lane		Traffic > 2 000 vehicles per lane			Additional conditions for implementation to be mandatory, or comments
			500-1 000 m	>1 000 m	500-1 000 m	1 000-3 000 m	>3 000 m	
Structural Measures	2 tubes or more	§2.1						Mandatory where a 15-year forecast shows that traffic > 10 000 veh./lane.
	Gradients ≤ 5 %	§2.2	*	*	*	*	*	Mandatory unless not geographically possible.
	Emergency walkways	§2.3.1						Mandatory where there is no emergency lane, unless the condition in §2.3.1 is respected. In existing tunnels where there is neither an emergency lane, nor an emergency walkway additional / reinforced measures shall be taken.
		§2.3.2	*	*	*	*	*	
	Emergency exits at least every 500 m	§2.3.3 - §2.3.9	○	○	*	*	*	Implementation of emergency exits in existing tunnels to be evaluated case-by-case.
	Cross-connections for emergency services at least every 1 500 m	§2.4.1	○	○ / ●	○	○ / ●	●	Mandatory in twin-tube tunnels longer than 1 500 m.
	Crossing of the central reserve outside each portal	§2.4.2	●	●	●	●	●	Mandatory outside twin- or multi-tube tunnels wherever geographically possible.
	Lay-bys at least every 1 000 m	§2.5	○	○	○	○ / ●	○ / ●	Mandatory in new bi-directional tunnels >1 500 m without emergency lanes. In existing bi-directional tunnels >1 500 m: depending on analysis. For both new and existing tunnels, depending on extra usable tunnel width.
	Drainage for flammable and toxic liquids	§2.6	*	*	*	*	*	Mandatory where transport of dangerous goods is allowed.
Fire resistance of structures	§2.7	●	●	●	●	●	Mandatory where a local collapse can have catastrophic consequences.	

- mandatory for all tunnels      ○ not mandatory  
\* mandatory with exceptions      ◉ recommended

SUMMARY OF MINIMUM REQUIREMENTS			Traffic ≤ 2 000 veh. per lane		Traffic > 2 000 vehicles per lane			Additional conditions for implementation to be mandatory, or comments
			500-1 000 m	>1 000 m	500-1 000 m	1 000-3 000 m	>3 000 m	
Lighting	Normal lighting	§2.8.1	●	●	●	●	●	
	Safety lighting	§2.8.2	●	●	●	●	●	
	Evacuation lighting	§2.8.3	●	●	●	●	●	
Ventilation	Mechanical ventilation	§2.9	○	○	○	●	●	
	Special provisions for (semi-) transverse ventilation	§2.9.5	○	○	○	○	●	Mandatory in bi-directional tunnels where there is a control centre.
Emergency stations	At least every 150 m	§2.10	*	*	*	*	*	Equipped with telephone and 2 extinguishers. A maximum interval of 250 m is allowed in existing tunnels.
Water supply	At least every 250 m	§2.11	●	●	●	●	●	If not available, mandatory to provide sufficient water otherwise.
Road signs		§2.12	●	●	●	●	●	For all safety facilities provided for tunnel users (see Annex III).
Control centre		§2.13	○	○	○	○	●	Surveillance of several tunnels may be centralised into a single control centre.
Monitoring systems	Video	§2.14	○	○	○	○	●	Mandatory where there is a control centre.
	Automatic incident detection and/or fire detection	§2.14	●	●	●	●	●	At least one of the two systems is mandatory in tunnels with a control centre.
Equipment to close the tunnel	Traffic signals before the entrances	§2.15.1	○	●	○	●	●	
	Traffic signals inside the tunnel at least every 1 000 m	§2.15.2	○	○	○	○	◉	Recommended if there is a control centre and the length exceeds 3 000 m.

SUMMARY OF MINIMUM REQUIREMENTS			Traffic ≤ 2 000 veh. per lane		Traffic > 2 000 vehicles per lane			Additional conditions for implementation to be mandatory, or comments
			500-1 000 m	>1 000 m	500-1 000 m	1 000-3 000 m	>3 000 m	
Communication systems	Radio re-broadcasting for emergency services	§2.16.1	○	○	○	●	●	
	Emergency radio messages for tunnel users	§2.16.2	●	●	●	●	●	Mandatory where radio is re-broadcasted for tunnel users and where there is a control centre
	Loudspeakers in shelters and exits	§2.16.3	●	●	●	●	●	Mandatory where evacuating users must wait before they can reach the outside.
Emergency power supply		§2.17	●	●	●	●	●	To ensure the functioning of indispensable safety equipment at least at during evacuation of tunnel users.
Fire resistance of equipment		§2.18	●	●	●	●	●	Shall aim to maintain the necessary safety functions.

### 3. Measures concerning operations

#### 3.1. Operating means

Tunnel operation shall be organised and dispose of such means as will ensure the continuity and safety of the traffic through the tunnel. The personnel involved in the operation as well as the emergency services shall receive appropriate initial and continuing training.

#### 3.2. Emergency planning

Emergency response plans shall be available for all tunnels. In tunnels starting and finishing in different Member States, a single bi-national emergency response plan shall involve the two countries.

### 3.3. Works in tunnels

Complete or partial closure of lanes due to construction or maintenance works planned in advance shall always begin outside the tunnel. Variable message signs, traffic signals and mechanical barriers may be used for this purpose.

### 3.4. Management of accidents and incidents

In the event of a serious accident or incident, all appropriate tunnel tubes shall be closed immediately to traffic.

This shall be done by simultaneous activation not only of the abovementioned equipment before the portals, but also of variable message signs, traffic signals and mechanical barriers inside the tunnel, if available, so that all the traffic can be stopped as soon as possible outside and inside the tunnel. Tunnels of less than 1 000 m may be closed by other means. Traffic shall be managed in such a way that unaffected vehicles can quickly leave the tunnel.

The access time for emergency services in the event of an incident in a tunnel shall be as short as possible and shall be measured during periodic exercises. In addition, it may be measured during incidents. In major bi-directional tunnels with high traffic volumes, a risk analysis in accordance with Article 13 shall establish whether emergency services shall be stationed at the two extremities of the tunnel.

### 3.5. Activity of the control centre

For all tunnels requiring a control centre, including those starting and finishing in different Member States, a single control centre shall have full control at any given time.

### 3.6. Tunnel closure

In the event of tunnel closure (long or short-term), users shall be informed of the best alternative itineraries, by means of easily accessible information systems.

Such alternative itineraries shall form part of systematic contingency plans. They should aim to maintain traffic flow as much as possible and minimise secondary safety effects on the surrounding areas.

Member States should make all reasonable efforts to avoid a situation in which a tunnel located on the territory of two Member States can not be used due to the consequences of bad weather conditions.

### 3.7. Transport of dangerous goods

The following measures shall be applied concerning access to tunnels for vehicles transporting dangerous goods, as defined in the relevant European legislation regarding the transport of dangerous goods by road:

- perform a risk analysis in accordance with Article 13 before the regulations and requirements regarding the transportation of dangerous goods through a tunnel are defined or modified,
- place appropriate signs to enforce the regulation before the last possible exit before the tunnel and at tunnel entrances, as well as in advance so as to allow drivers to choose alternative routes,

- consider specific operating measures designed to reduce the risks related to some or all of the vehicles transporting dangerous goods in tunnels, such as declaration before entering or passage in convoys escorted by accompanying vehicles, on a case by case basis further to the aforementioned risk analysis.

### 3.8. Overtaking in tunnels

A risk analysis shall be carried out in order to decide whether heavy goods vehicles should be allowed to overtake in tunnels with more than one lane in each direction.

### 3.9. Distances between vehicles and speed

The appropriate speed of vehicles and the safe distance between them are especially important in tunnels and shall be given close attention. This shall include advising tunnel users of appropriate speeds and distances. Enforcement measures shall be initiated as appropriate.

Road users driving passenger cars should under normal conditions maintain a minimum distance from the vehicle in front of them equivalent to the distance travelled by a vehicle in 2 seconds. For heavy goods vehicles this distance should be doubled.

When traffic stops in a tunnel, road users should maintain a minimum distance of 5 metres from the vehicle in front, except if this is not possible due to an emergency stop.

## 4. Information campaigns

Information campaigns regarding safety in tunnels shall be regularly organised and implemented in conjunction with interested parties on the basis of the harmonised work of international organisations. These information campaigns shall cover the correct behaviour of road users when approaching and driving through tunnels, especially in connection with vehicle breakdown, congestion, accidents and fires.

Information on the safety equipment available and proper road user behaviour in tunnels shall be provided in convenient places for tunnel users (for example at rest areas before tunnels, at tunnel entrances when the traffic is stopped or on the internet).