



**Economic and Social
Council**

Distr.
GENERAL

TRANS/AC.7/2001/8
8 January 2001

Original: ENGLISH

ECONOMIC COMMISSION FOR EUROPE

INLAND TRANSPORT COMMITTEE

Ad hoc Multidisciplinary Group of Experts on
Safety in Tunnels

(Third session, 20-21 March 2001)

QUESTIONNAIRE - PART A RESPONSES

PART A : REGULATIONS AND GENERAL DATA ON ROAD TUNNEL SAFETY

1. Are there any legislation, regulations, recommendations on safety in road tunnels in your country (dealing with geometry, infrastructure, equipment, signalling, operation, traffic, driver education and training, etc.)? If yes, please give details and provide all documents.
2. Do you consider the above texts sufficient? If not, please give details.
3. Is your authority considering any changes in the above texts? If yes, please give details and provide the current drafts.
4. Is there any specific methodology for risk assessment and risk management for tunnels in your country? If yes, please provide details and documents.
5. Does your country classify road tunnels, or envisage to do so in future, by the risk of accident associated with them? If yes, please provide details and documents.
6. Please provide any existing data and statistics on fires, accidents, breakdowns in road tunnels in your country.

Armenia

1. There are no legislation or regulations on safety in road tunnels in our country. The rules of road traffic are applicable for tunnels, too.
2. --
3. --
4. There is no specific methodology for risk assessment and risk management for tunnels in our country.
5. Our country does not classify road tunnels and does not envisage to do so in the near future.
6. The only tunnel longer than 1000m in Armenia is Pushkin tunnel where no accidents, fires or breakdowns have been recorded up to date.

Austria

1. The regulations and recommendations concerning safety in road tunnels are RVS 9.234 interior constructions, RVS 9.261 ventilation, RVS 9.262 calculation of the fresh air demand, RVS 9.27 lighting, RVS 9.281 operating safety equipment, structural part, RVS 9.282 operating and safety equipment, electromechanical part, RVS 9.286 tunnelling radio and RVS 13.74 maintenance of tunnel equipment.
2. --
3. The recommendations on RVS 9.281 and RVS 9.282 were in part in revision and are now finished but not yet published.
4. RVS 9.261 contains a risk assessment, based on traffic volume, two- or one-way traffic, conflict points and the number of transports of dangerous goods.
5. In the new guidelines RVS 9.281 and RVS 9.282 safety equipment are based on the risk potential of the tunnels (see point 4).
6. Data on accidents and breakdowns in road tunnels are collected.

Belgium

Questionnaire has been sent to the 3 tunnel operators involved (>1000m).

Bosnia and Herzegovina

1. We have a relevant regulation.
2. --
3. Yes, it is necessary in accordance with European standards.
4. --
5. --
6. --

Croatia

1. Book of Regulations on Technical Standards and Conditions for Design and Construction of tunnels on roads (Official Gazette 59/73).
2. No, they are out of date.
3. Yes, a new book of regulations is being drafted.
4. No specific methodology.
5. No risk classification.
6. Two accidents in the Tuhobic tunnel caused by human factors (exhausted drivers).

Denmark

1. From the Nordic Road Association, there are 3 recommendations (transmitted to the ECE secretariat). In Denmark, there are no legislation, regulations and standards for tunnel design.
2. Yes.
3. No.
4. There are no general methodologies for risk assessment and risk management. Each tunnel is assessed individually.
5. No.
6. Apart from normal traffic accidents, there have been no fires, accidents or other severe accidents or breakdowns in tunnels on the State Road Network. There are in total 4 traffic tunnels in Denmark on the State Road Network, all considered to be minor tunnels (length < 550 m).

Germany

1. RABT 1994 : Richtlinie für die Ausstattung und den Betrieb von Straßentunneln, Forschungsgesellschaft für Straßen- und Verkehrswesen, Arbeitsgruppe Verkehrsführung und Verkehrssicherheit, Heft FGSV 339, Köln.
2. No. Amendments are made with respect to e.g.: smoke and fire control, emergency exits, better information and communication measures, tunnel barriers, emergency cabins, emergency lighting (see also appendices only in German).
3. Yes. Current proposals for a draft (see appendices only in German).
4. No. So far not.
5. No. So far not. It is envisaged to do so in the future.
6. The only available data are from 1975 to 1997 for the Elbtunnel in Hamburg (see appendices).

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Hungary

1. Traffic Law 1985 (about stop Prohibition); Road Standard (about Geometric Design) 1994.
2. Yes.
3. No.
4. No.
5. No.
6. No.

No accidents in tunnels, no tunnels longer than 1000 m.

Latvia

1. No.
2. No legislation, regulations or recommendations concerning safety in road tunnels.
3. No.

4. No.
5. No.
6. No.

No road tunnels.

Liechtenstein

1. There is no legislation dealing with safety in road tunnels. General regulations on road safety and road traffic, however are included in the "Road Traffic Act of 1978" and its amendments.
2. Yes, as there is only one tunnel on the territory of Liechtenstein. It is a single-tube tunnel of 750 meters length.
3. No.
4. A safety concept for the above-mentioned tunnel is in preparation. It includes the provision of hydrants, fire extinguishers, escape-signals, as well as a monitoring system.
5. No.
6. So far, no fires, accidents or breakdowns have occurred within the above-mentioned tunnel.

Lithuania

No road tunnels.

Malta

1. Malta does not have any regulations on the design and usage of road tunnels. German, UK design standards are currently being used as Guidelines for design purposes (relating to Geometry/Lighting/Ventilation), particularly Department of Transport "Design of Road Tunnels" - BD 78/99, Part 9, Vol. 2.
2. The above-mentioned guidelines do not give information on the geometrical design of tunnels where the design speed is less than 50 Kph.
3. N/a.
4. No.
5. No.

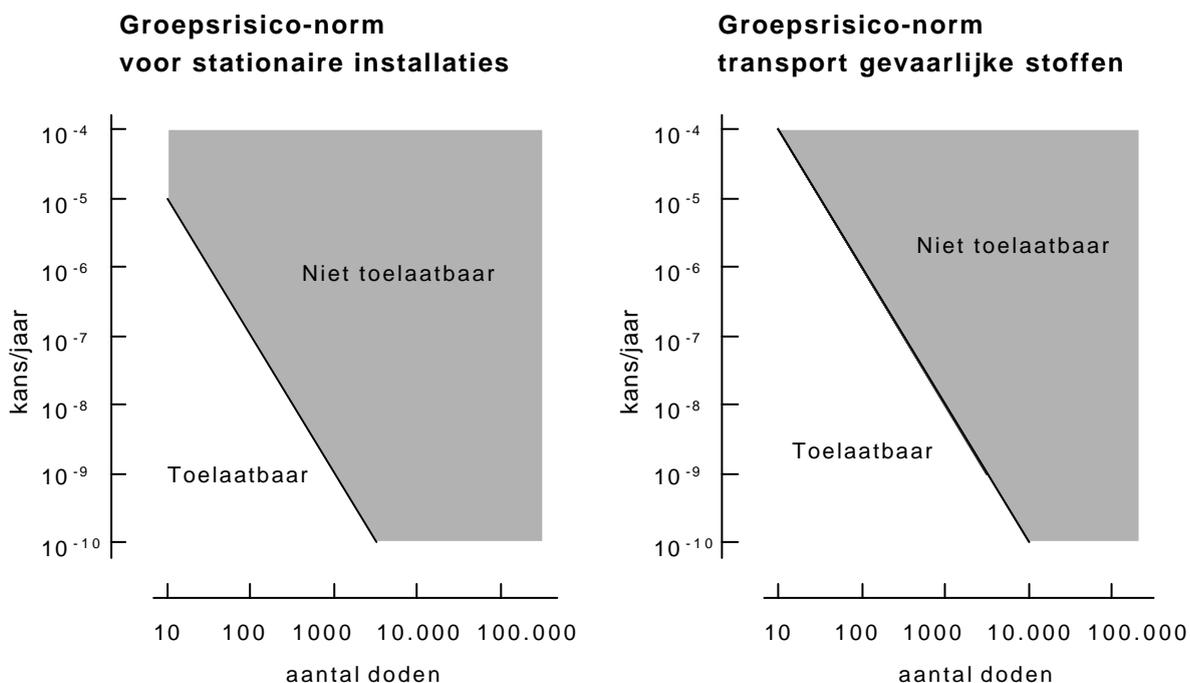
6. 4 towns (4 tunnels), 13 accidents: 6 simple, 5 injury, 1 fatal, 1 fire-related.

Monaco

Answer to Part B only.

Netherlands

1. There are technical standards for the provisions and installations in road tunnels of the immersed type. The English text is available. A project is under way to draft more general applicable principles for the safety of road tunnels. There are no recommendations on driver education and training. For many tunnels there are contingency plans.
2. In the guidelines for immersed tunnels a distance between emergency exits of 100 m is advised. These doors give access to an escape passageway in the middle of the tunnel. For bored tunnels this would be too expensive. Therefore criteria will have to be defined in which costs and safety criteria are balanced.
3. It is too early to provide the current drafts.
4. In a couple of projects probabilistic risk assessment methods have been applied to determine the level of safety for motorists in relation to the chances of heavy fires and explosions in tunnels. Also in one project some fire scenarios have been analysed and the distance between cross passages was determined on the base of this “deterministic” analysis. These methods are considered to play a role in the future approach to safety in tunnels. As examples of the possible probabilistic risk criteria the criteria for the group risk in the case of stationary installations and for the transport of dangerous goods are given below (diagram Netherlands Part A).



5. It is possible to prohibit the transport of dangerous goods through tunnels. Three categories of tunnels are discerned. Through category II tunnels no flammable hydrocarbons or explosive goods like PLG are allowed; through category I tunnels no explosive goods are allowed. Tunnels which are not identified as category II or I are open to all traffic. The decision whether a tunnel is category I or II is taken by the Minister of Transport after careful examination of the risks for people and infrastructure of alternatives and after deliberation with the local fire brigade and government/municipality.

6. The length of immersed tunnels in the Netherlands is confined (300 to 1500 m), but the ramps are steep (4.5%). The accident rate in which injuries occur vary from 0.07 to 0.25 per million vehicle kilometers. The average for motorways is 0.05 per million vehicle kilometers.

Norway

1. Yes there are different legislation, regulations and recommendations concerning safety and safety equipment. All publications are in Norwegian. All in all it probably amounts to more than 100 pages. This includes our tunnel design manual.

2. Yes they are probably sufficient but refinements are always needed.

3. Yes our design manuals are under revision.

4. We do have a special model for calculating emergency stops, accidents and fires.

5. We are classifying tunnels by AADT and length and will not change this.

6. We have sent a report. We are also, at this time, doing a similar study on incidents in the most recent years.

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See report "Studies on Norwegian Road Tunnels".

Poland

No road tunnels over 1000 m.

Portugal

1. No.
2. Yes.
3. No answer.
4. No.
5. No.
6. No data or statistics.

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Romania

Nine road tunnels less than 884 m.

Slovak Republic

1. Legislation and recommendations on road tunnel safety (geometry, infrastructure, equipment, signalling, operation, traffic, driver education and training, etc.) already had to be elaborated when the study for individual planned tunnels was processed. During the year 2000 some tasks were processed which became the base for further activities of employer, designer and contractor:

- Draft STN 73 7507 Design of tunnels of road communication
- Technical regulation: Technological equipment for road tunnels
- Regulation on technical outfit and road tunnel construction
- Regulation on operation and maintenance of road tunnels

At the present time, fire regulations are being prepared. Comprehensive materials and information are available in the Slovak language and can be provided.

2. We elaborated and processed the mentioned materials on the basis of foreign experiences, because our country has insufficient knowledge and experience in this field. We are trying to define the requirements in technical regulations (TR) in such a way that we can reach the European standard as soon as possible. Our country is working on motorway construction development in line with the government programme and it is trying to speed up its completion.

3. We can identify this question with the question No. 2. Just to complete it, groups of foreign experts with a lot of experience and good references are working in our country.

4. We cannot stipulate any specific methodology for risk assessment and risk management for tunnels in our country so far.

5. For the time being road tunnels in our country are classified according to foreign standards and regulations, which we are adjusting to our conditions. We are taking mainly the standards and regulations valid in Austria, Switzerland, Germany and the UK. There exists also close cooperation with Czech experts in this field, which is based mainly on the exchange of information in the given field, on the mutual cooperation of experts and on the help by project and contractor works.
6. We do not have any statistical data from this area: the reason is that for the time being there is no tunnel in operation as part of the motorway programme.

Spain

1. “Instrucción para el proyecto, construcción y explotación de obras subterráneas para el transporte terrestre (IOS-98)”
Manual for the design, construction and operation of tunnels
“Instrucción de Carreteras, Norma 3.1 IC – Trazado – “ (December 1999) refers to tunnels and especially to cross section and slopes.
“Instrucción de Carreteras, Norma 8.1 IC – Señalización vertical –“ (December 1999) refers to signalling at tunnel entries.
“Recomendaciones para la iluminación de carreteras y túneles” (1999)
Recommendations on road and tunnel lighting.
2. The existing texts are not sufficient at all. Infrastructure, safety requirements, operation management rules and measures to be carried out on existing tunnels are not considered. Ventilation and signalling are barely treated.
3. In spite of the existing worry, Spanish authorities are not considering immediate modifications to be applied in the near future. However, some individual works are being oriented to create different proposals.
4. No, there is no specific methodology.
5. At the moment, there is an inventory of the road tunnels belonging to the National Road Network. However, it does not include any information related to the risk of accident.
6. Collected statistical data on fires, accidents, etc do not exist.

Sweden

1. Legislation; Byggnadsverkslagen (Law on construction works), see appendix 1. In appendix 2 the revised parts of this law are listed.
Ordinance; Förordningen om tekniska egenskapskrav för byggnadsverk (ordinance on essential demands for construction works), see appendix 3. In appendix 4 the revised parts of this ordinance are listed.
Appendices 1-4 can also be found in full text at <http://www.riksdagen.se/debatt/sfsr/index.asp>.
Recommendations; General Technical Description for Road Tunnels, Tunnel 99 (internal regulations within the Swedish National Road Administration). The General Technical Description for Roads, VU94 (internal regulations within the Swedish National Road

Administration), contains some tunnel specific recommendations on geometry, equipment and signalling.

General information, see http://www.vv.se/for_lang/english/index.htm

Tunnel 99 in full text, see http://www.vv.se/publ_blank/bokhylla/ATB/tunnel/1999_138.pdf

VU94 in full text, see

http://www.vv.se/publ_blank/bokhylla/ATB/vagutformning/vu94/index.htm

No rules exist on driver education or training for road tunnels.

The National Board of Housing has supervisory responsibility for personal safety in road tunnels. The Swedish National Road Administration is responsible for the planning, construction, operation and maintenance of the state roads and that includes personal safety in their road tunnels.

General information, see <http://www.boverket.se/>

Regulations for buildings are published in BBR and BKR. These regulations were used by the Swedish National Road Administration when writing their internal regulations for road tunnels, Tunnel 99.

BBR in full text, see <http://www.boverket.se/novo/filelib/personal/antabe/bbrfulltext.pdf>

BKR in full text, see <http://www.boverket.se/novo/filelib/personal/hangus/bkr98ftext2.pdf>

2. The legislation is generally considered as sufficient. However there is lack of routines on the detailed design of construction works, exclusive of buildings, in order to comply with the existing legislation and regulations.

The Swedish National Road Administration is carrying out R&D activities and participating in several organisations in order to incorporate new knowledge into our regulations for road tunnels. The PIARC Committee on Road Tunnel Operation, UN/ECE, International Tunnelling Association and Nordic Road Association constitute important organisations for this work.

3. The National Board of Housing has put forward a proposal to create a national expert group for personal safety in road tunnels. The commission for this expert group will be to follow the planning of new tunnels, to support local authorities in their planning process and to produce background documents in order to make the planning procedures more efficient.

4. There is no specific methodology for risk assessment and risk management for road tunnels in Sweden. Internal rules within the Swedish National Road Administration state that risk analysis is mandatory for new tunnels. A guidance paper on methodology for risk assessment and risk management is under elaboration.

5. The Swedish National Road Administration is examining the results of the PIARC/OECD work on Transport of Dangerous Goods through road tunnels with the aim of incorporating these results for our road tunnels.

6. Fires. No fires have been reported on national roads. In the municipal tunnel Söderledstunneln in Stockholm a few fires in passenger cars have occurred. No personal injuries have been reported in these fires.

Accidents. All severe accidents that are reported to the police are registered in a national database. Only one fatality has been reported, a motorcyclist in the Muskö tunnel.

14 accidents with severe personal injuries have been reported.
In motorway tunnels almost 50% of all accidents are head to tail accidents.
Breakdowns are not registered.

United Kingdom

1. Covered in documents BD78 and BD53. Privately owned tunnels are covered by Acts of Parliament.
2. Yes.
3. Not at present.
4. Yes as described in BD78.
5. No.
6. Not available.

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