Association mondiale de la Route
AIPCR
PIARC
World Road Association

OECD
OCDE

OECD/PIARC

ERS2 "TRANSPORT OF DANGEROUS GOODS THROUGH ROAD TUNNELS"

TECHNICAL REPORTS

ON

CURRENT NATIONAL AND INTERNATIONAL REGULATIONS

PREPARED BY DET NORSKE VERITAS (DNV)

DNV
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ERS2 "TRANSPORT OF DANGEROUS GOODS THROUGH ROAD TUNNELS"

TECHNICAL REPORT OF

MISSION 1

DNV
DET NORSKE VERITAS

Abstract

This task was conducted by Det Norske Veritas (DNV) on behalf of the OECD and PIARC

OECD and PIARC initiated a joint venture research project on the transport of dangerous goods through road tunnels. The overall objectives of the joint project were:

- to improve the overall safety of the transport of dangerous goods by road;
- to facilitate the organisation of such transport in order to prevent unnecessary costs, and promote economic development.

The project is divided into four different tasks. The first of these four tasks had the objective to review current national and international regulations. It was divided into two parts, Missions 1 and 2 of which DNV was engaged to perform Mission 1.

In January 1996, the OECD issued a questionnaire to 68 recipients in 24 countries and answers were requested by 1 April 1996. During Mission 1, the information in the received questionnaires was systemised and the need for further work had to be identified. The results from this work is documented in this report.

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1. SUMMARY

The OECD and PIARC have initiated a joint venture research project on the transport of dangerous goods through road tunnels. One of the tasks of this project has as its objective to review current national and international regulations. It has been divided into two parts, Missions 1 and 2. DNV was hired to perform Mission 1: to systemise the information collected in questionnaires submitted to 24 countries, clarify answers, and give recommendations for further analysis work during Mission 2.

The rate of return on a country basis is satisfactory. A total of 22 countries returned their completed questionnaires. One of the countries does not have any road tunnels, so that the analysis is based on the answers from 21 countries.

The rules and regulations for the transport of dangerous goods in tunnels vary considerably among countries and within countries. Most countries have no general rules and regulations for the transport of dangerous goods in tunnels, but rules and regulations applying to specific tunnels have been devised in a number of countries. Rules and regulations are frequently defined and enforced for tunnels with special characteristics such as under water crossing, urban location, high traffic density or age.

In Europe, the ADR or codes based on the ADR are commonly used for defining the transport of dangerous goods by road. Most states in the United States and provinces in Canada follow codes in compliance with the UN Orange Book. Australia and Japan have their own codes for defining dangerous goods.

Often countries and/or regions with few tunnels have more and stricter rules and regulations for the transport of dangerous goods in tunnels, than tunnel-rich countries. The Netherlands and the Flemish region of Belgium have strict regulations on all or some dangerous substances, whereas the two countries with the most important road tunnels, Norway and Italy, have a few or no restriction.

Two accidents in road tunnels involving dangerous goods were revealed in the responses to the questionnaires. Due to the wording of the questions it is not possible to assess how many countries have implemented a system for recording accidents involving dangerous goods. Details about such systems should be investigated during Mission 2.

2. INTRODUCTION

2.1 Background and overall objectives of the ERS2 project

The OECD and PIARC have initiated a joint venture research project on the transport of dangerous goods through road tunnels. The overall objectives of the joint project are:

- to improve the overall safety of the transport of dangerous goods by road
- to facilitate the organisation of such transport in order to prevent unnecessary costs, and promote economic development

The project has been divided into four tasks:

Task 1: Review of current national and international regulations
Task 2: Methodologies relating to risk assessment and decision process
Task 3: Risk-reducing measures
Task 4: Conclusions and recommendations

The objective of Task 1 is to review current national and international regulations. It has been divided into two parts, Missions 1 and 2. DNV has been hired to perform Mission 1 of Task 1.

2.2 Scope of work for Task 1- Mission 1

In January 1996, a questionnaire was submitted to 24 countries. Answers were requested by 1 April 1996. The information in the responses was to be systematised, and the need for further work shall be identified.

More specifically the following topics were to be covered:

- compile and analyse the received questionnaires
- contact the respondents for additional information or for clarification about the answers
- preparation of an interim report containing recommendations on additional work to be performed in Mission 2, if such work should be necessary to obtain reliable and comprehensive data

To facilitate data analysis, a database was to be developed.

2.3 Work undertaken

A total of 68 questionnaires was submitted to 24 countries by the OECD. Of these, 46 questionnaires from 21 countries were answered and returned to the OECD. The addressees of the remaining 22 questionnaires were sent a reminder letter from DNV on 27 September 1996.

By 1 November, one of the 22 addressees had returned the questionnaire to DNV. In addition, one questionnaire was filled out and returned from one informant not on the initial list. Hence, the analysis is based on 48 questionnaires from 22 countries (Greece and Luxembourg are the only countries that did not returned any questionnaires). Two respondents indicated the absence of any public road tunnels in their country/state: Ireland and the State of Connecticut (United States).

INTRODUCTION

The information in the questionnaires was entered into a Microsoft “ACCESS” database. Throughout the process of entering the information, some respondents were contacted by telephone, fax or mail, for clarification of their answers.

Statistics were prepared for the various answers. In addition, the practice and application of rules and regulations in each country was commented upon. Unclear and/or still missing information was highlighted, and this information should be gathered throughout Mission 2 of the project.

The output of Mission 1 is this report, the database on the questionnaire contents, and the systematised archive referred to in the database.

3. SUMMARY OF QUESTIONNAIRE INFORMATION FOR INDIVIDUAL COUNTRIES

In this chapter, a summary of the information submitted in the questionnaires is given per country. In section 3.21, some issues covered by the rules and regulations with regard to the transport of dangerous goods in tunnels is summarised for the various countries.

3.1 Australia

There are no general road traffic regulations specific to road tunnels in Australia. In the Australian Code for the Transport of Dangerous Goods by Road and Rail, there is a general paragraph stating that drivers of vehicles carrying dangerous goods shall, as far as practicable, choose routes without tunnels.

Dangerous goods in road transport are defined by using the Australian Code for the Transport of Dangerous Goods by Road and Rail.

Further rules concerning the transport of dangerous goods in tunnels may be devised by the various state authorities. For Queensland, there exists a list of tunnels for which there are specific restrictions for the transport of dangerous goods. In Western Australia, there is at present no road tunnel, but one is being designed in Perth for which detailed procedures and requirements are being developed.

3.2 Austria

There are no general road traffic regulations specific to road tunnels in Austria, but the transport of dangerous goods through road tunnels longer than 1 000 m is regulated through “Der Straßentunnelverordnung”. Dangerous goods are defined according to the ADR Convention.

In addition to the general rules that apply to all types of dangerous goods traffic through tunnels, there are specific rules requiring escort vehicles to be used for the transport of certain types of dangerous goods in tunnels longer than 5 000 m.

3.3 Belgium

Both the national Ministry of Transport and the regional authorities in the Belgium regions of Flanders and Walloon, are responsible for specifying rules for the transport of dangerous goods on roads. There are, however, no general rules for the transport of dangerous goods in road tunnels; generally the same rules apply as outside of tunnels apply.

In the Flanders region there is one tunnel, the Zelzate tunnel, in which no dangerous goods are allowed.

The ADR Convention is used for defining dangerous goods in all the regions.

3.4 Czech Republic

In the Czech Republic, there are neither general road traffic regulations specific to road tunnels, nor specific rules for the transport of dangerous goods in road tunnels. Dangerous goods on the roads are defined by using the ADR Convention.

3.5 Denmark

In Denmark, there are neither general road traffic regulations specific to road tunnels, nor specific rules for the transport of dangerous goods in road tunnels. The local police may put restrictions on the transport of dangerous goods on given routes.

For the relatively long road tunnels presently being designed or constructed, numerous technical and operational measures have been implemented to permit the transport of dangerous goods through road tunnels. Risk assessment, general practice, and the availability of alternative routes, influence the choice of measures.

Dangerous goods on the roads are defined by using the ADR Convention.

3.6 Finland

On the public roads in Finland, there are only four tunnels ranging from 50 to 325 meters. Hence, neither general road traffic regulations specific to road tunnels, nor specific rules for the transport of dangerous goods through road tunnels exist. Dangerous goods are defined according to the ADR Convention.

3.7 France

The road tunnels in France add up to a total of 180 km. There are no general road traffic regulations specific to road tunnels, and no general rules exist for the transport of dangerous goods in all road tunnels throughout the country. However, special rules are developed for each single tunnel and for groups of tunnels. Transport of dangerous goods through tunnels located in the national road network, is regulated through "*Circulaire No. 76-44 du 12 mars 1976 - relative à la réglementation de la circulation dans les tunnels des véhicules routiers transportant des matières dangereuses*". Generally, in most of the urban tunnels transport of dangerous goods is banned. Since vehicles transporting dangerous goods are to be authorised at each tunnel, they are subject to conditions set out in this regulation, e.g.

- limited access during rush hours (determined for each tunnel as a function of volume of traffic)
- speed limit between 40 and 60 km/h (fixed for each tunnel)
- distance to other vehicles (200 m is the minimum limit for the Mont Blanc tunnel)
- in tunnels with two-way traffic and with heavy traffic, the transport may require police escort, in some cases, the traffic may be stopped.

At the national level, the definition of dangerous goods in road transport is given in "*Règlement pour le Transport des Matières Dangereuses par Route (RTMDR)*", which was issued on 12 December 1994. This text will be totally aligned with the ADR Convention on 1 January 1997. In order to permit transport of dangerous goods through the road tunnels, measures are taken in tunnel design and management, e.g.:

- additional ventilation equipment
- incident detection systems
- dangerous goods vehicle convoys
- emergency exercises.

The current rules for each tunnel with respect to the transport of dangerous goods, are advertised at the tunnels to inform the transport operators.

For the Alpine/border tunnels given below only the ADR is applied:

- Mont Blanc (France-Italy)
- Fréjus (France-Italy)
- Giraude (France-Italy)
- Tende (France-Italy)
- Aragnouet-Bielsa (France-Spain)
- Rainier III (France-Monaco).

For the last, the transport of dangerous goods is totally forbidden.

A complete list of all French road tunnels with length exceeding 800 m was prepared by CETU (April 1996) showing tunnel characteristics and conditions with respect to the transport of dangerous goods. This document is included in the archive (ref. Chapter 6 of this report) established in this project. The regulations developed for the Mont Blanc, Fréjus, Chamoise, Vuache and Chat tunnels may be considered as the most representative ones for France.

Mont Blanc and Fréjus tunnels

On the French side of both tunnels, each vehicle with an orange sign indicating transport of dangerous goods is controlled by French customs. For the Fréjus tunnel, these vehicles are directed into specific lanes where the cargo is controlled. After this control, the vehicle is given authorisation to drive through the tunnel with or without police escort. The custom officers in charge of the control transmit to the Italian side (by fax) the vehicle's licence plate number, the product number, the ADR class, nationality, packing, and time of control. Also, time of transit and the names of French and Italian officers who may escort the vehicle. On the Italian side, the police communicate the given information by telephone to the control post.

Traffic regulations are specially developed for each of these two tunnels:

- "*Règlement de circulation du tunnel routier du Fréjus*" of 31 December 1992 (modified 8 June 1994). In an appendix, the transport of dangerous goods is outlined in detail.
- "*Règlement de la circulation routière dans le tunnel sous le Mont Blanc*" , Arrêté préfectoral No. 95-1247 of 3 July 1995. In an appendix, the transport of dangerous goods is outlined in detail.

Both of these documents are found in the above-mentioned archive, and hence not included in this report.

3.8 Germany

In Germany, there are no general traffic regulations specific to road tunnels. On some highways, which may include tunnels, the transport of certain types of dangerous goods is restricted or totally prohibited. Rules for transporting dangerous goods through tunnels are specified both by

the Federal Ministry of Transport and regional authorities, and the rules thus differ between the regions.

The development of the rules for each tunnel is, according to the *RABT (Richlinien für die Ausstattung und den Betrieb von Straßentunneln*), based on risk assessment. There is a list of the various tunnels where the special conditions with regard to the transport of dangerous goods are indicated (*Regelungen zum "Transport gefährlicher Güter*"). Often, permission to transport certain types of dangerous goods is restricted to off-peak periods.

According to the German reply to the questionnaire, the only general measure taken in tunnel design and management to cater for the transport of dangerous goods, is the design and implementation of a slot gutter. This is in contradiction with the information found in the report from the PIARC Montreal meeting of September 1995. The topic needs to be further investigated during Mission 2 of the project. Dangerous goods on roads in Germany are defined by the German regulation "*Gefahrgutverordnung Straße-GGVS § 2*" which is based on and similar to the ADR Convention.

3.9 Italy

Italy has highway tunnels which total 600 km. There are no specific rules for the transport of dangerous goods through road tunnels. Furthermore, there are no general road traffic regulations specific to road tunnels: the same rules apply as for traffic outside the tunnels. However, according to Article 366 in the"*Roadway Code*" (CDR, regulation of 1992), the Ministry of Public Works together with the Ministry of Transport may impose limitations with respect to traffic in tunnels and over bridges. Accordingly, with reference to Article 168 in CDR the Ministry of Transport together with the Ministries of Interior, Industry, Commerce and Health may establish further classifications of dangerous goods relative to the ADR Convention. The extent and details of the last two items are not documented in the questionnaire replies and should be clarified in Mission 2. Enforcement of current rules and regulations is the responsibility of the Police and the tunnel operator. In order to permit transport of dangerous goods through the road tunnels, measures are taken in tunnel design and management with respect to the following:

- additional ventilation equipment
- incident detection systems
- use of TV cameras for traffic control

The above is valid for the Italian road tunnels in general, but for the Alpine/border tunnels Mont Blanc (Italy-France), Fréjus (Italy-France) and Grand Saint Bernard (Italy-Switzerland), specific rules are developed for both regulation of traffic and transport of dangerous goods. The first two of these tunnels are treated separately in section 3.7 . Please refer to section 3.15 for the Grand Saint Bernard tunnel.

3.10 The Netherlands

In the Netherlands, there are both general road traffic regulations specific to tunnels, and specific rules for the transport of dangerous goods in tunnels. In most municipal tunnels in the Netherlands, the transport of dangerous goods is forbidden. The highway and urban tunnels are categorised into three types based on risk assessment:

- tunnels without any restrictions
- category I: restrictions on potentially explosive substances
- category II: restrictions on flammable explosive substances.

A total of 14 tunnels are classified into category I or II.

Specific technical measures are taken in tunnels according to the type of dangerous goods transport permitted. Typical measures are: additional fire resistance, additional ventilation, incident detection systems, and tunnel-specific measures aimed at preventing and limiting the risk of explosion.

The ADR Convention is used for defining dangerous goods.

3.11 Norway

Norway has 691 road tunnels with a total length of 575 km. The tunnels vary considerably, from low-traffic bi-directional tunnels without any technical installations in remote regions, to modern two-tube tunnels with dense traffic in urban areas.

In Norway, there are no general road traffic regulations specific to road tunnels, but there are specific rules for the transport of dangerous goods through certain tunnels. Even if the national Department of Transport is responsible for specifying the rules, the rules differ between the regions. This is probably due to the fact that both geographically and demographically Norway's various regions vary considerably.

For the very few tunnels in Norway having restrictions on the transport of dangerous goods, the most common restriction is to prohibit the transport of certain dangerous goods at certain periods of the day. The tunnels in the Oslo region with high traffic density prohibit the transport of dangerous goods during peak hours, but the regulation is not strictly adhered. The regulation is not advertised at the tunnels.

It is mandatory to report all accidents involving dangerous goods to a governmental body, the Directorate for Fire and Explosion Prevention. So far, no such accidents have been reported in road tunnels.

General experience combined with the availability of alternative routes have determined the definition of rules for transporting dangerous goods through road tunnels. Until recently, the same factors have also determined the choice of safety measures, but risk assessments are now occasionally used in the design and implementation of technical and organisational safety and emergency preparedness measures.

Dangerous goods in road transport are defined according to the ADR Convention.

3.12 Portugal

Portugal has neither general road traffic regulations specific to road tunnels nor specific rules for the transport of dangerous goods through tunnels. However, in urban areas, the local authorities may impose the prohibition of such transport. Dangerous goods in road transport are defined by using the ADR Convention and in accordance with "RPE", a national legislation similar to the ADR Convention.

3.13 Spain

In Spain, there exist general road traffic regulations specific to road tunnels, and specific rules for the transport of dangerous goods through tunnels with a certain volume of traffic. Dangerous goods in road transport are defined by using the ADR Convention and the rules are specified by the Ministry of Interior - Directorate of Road Traffic.

3.14 Sweden

Sweden has relatively few road tunnels in operation, but a few large tunnels with a fairly high traffic density are presently under construction. There are no general road traffic regulations specific to road tunnels, but there are specific rules for transporting dangerous goods through some of the tunnels. The specific rules for tunnels are defined by the local municipality or county. For this reason, there are different rules in different national regions.

Three road tunnels have restrictions on the transport of dangerous goods. The restrictions are a combination of prohibition of certain types of dangerous goods and curfews.

The rules regarding the transport of dangerous goods in road tunnels are determined by considering several aspects. Risk assessment combined with general experience is used as a tool. The availability of alternative routes as well as the proximity to and efficiency of the rescue organisation are also considered.

For a few years, it has been mandatory to report all accidents involving dangerous goods to the Swedish Rescue Services Board. So far no such accidents have been reported for road tunnels.

3.15 Switzerland

Switzerland has a total of some 140 km road tunnels. There are general road traffic regulations specific to road tunnels which are detailed in:

(i) Road Traffic Regulation of 13 November 1962 (“RS 741.11”), Article 5

(ii) Federal law on Road Traffic of 19 December 1958

Furthermore, there are specific rules for transporting dangerous goods through road tunnels in “Regulation of Road Transport of Dangerous Goods” (SDR) of 24 May 1972, Article 23 entitled “*Liste de tronçons de route pour lesquels sont prescrites des limitations de passage avec certaines marchandises dangereuses*”. This regulation is developed on the basis of the ADR Convention. The article gives a list of tunnels (“margin” 280100) and the types and quantities for which transport of dangerous goods through these tunnels are either free, only with authorisation, or totally forbidden (“margin” 280150 and 280151). “Margin” 280151 was specially developed for the Saint-Gothard tunnel.

From “margin” 280100, the following list of tunnels with restrictions is given.

Name of tunnel (name, road no[1]., cantons)	Regulation(s)
Seelisberg (N2 Stans-Flüelen, NW-UR)	Marg. 280150[2]
Costoni di Feud (N2 Col du St. Gothard-Airolo, TI)	Marg. 280150[2]
Kerenzer (N3 Wesen-Murg, GL)	Marg. 280150[2]
St. Gothard (N2 Göschenen-Airolo, UR-TI)	Marg. 280151
Rongellen II (N13 Thusis-San Bernardino, GR)	Marg. 280150
Via Mala (N13 Thusis-San Bernardino, GR)	Marg. 280150
Bärenburg (N13 Thusis-San Bernardino, GR)	Marg. 280150
Rofla (N13 Thusis-San Bernardino, GR)	Marg. 280150
San Bernardino (N13 Thusis-Tessin, GR)	Marg. 280150
Great St. Bernard (RC Martigny-Aoste, VS, Switzerland.-Italy)	Marg. 280150
Solis (RC Thusis-Tiefencastel, GR)	Marg. 280150
Alvaschein (RC Thusis-Tiefencastel, GR)	Marg. 280150
Landwasser (RC Tiefencastel-Davos, GR)	Marg. 280150

1): N = National Road, RC= “Cantonal” Road

2): It is forbidden to transport the quantities of dangerous goods exceeding those indicated in the last column entitled "Interdit en quantité supérieure à"(“prohibited in quantities greater than”) of Table 280150 of the Swiss regulations on the transport of dangerous goods (SDR) (ref. archive), on the following days:
* On Saturdays and Sundays
* Holidays mentioned in RS 741.11 "Rules for Road Traffic" (OCR), regulation of 13 November 1962, article 91, § 1
* Monday-Friday 1700-0700 hrs

In order to permit the transport of dangerous goods through the road tunnels, measures are taken in tunnel design and management with respect to proper ventilation equipment and drainage.

3.16 Turkey

Turkey has approximately 60 highway tunnels, with a total length of 10.6 km. Only five tunnels are longer than 300 m, and the longest is 1 700 m. There are some general road traffic regulations specific to road tunnels, e.g. specifying the use of headlights and prohibition of overtaking. Concerning the transport of dangerous goods, no specific rules for road tunnels exist, and the same regulations as for the rest of the highway network apply.

The two replies received from Turkey give contradictory information on the issue of whether additional measures are taken to permit the transport of dangerous goods through road tunnels. Clarifications is left for Mission 2.

Dangerous goods are defined by a Turkish regulation, which is based on the ADR.

3.17 United Kingdom

In the United Kingdom, there are approximately 30 road tunnels with a total length of 27 km. The tunnels have been constructed over a century and the construction standards vary correspondingly.

There are no general road traffic regulations specific to road tunnels in the United Kingdom. There are however specific rules for the transport of dangerous goods through some road tunnels. The three UK toll tunnels, Dartford, Mersey and Tyne, have developed a common policy and implemented restrictions on the transport of dangerous goods. Also, for some other tunnels rules

exist, which vary according to the age and type of the tunnel, and the traffic volume. Modern tunnels built during the last 20 years operate without any restrictions on the transport of dangerous goods.

To the extent that rules for the transport of dangerous goods in tunnels exist, they are based on risk assessment, general experience and advice from consultants. Specific measures are taken for some of the tunnels to permit the transport of dangerous goods, e.g. escort/convoys and emergency exercises.

In the United Kingdom, dangerous goods in road transport have until now been defined by using the UN Orange Book. From 1 September 1996 dangerous goods are defined according to the ADR.

There have not been registered incidents involving dangerous goods in UK road tunnels.

One questionnaire was received from Ireland, which does not have road tunnels.

3.18 Japan

Japan has neither general road traffic regulations specific to road tunnels, nor general rules applying to the transport of dangerous goods through all road tunnels. Specific rules for the transport of dangerous goods do exist for some road tunnels.

Dangerous goods in road transport is in Japan defined by the Laws of the Road. The Law specifies that the road operator can prohibit or restrict the transport of dangerous goods through specific road tunnels, if the risk for the tunnel structure and the traffic is deemed unacceptable. Specific tunnels means: tunnels crossing under water, tunnels with entrances close to the seaboard, and tunnels longer than 5 000 m. Japan has 22 tunnels of these types.

Information on incidents involving dangerous goods is systematically collected by the Institute for Traffic Accident Research and Data Analysis. One accident was reported: an ether fire on 11 July 1979 in the Nihonzaka Tunnel which exposed/involved 189 other vehicles.

3.19 United States

Dangerous goods transport by road in the United States are regulated by federal laws in addition to laws specific to each state. Dangerous goods in road transport are defined by using the US code of Federal Regulations, but some states use their own classification as well.

California

California has altogether 90 tunnels under state administration in addition to other tunnels under city or county administration. General road traffic regulations specific to road tunnels are given in the State of California Vehicle Code. The Code contains rules for the transport of dangerous goods in general as well as through tunnels. The Caldecott tunnel is the only tunnel that has specific restrictions, and all explosives, flammable liquids, LPGs and toxic gases are banned in this tunnel outside of the period 3:00 a.m. to 5:00 a.m.

Rules for the transport of dangerous goods in tunnels are devised based on general risk assessment and the risk for traffic congestion. In new tunnels, specific technical measures are taken to mitigate the consequences of accidents involving dangerous goods, including such

measures as additional fire resistance, additional ventilation equipment and incident detection systems.

All accidents in tunnels are being recorded. One accident involving dangerous goods has occurred; in April 1982, a fuel tanker capsised and the leaking fuel ignited in the Caldecott tunnel resulting in 7 fatalities.

Illinois

According to the questionnaire reply, there are general rules applying to the transport of dangerous goods through all road tunnels, as well as specific rules for some road tunnels. No further information as to the nature and extent of the rules and regulations is given, and it was not possible to reach the respondent. Further investigations are left to Mission 2.

Maryland

State of Maryland laws and regulations contain general road traffic regulations specific to road tunnels. Maryland laws also specify which types of dangerous goods are allowed for road tunnels in general. In addition, particular rules are given for the Baltimore Harbour Tunnel Thruway and the Fort McHenry Tunnel.

North Carolina

There are three tunnels, each approximately 300 m long, under jurisdiction of the North Carolina Department of Transport. There are neither general road traffic regulations specific to road tunnels in the State, nor specific rules for the transport of dangerous goods in road tunnels.

New York and New Jersey

General State road traffic regulations specific to road tunnels as well as general state rules for the transport of dangerous goods exist. The Holland and Lincoln tunnels have additional regulations for the transport of dangerous goods.

3.20 Canada

Of the ten provinces and two territories of Canada, three provinces have road tunnels.

Province of Ontario

Dangerous goods in road transport are defined by the Federal Transportation Regulations which have been adopted at the provincial level. The Federal Regulations are based largely upon the UN Orange book.

In general, there are no restrictions on the transport of dangerous goods through tunnels, except for the private Windsor/Detroit tunnel between Canada and the United States, where dangerous goods are totally banned.

Province of Quebec

Dangerous goods are defined in provincial codes based on the UN Orange Book. Generally, there are no restrictions on the transport of dangerous goods in tunnels. However, in the tunnels Louis-Hippolyte-Lafontaine, Joseph-Samson and in the tunnel sections of the Ville-Marie autoroute, only small quantities of dangerous goods are allowed.

Province of British Columbia

Dangerous goods are defined in the British Columbia Highways Act Regulations. No specific dangerous goods regulation applies to tunnels, but restrictions are put on the transport of dangerous goods in the George Massey Tunnel and the Casslar Connector Tunnel where only small quantities of dangerous goods are allowed.

3.21 Overview of rules and regulations

In Table 3-1 some issues covered by the rules and regulations with regard to the transport of dangerous goods in tunnels have been summarised for the various countries. An 'x' means that the rule or measure has been incorporated in one or more specific tunnels, whereas an **'X'** (bold) indicates issues that are valid for all road tunnels in the country.

Table 3-1 Overview of some issues covered by rules and regulations in the various countries

Country	Total banning of d.g. in some tunnels	Banning of some substances	Curfew of d.g. transp. in some tunnels	Escort vehicles	Convoys	Warning lights on vehicles	Special tech. installations	Rules announced at entrance 1)	Comment
Australia		x					x		
Austria				x		x		**X**	
Belgium	x							**X**	Only Zelzate tunnel
Canada	x	x						**X**	
Czech Republic									
Denmark							x	**X**	
Finland									
France	x			x	x		x	**X**	
Germany		x	x				x	**X**	
Italy	x						x	x	
Japan		x	x					**X**	
The Netherlands	x	x					x		
Norway			x*				x		*) Oslo area
Portugal							x	**X**	Further invest. Mission 2
Spain							x		Further invest. Mission 2
Sweden		x	x				x	x	
Switzerland	x	x	x				x	**X**	
Turkey									
United Kingdom	x			x	x		x	**X**	
United States		x	x				x		
Hungary									

1) Special technical installations aimed at normal traffic accidents

4. ANALYSIS OF QUESTIONNAIRES

The questionnaire issued requires response to both general and tunnel-specific questions: general: questions 2-7B, 9-11, and 14-16; tunnel-specific: questions 8, 12-13, and 14 A (8 and 14A are not questions, but items of information). In sections 4.1 - 4.13, the answers to the general questions in the 45 submitted replies from 21 different countries are summarised per question. The number of actual answers are given per alternative and in percentage of total. For some of the questions, several alternatives may be chosen, and hence the number of answers related to these questions may exceed the number of replies submitted.

In sections 4.15 - 4.18, the tunnel-specific information received is summarised per question.

The information contained in the submitted replies is recorded in a database specially developed for the project (see Chapter 5). Each reply to the questionnaire was given a unique identification number. Note that question No. 1 is omitted in this presentation and in the database. Further detail on some of the questions in the replies can be found in the database and is not outlined in this report.

4.1 Definition of road tunnel, question 2

Is a "ROAD TUNNEL" defined in your country? (*Quelle est la définition de "TUNNEL ROUTIER" dans votre pays?)*

Alternatives:

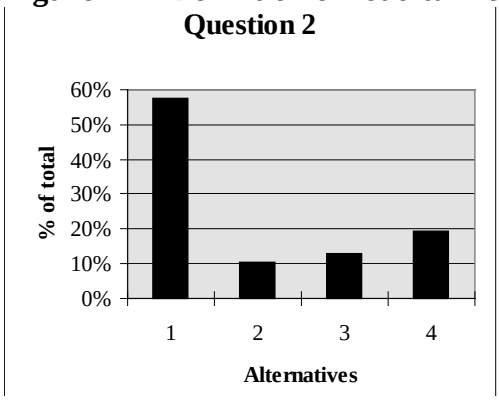
1. Not defined (*Pas de définition*)
2. Anything underground (*N'importe quel souterrain*)
3. By length (*Longueur*)
4. Other (*Autre*)

The answers received are distributed as shown in Figure 4-1 below.

(No alternative given in 2 replies to the questionnaire)

From the answers it can be concluded that, in general, the term "road tunnel" is not very well defined in the participating countries. Where definitions do exist, there is no common definition that is used in most countries.

Figure 4-1 Definition of road tunnel



For alternative 4, answers are summarised below:

- National Road Administration: Tunnel is a passage, surrounded by rock, earth or water and which leads to the open air or which joins spaces and ground with each other or the open air. (***Sweden***)
- Area-to-length ratio (***United States***)
- Road tunnel is defined as a part of the road structure definition (***Turkey***)
- The definition "Road Tunnel" varies with the type and location of the tunnel. The regulations retain different criteria according to the field of application. (***France***)
- Road tunnel is defined in the standard CSN "Design of Highway Tunnels" as follows: A linear underground structure housing a highway, motorway or urban road, located in a rocky massif or water environment, designed to enable safe and smooth movement of vehicles crossing mountain chains, water barriers, built-up zones or areas of special cultural, historical or other interest. (***Czech Republic***)
- Tunnel is defined as one of the road structures (***Turkey***)
- Drilled underground passage constituting a caisson in an excavation in the ground (***Canada***)
- Tunnels crossing a mountain, road or highway tunnels, artificial tunnels (***Italy***)
- No road tunnels currently exist in West Australia. However, a project in Perth (the "City Northern Bypass") which includes a 1.6 km tunnel, will commence in June 1996 with completion in June 2000. (***Australia***)

4.2 Road traffic regulations for tunnels, question 3

Are there general road traffic regulations specific to road tunnels? (*Existe-t-il des règles de circulation spécifiques aux tunnels routiers?*)

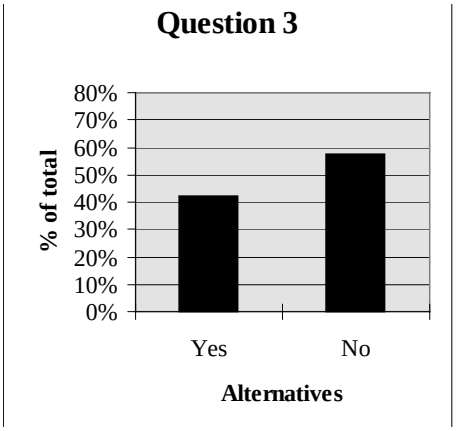
Alternatives and percentage distribution of answers:

Yes (*Oui*): 42%

No (*Non*): 58%

The answers received are distributed as shown in Figure 4-2 below.

Figure 4-2 Road traffic regulations for tunnels



4.3 Specific rules for transport of dangerous goods in tunnels, question 4

Are there specific rules for the transport of dangerous goods in road tunnels in your country? (*Existe-t-il des règles pour le transport de marchandises dangereuses dans les tunnels routiers dans votre pays?*). Alternatives and percentage distribution of answers are given below:

Yes (*Oui*) 60%

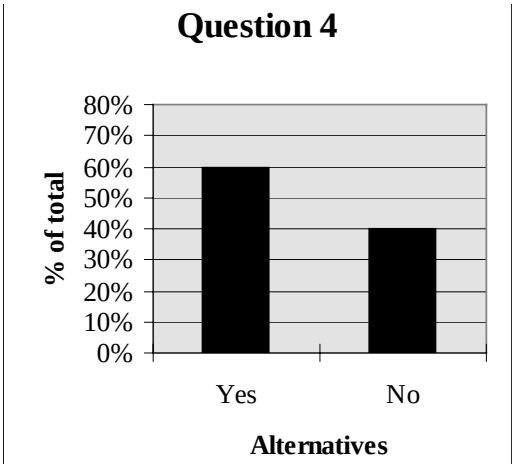
No (*Non*) 40%

The answers received are distributed as shown in Figure 4-3 below.

Comment to question 4:

In some questionnaires it seems that the respondent misinterpreted the question. In view of the answers given to question 7 and to avoid confusion, the question should have read: "Are there specific rules for the transport of d.g. in specific road tunnels.....?"

Figure 4-3 Specific rules for transport of dangerous goods in tunnels



4.4 Rules and regulations for defining dangerous goods, question 5

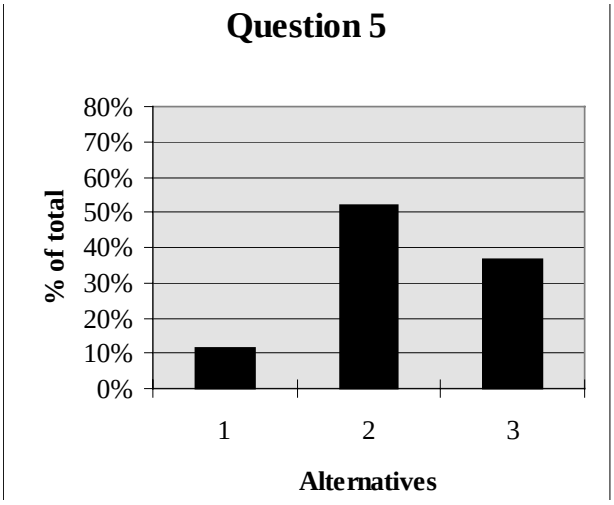
Do you define dangerous goods in road transport by using: (*Quelle est l'origine de la définition dans votre pays des marchandises dangereuses transportées par route?)*

Alternatives:

1. UN Recommendations on the Transport of Dangerous Goods, "Orange Book" (*Recommandation de l'ONU relatives au transport de marchandises dangereuses, le "Livre Orange")*
2. The European Agreement on the Transport of Dangerous Goods by Road, "ADR" (*Accord européen relatif au transport international des marchandises dangereuses par route, "ADR"*)
3. Other classification (Autre)

The answers received indicate that ADR is the dominating regulation in Europe whereas the situation is more complex outside Europe. On a percentage basis the answers are distributed as shown in Figure 4-4 overleaf.

Figure 4-4 Rules and regulations for defining dangerous goods



For alternative 3, answers are summarised below

- State and Federal laws (***United States***)
- Federal Transportation of Dangerous Goods regulations as well as US CFR 49 regulations that are largely based upon the "Orange Book". (***United States***)
- US "Code of Federal Regulations", section 49, parts 100-180 (***United States***)
- "The Regulation on the Transport of Dangerous Goods" (***Turkey***)
- According to the French "Règlement pour le transport des matières dangereuses par route", 12 Dec. 1994 (referred to as RTMDR 95). This regulation is revised 1 January 1997 so as to be in line with the ADR. (***France***)
- Applying law of road. (***Japan***)
- RPE - national legislation similar to ADR (***Portugal***)
- Federal transportation of dangerous goods regulations which have been adopted at the provincial level. The federal regulations are based largely upon the "Orange Book" (***Canada***)
- Defined in British Columbia Highways Act Regulations (***Canada***)
- Australian Dangerous Goods Code and State legislation (***Australia***)
- Definitions given in the "Dartford-Thurrock Crossing Regulations" (1994&1995), ref. archive. This regulation refers to List of Restrictions on Dangerous Goods set out in booklet "Dangerous Traffic" (ref. archive) (***UK***)
- Dangerous goods regulation Strasse-GGVS § 2 section 11 of ADR (ref. archive, Anlage 1) (***Germany***)
- According to the CDR regulation (art. 366, 16.12.92), further classifications may be established regarding dangerous goods. (***Italy***)

4.5 Responsible body for specifying the rules, question 6

What body is responsible for specifying the rules for the transport of dangerous goods through road tunnels? (*Quel est l'organe responsable pour déterminer les règles pour le transport de marchandises dangereuses dans les tunnels routièrs?)*

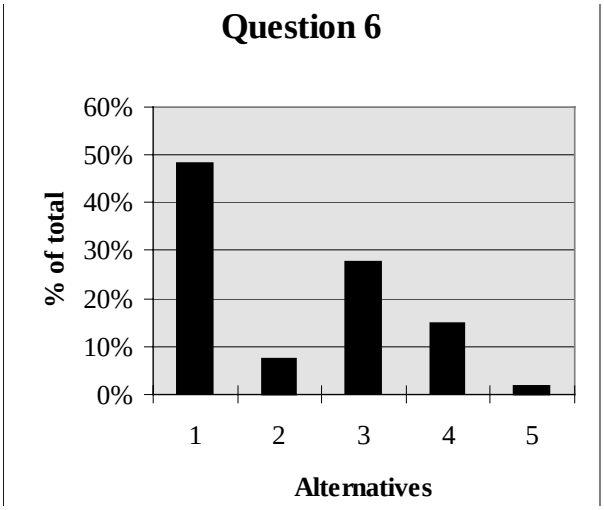
Alternatives:

1. National Ministry of Transport (*Ministère national des Transports*)
2. Other national authority (*autre autorité nationale*)
3. Regional or local authority (*autorité régionale ou locale*)
4. Tunnel operator (*direction du tunnel*)
5. Other (*autre*)

The answers received indicate that the transport ministries are the dominant bodies. For federal states, the authority to regulate dangerous goods through road tunnels is left with the regional or local authority. The answers are distributed as shown in Figure 4-5 below.

(No alternative chosen on 1 questionnaire)

Figure 4-5 Responsible body for specifying the rules



For alternatives 2 and 5, answers are summarised below.

Alternative 2:

- Département fédéral de justice et police (***Switzerland***)
- Statens Inst. for Strålehygiene, Beredskapsstyrelsen, Police (restricted routes) (***Denmark***)
- Ministry of Interior, Industry, Health and Public Works (***Italy***)
- Western Australia Dept. of Minerals and Energy (***Australia***)

Alternative 5:

- Commission Intergouvernementale pour la réglementation d'ouvrages internationaux (***Italy***)

4.6 General rules for transport of dangerous goods in road tunnels, question 7

Are there general rules applying to the transport of dangerous goods through all road tunnels in your country? (*Existe-t-il des règles générales qui s'appliquent au transport de marchandises dangereuses dans tous les tunnels routiers dans votre pays?*)

Alternatives and percentage distribution of answers:

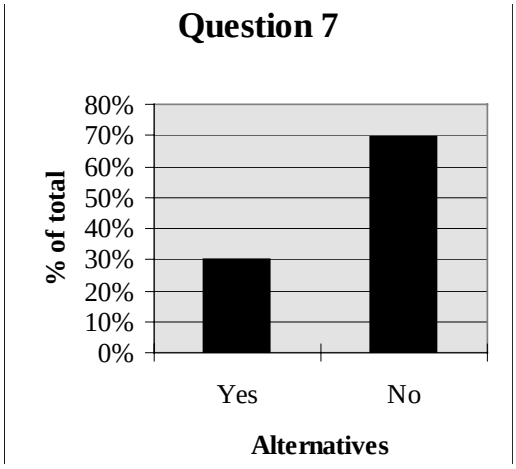
Yes (*Oui*) 30%

No (*Non*) 70%

The answers received are distributed as shown in Figure 4-6 below.

(No alternative chosen on 2 questionnaires)

Figure 4-6 General rules for transport of dangerous goods in road tunnels



If yes/no is the answer to question 7, a corresponding follow-up question 7A/7B is given (ref. section 4.6.1/ 4.6.2 below).

One respondent to the questionnaire answered "yes" to question 7 and ticked off alternatives under question 7B, and one respondent has answered "no" to question 7 and ticked off alternatives under question 7A. This may indicate that a few of the respondents have not put too much effort in completing the questionnaire.

4.6.1 Basis for rules, question 7A

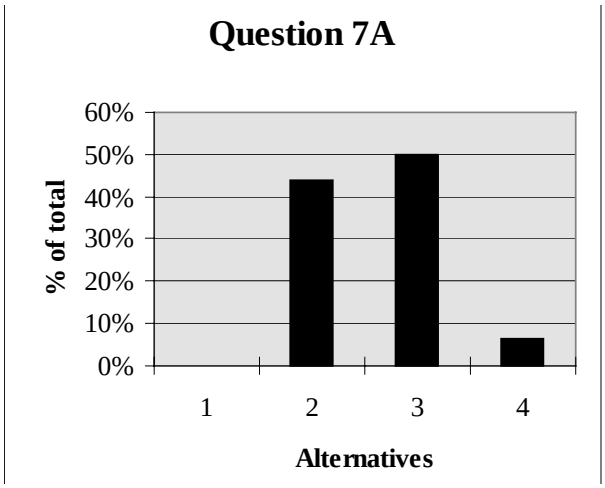
If yes, what are these rules based on? (*Si oui, quelle est l'origine de ces règles?)*

Alternatives:

1. The United Nations Recommendations on the Transport of Dangerous Goods (which edition?.....) (*Recommandation de l'ONU relatives au transport de marchandises dangereuses (spécifier le numéro de l'édition)*)
2. The European Agreement on the Transport of Dangerous Goods by Road, "ADR" (which edition?.....) (*Accord européen relatif au transport international des marchandises dangereuses par route, "ADR"(spécifier l'année de l'édition)*)
3. Other national rules (*Autre règles nationales*)
4. No dangerous goods allowed through any road tunnels (*Les marchandises dangereuses ne sont admises dans aucun tunnel routier*)

The answers received are distributed as shown in Figure 4-7 below.

Figure 4-7 Basis for rules



Note that alternative 4 (no dangerous goods allowed) applies to the Windsor tunnel in Ontario, Canada.

For alternative 3, answers are summarised below.

- "Vehicle Code" (ref. archive) and Federal laws and regulations (***UNITED STATES***)
- US "Code of Federal Regulations", section 49, parts 100-180 (***UNITED STATES***)
- (a) 49 CFR Parts 100-180 & 397, (b) Illinois Hazardous Materials Transportation Regulations, IL admin. code title 92, chapter I, subchapters C & D (***UNITED STATES***)
- Code de la Route (C.D.R.) (***Italy***)
- Australian Dangerous Goods Code (***Australia***)
- Federal transportation of dangerous goods regulations which have been adopted at the provincial level. (***Canada***)

4.6.2 Tunnel specific rules, question 7B

If no, in what ways do they differ? (*Si non, quelles sont les variations?*)

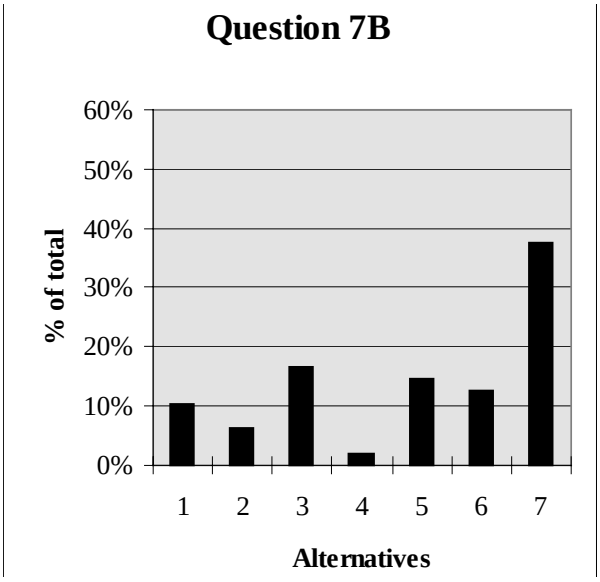
Alternatives:

1. Different rules in different national regions (*Règles différentes selon les régions*)
2. More/less restrictive for older tunnels (*Règles plus/moins sévères pour les tunnels plus anciens*)
3. More/less restrictive for tunnel types (*Règles plus/moins sévères selon le type de tunnel*)
4. More/less restrictive for toll tunnels (*Règles plus/moins sévères pour les tunnels à péage*)
5. More/less restrictive for longer tunnels (*Règles plus/moins sévères pour les tunnels plus longs*)
6. More/less restrictive for volume of traffic (*Règles plus/moins sévères selon le volume de circulation*)
7. Other (*autre*)

The answers received are distributed as shown in Figure 4-8.

(No alternative chosen in two replies to questionnaire although answer to question 7 was “No”. In addition, no alternative was chosen in two replies to the questionnaire where question 7 was left blank).

Figure 4-8 Tunnel specific rules



For alternative 7, answers are summarised below.

- Local police decides where to place restricted routes (***Denmark***)
- General rules only apply to the French State tunnels, specified in "Circulaire No. 76-44 du 12 mars 1976 relative à la réglementation de la circulation dans les tunnels des véhicules routiers transportant des matières dangereuses" (ref. archive) (***France***)
- Art. 46 (Law of the Road) says that the road operator can prohibit or restrict the transport of dangerous goods through specific road tunnels if there is risk to tunnel structure and traffic. The specific road tunnels mean the tunnel under water, the tunnel at edge of the water and under water level, and the tunnels longer than 5 000 m (***Japan***)
- One exception; ref. tunnel which is the only access to a part of the North coast. (***Canada***)
- Road tunnels are considered as highways (***Turkey***)

4.7 Decision support for restrictions, question 9

Are dangerous goods in road tunnels rules determined by: (*Les règles pour le transport des marchandises dangereuses dans les tunnels routiers sont-elles déterminées par:*)

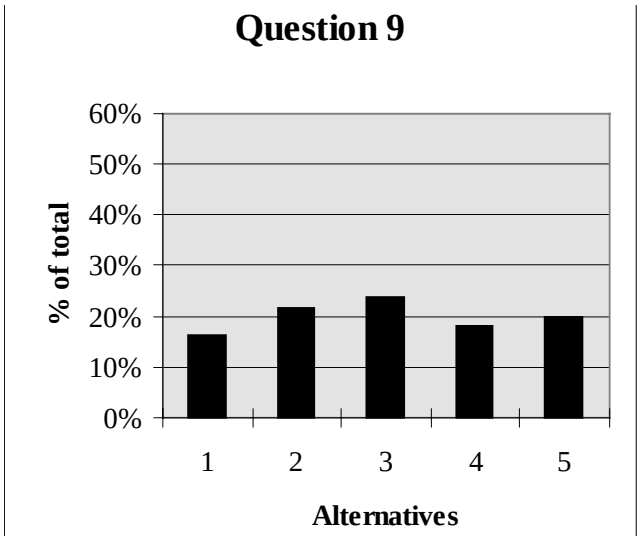
Alternatives

1. General risk assessment (*Analyse générale des risques*)
2. Risk assessment for each tunnel (*Analyse des risques pour chaque tunnel en particulier*)
3. General experience (*Pratique générale*)
4. Availability of alternative non-tunnel routes (*L'existence ou non d'itinéraires alternatifs en surface*)
5. Other (*Autre*)

The answers received are distributed as shown in Figure 4-9 below.

(No alternative chosen on 6 questionnaires)

Figure 4-9 Decision support for restrictions



For alternative 5, answers are summarised below.

- Traffic congestion (***United States***)
- Judgement for each tunnel (***Japan***)
- Advice from Consultant Chemist (***United Kingdom***)
- Municipality: Transport of hazardous materials is forbidden (***Netherlands***)

4.8 Safety measures for tunnels with transport of dangerous goods, question 10

Are specific measures taken in tunnel design and management to permit the transport of dangerous goods through road tunnels? (*Existe-t-il des mesures spécifiques au niveau de la conception et de la gestion des tunnels routiers pour permettre le transport des marchandises dangereuses*). Alternatives:

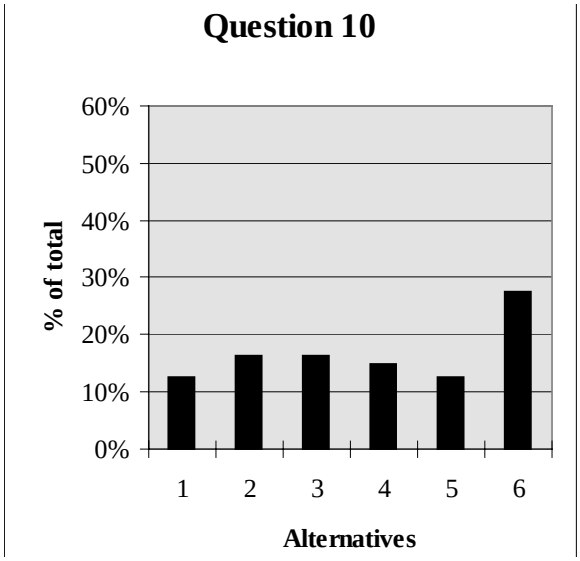
1. Additional fire resistance (*Protection ignifuge supplémentaire*)
2. Additional ventilation equipment (*Ventilation supplémentaire*)
3. Incident detection systems (*Dispositifs pour détecter les incidents*)
4. Dangerous goods vehicle convoys (*Circulation des vehicules de marchandises dangereuses en convoi*)
5. Emergency exercises (*Simulations de cas d'urgence*)
6. Others (*Autres*)

The answers received are distributed as shown in Figure 4-10 below. (No alternative chosen on 10 questionnaires).

Comment to question 10:

Some of the replies listed technical measures which are suspected not to be related directly to avoiding accidents/incidents involving dangerous goods, but rather mitigating consequences of normal accidents/incidents. The measures may however also have a positive effect in dangerous goods accidents.

Figure 4-10 Safety measures for tunnels with transport of dangerous goods



For alternative 6, answers are summarised below.

- Ventilation direction (***United States***)
- Escape routes (***Denmark***)
- Safety index for goods of category “B"‘in the "Règlement de Circulation" (***Italy***)
- Traffic control by TV camera (***Italy***)
- If there is risk for tunnel structure or traffic, the road operator can prohibit the transport of dangerous goods through specific road tunnels (***Japan***)
- No additional measures are taken. Future tunnels will address added measures. (***Canada***)
- Manned marshalling areas at approach to tunnels (***United Kingdom***)
- Notification obligation (ref. Road tunnel regulations "Verordnung des Bundesministers für öffentliche Wirtschaft und Verkehr", 19.12.89, found in archive) (***Austria***)
- Prevent and limit the risk of explosion (***Netherlands***)

4.9 Advertising of dangerous goods tunnel restrictions, question 11

How are transport operators made aware of the rules for each tunnel? (*Comment les règles pour chaque tunnel sont-elles portées à la connaissance des transporteurs?*)

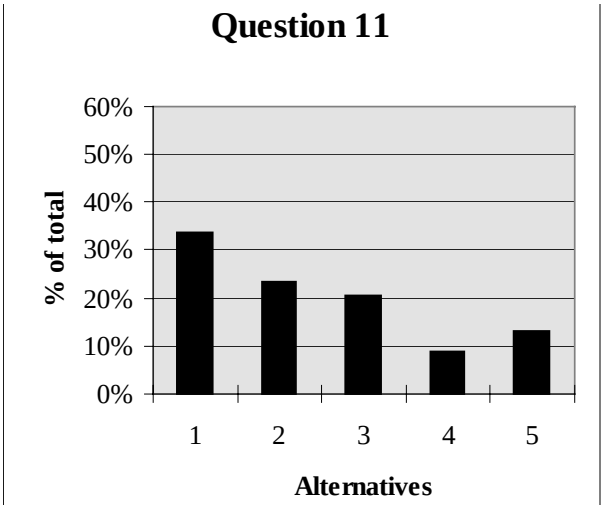
Alternatives:

1. Advertised at tunnel (*Affichées à l’entrée du tunnel*)
2. Rules published nationally (*Publiées à l’échelon national*)
3. Operators informed by trade associations (*Communiquées aux transporteurs par leurs associations professionnelles*)
4. Up to transport operators to find out (*Recherche de l’information laissée à l’initiative du transporteur*)
5. Other (*Autrement*)

The answers received are distributed as shown in Figure 4-11.

(No alternative chosen on 8 replies to the questionnaire)

Figure 4-11 Advertising of dangerous goods tunnel restrictions



For alternative 5, answers are summarised below.

- State maps and rules (***United States***)
- Inspection sites (***United States***)
- Informational phone numbers (***United States***)
- The rules for tunnels are defined in traffic laws and the regulations about dangerous goods (***Turkey***)
- In the official gazette (***Japan***)
- Transport of dangerous goods rules apply to highways whether tunnel is present or not (***Canada***)
- Word of mouth - years of prohibiting dangerous goods (***Canada***)
- It is anticipated these will be incorporated into permits (***Australia***)

4.10 Incident information, question 14

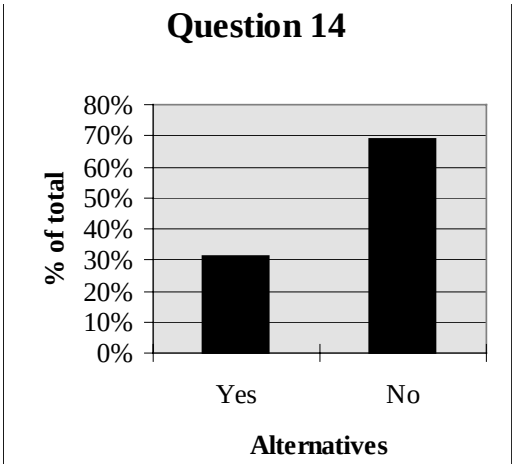
Is data available on incidents involving dangerous goods in road tunnels? (*Existe-t-il des données sur les incidents concernant les matières dangereuses dans les tunnels routiers?)*

Yes (*Oui*)

No (*Non*)

The answers received are distributed as shown in Figure 4-12 below.

Figure 4-12 Incident information



If "yes" is the answer to the above question, where is such information held? (*Si oui, où peut-on trouver ces données?)*

The answers are listed below.

- The National Road Administration has statistics over their rescue operations. For a few years, all accidents concerning dangerous goods, have had to be reported to the Swedish Rescue Services Board as well. To date, no serious accidents involving dangerous goods in road tunnels have been reported (***Sweden***)
- It is known that there can be problems in identification if the tunnel is a connector ramp. All accident reports by location on all California state-maintained highways are kept by the California DoT (***United States***)
- Ref. Mr. Anthony Caserta US DoT (***United States***)
- Data available at Inst. of Traffic Accident Research and Data Analysis which collects all data on traffic accidents (***Japan***)
- Data available from Directorate for Fire and Explosion Prevention (***Norway***)
- Data found at Federal Government, DoT, Ottawa, Ontario (***Ontario, Canada***)
- Data found in SAAQ-Police Report (***Québec, Canada***)
- Traffic police, Antwerp + AWP Reijksmacht, Antwerp (***Belgium***)
- S.I.T.A.F./Direzione di esercizio; T4-Casella Postale n.31 Bardoneccia, Torino (***Italy***)
- At least for the Alpine tunnels (***Italy***)
- Data available from the tunnel operators (***Italy***)
- Part of hazardous materials incident statistics held by Fire Brigade (***Australia***)
- Data will be available through the tunnel operating systems and surveillance systems will incorporate world's best practice (***Australia***)

Comment to question 14:

The question may be misunderstood. The purpose of the question, at least partially, is probably to reveal if there is a system for registration of incidents involving dangerous goods, which quite a few countries have. Given the wording of the question, both the countries without a systematic registration of incidents as well as those with a system for registration, but where incidents have

not occurred, may tick the "No" answer. On the other hand, one might interpret the question to mean whether a system exists for collecting data on incidents. Countries with such a system but where incidents have not occurred, will in this case tick the "Yes".

4.11 Interest in the OECD research project, question 15

Is your authority interested in the OECD research project: (*Quel est l'intérêt de votre organisation pour le projet de recherche OCDE*)

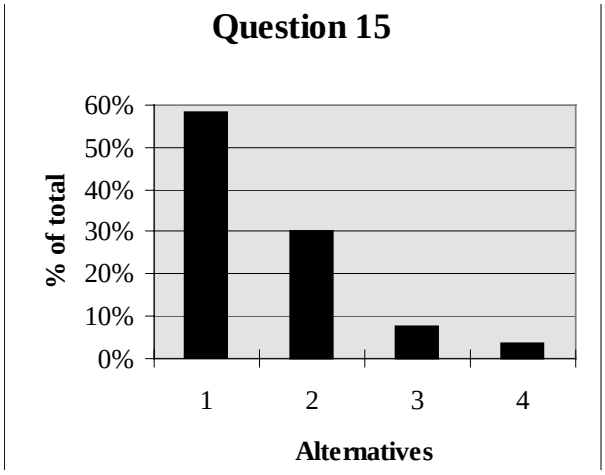
Alternatives:

1. By seeing the results (*Voudrait voir les conclusions*)
2. By participating (*Voudrait participer*)
3. By contributing funding (*Voudrait contribuer financièrement*)
4. Not interested (*N'a pas d'intérêt*)

The answers received are distributed as shown in Figure 4-13.

(No alternative chosen on 2 questionnaires)

Figure 4-13 Interest in OECD research project



4.12 Further participation, question 15A

Would you be willing to co-operate with a follow-up in depth discussion with an OECD analyst? (*Seriez-vous disposé à participer à une discussion plus approfondie avec un expert de l'OCDE?)*

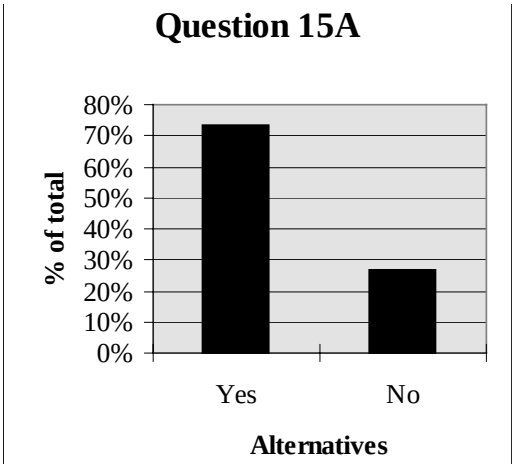
Alternatives:

Yes (*Oui*)

No (*Non*)

The answers received are distributed as shown in Figure 4-14.

Figure 4-14 Further participation



4.13 Further comments, question 16

This "question" concerns further general comments on the transport of dangerous goods in road tunnels. (*Autre commentaire général sur le transport des marchandises dangereuses dans les tunnels routiers*). In the database this field is also used to give details of questions in the questionnaire when needed. The information received from the respondents is listed below.

- It is assumed that Tony Caserta of the US Federal Highway Administration will provide the Federal Regulations. The three newest tunnels with forced air ventilation are freeway-to-freeway connectors and have reversible pitch fans. They will change from forced air to exhaust in case of fire. (***United States***)
- There are only three road tunnels in North Carolina under the jurisdiction of the DoT. Each of these is approximately 1 000 ft long. Vehicles carrying dangerous cargo must have identification placards and movement of radioactive materials requires notification of law enforcement authorities. (***United States***)
- In Denmark, there are no specific rules for the transport of dangerous goods through road tunnels. Besides the restricted routes for some kinds of dangerous goods, there are only rules applying to the adjacent roads. (***Denmark***)
- Studies for the adoption of the ADR are being performed. (***Turkey***)
- There are no specific regulations for the transport of dangerous goods in road tunnels. However, work is undertaken on the subject and any help will be welcomed. The national report, "Highway Tunnels in Turkey", is found in the archive. (***Turkey***)
- Complementary comments and information to the completed questionnaire are found in the archive. (***France***)
- Ref. annexe in archive "Commentaire général sur le transport des matières dangereuses" (***Belgium***)
- The United Kingdom has recently commissioned a policy discussion document on the transport of dangerous goods through road tunnels from WS Atkins Consultants. This report is found in the archive, but should not be taken as an indication of UK government policy. (***United Kingdom***)
- Transport operators transporting dangerous goods are obliged to submit information about classification of dangerous goods and quantity to the tunnel guard. (***Austria***)

- Hungary has only one road tunnel 300 m long in the middle of Budapest. Hungarian drivers performing haulage abroad comply with the general provisions of the ADR that request obeying the rules and regulations of the country concerned. (***Hungary***)

4.14 Questions 3, 4 and 5. A summary

Table 4-1 summarises the answers to questions 3, 4 and 5 for each country. As can be seen from the table, for some countries there are regional/provincial differences in the established laws and regulations.

Table 4-1 Questions 3, 4 and 5. A summary

Country/Region/ Province	Quest. 3[1]	Quest. 4[2]	Quest. 5[3,4]	Quest. 5 comments/specifications, misc. specifications
Austria	N	Y	ADR	
Belgium, Walloon (questionnaires 3,4) + West Flanders	N	N	ADR	
Belgium, Walloon (questionnaire 12)	Y	Y	ADR	
Belgium, East Flandern	N	Y	ADR	
Czech Republic	N	N	ADR	
Denmark	N	N	ADR	
Finland	N	N	ADR	
France	N	N	ADR* + Other**	*) border/alpine tunnels **) R.T.M.D.R.
Germany	N	Y	ADR + Other	Gutverordnung Strasse-GGV5
Hungary	N	N	ADR	
Italy	Y N	Y N	ADR ADR + other	Mont Blanc & Fréjus tunnels Art. 366 "Réglement C.D.R."
Netherlands	Y	Y	ADR	
Norway	N	N	ADR	
Portugal	Y	N	Other	National legislation, based on ADR
Spain	Y	N	ADR	
Sweden	N	Y	UN+ADR	
Switzerland	Y	Y	Other	Regulation of Transport of Dangerous Goods, based on ADR
Turkey	Y	N	ADR	
United Kingdom (England)	N Y	Y Y	UN+ADR Other	Dartford-Thurrock Crossing
Japan	N	Y	Other	"Law of Road"
Australia, Austroads	N	N	UN + Other	Australian Dangerous Goods Code (ADG) and State legislation
Australia, Queensland & New South Wales	N	Y	Other	Australian Dangerous Goods Code (ADG) and State legislation
USA, California, Illinois, Maryland, New York/ New Jersey	Y	Y	Other	State and Federal Laws
USA, North Carolina	N	N	Other	State and Federal Laws
Canada, Ontario	N	N	Other	Federal regulations; based on UN
Canada, Québec, British Columbia	Y	Y	UN	

1) Question 3: Are there general road traffic regulations specific to road tunnels? (*Existe-t-il des règles de circulation spécifiques aux tunnels routiers?*)
2) Question 4: Are there specific rules for the transport of dangerous goods in road tunnels in your country? (*Existe-t-il des règles pour le transport de marchandises dangereuses dans les tunnels routiers dans votre pays?*)
3) Question 5: Do you define dangerous goods in road transport by using: (*Quelle est l'origine de la définition dans votre pays des marchandises dangereuses transportées par route?)*
4) Alternatives, question 5 (refer to section 4.4 for details): UN, ADR, other classification

4.15 Rules for the transport of dangerous goods through tunnels, question 8

Please list (and if possible enclose copies of) all rules for the transport of dangerous goods through specific road tunnels (*Veuillez indiquer tous les règlements pour le transport des marchandises dangereuses dans des tunnels routiers déterminés. Si possible, veuillez joindre une copie du règlement*).

The quality and quantity of information provided under this item varied extensively. In most cases, the item was not filled in, i.e. specific names of tunnels were not given. Since it is not relevant to obtain statistics on this item/question, the information provided is found in the database and is not included in this report.

4.16 Responsible body for enforcement of rules, question 12

Which body is responsible for enforcing these rules? (*Quel est l'organe chargé de faire respecter les règles?*).

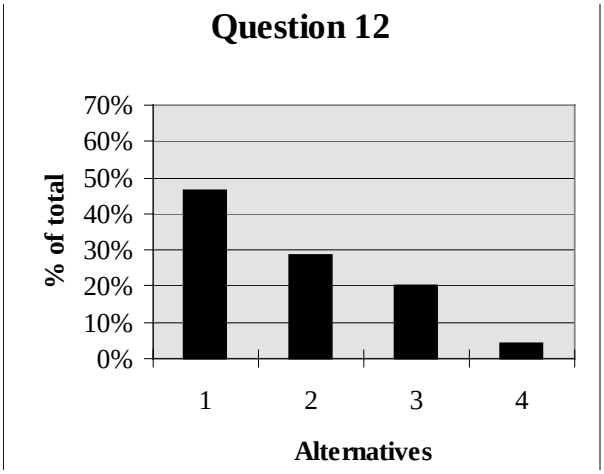
Alternatives:

1. Police (*Police*)
2. Tunnel operator (*Direction du tunnel*)
3. Ministry of Transport (*Ministère des Transports*)
4. Other agency (*Autre organe*)

The answers received are distributed as shown in Figure 4-15.

(No alternative chosen on 8 questionnaires)

Figure 4-15 Responsible body for enforcement of rules



For alternative 4, answers are summarised below.

- Custom personnel (***France***)
- Bundesanstalt für Güterverkehr (***Germany***)
- GNR (***Portugal***)
- General Directorate of Highways (***Turkey***)
- Local authority (***United Kingdom***)
- Dept. of Minerals and Energy is responsible for setting vehicle conformance standards (***Australia***)

- Agrupación de Tráfico de la Guardia Civil-Dirección General de Tráfico-Ministerio de Justicia e Interior (***Spain***)
- Gendarmerie (***Belgium***)

4.17 Means of enforcement, question 13

How are dangerous goods rules applied and enforced at each tunnel? (*Comment applique-t-on et fait-on respecter les règles relatives aux marchandises dangereuses pour chaque tunnel?)*

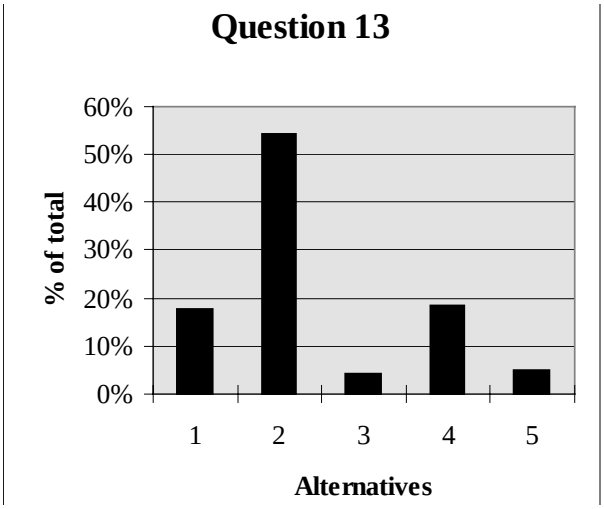
Alternatives:

1. Vehicle tagging (*Suivi électronique des véhicules*)
2. Spot checks (*Vérifications au hasard*)
3. Vehicle convoys (*Véhicules en convoi*)
4. On trust (*Fait confiance au transporteur*)
5. Other (*Autre*)

The answers received are distributed as shown in Figure 4-16.

(No alternative chosen on 17 questionnaires)

Figure 4-16 Means of enforcement, all questionnaires



For alternative 5, answers are summarised below.

- Operations and maintenance procedures manuals, which will be developed for the tunnel, will contain appropriate rules. Tunnel surveillance systems will incorporate world's best practice. (***West Australia***)
- Police posts and toll collector's notify police of possible violations (***United States***)
- Staff prohibit any visible evidence of dangerous goods (***Canada***)
- S.A.A.Q. ("Société d'Assurance-Automobile du Québec") special operations (***Québec, Canada***)

4.18 List of incidents, question 14A

Please list incidents if possible (*Indiquer les incidents, si possible*).

Only two incidents were referred in the submitted questionnaires:

Incident I: **Date**: 11 July 1979, **Tunnel**: Nihonzaka tunnel (Tome, Japan), **Description**: Fire with ether and 189 cars.

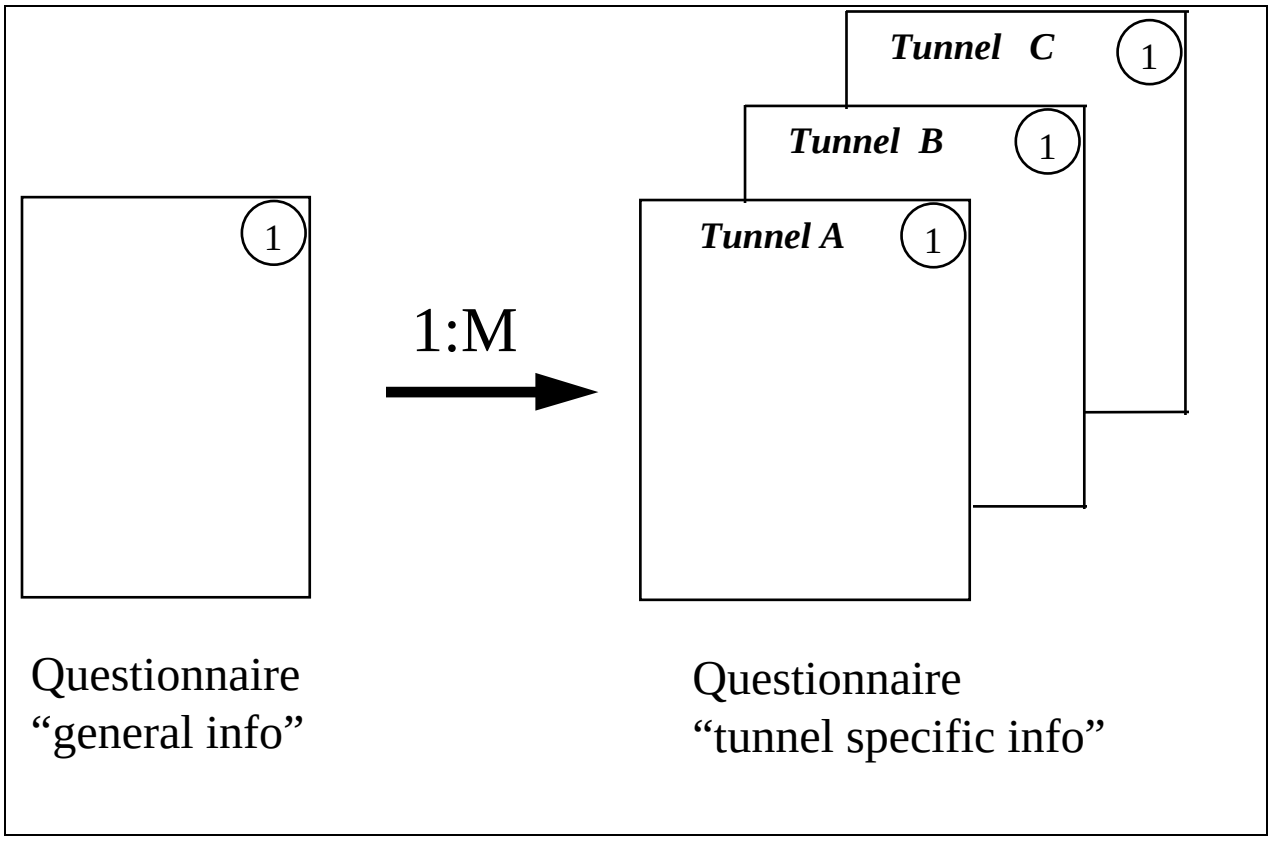
Incident II: **Date**: 7 April 1982, **Tunnel**: Caldecott tunnel, State of California (***UNITED STATES***), **Description**: Tanker toppled in tunnel and leaking fuel ignited, damaging one bus and several autos. 7 fatalities

The above may not be a complete list of dangerous goods incidents in road tunnels for the countries which have submitted replies, but it must be concluded that severe dangerous goods accidents in road tunnels are very rare.

5. DATABASE

A database was developed in order to facilitate future analysis and retrieval of the information contained in the replies. Microsoft's "ACCESS" was chosen for the development. The application comprises two databases which are linked together through the questionnaire identification number. The database structure is shown in Figure 5-1 below.

Figure 5-1 Database structure



As seen from the figure above, each tunnel specified in one particular reply is represented by one record in the "tunnel" database.

In order to run the database application Microsoft's "ACCESS" must be installed on the PC/network. Please see /4/ for the operation of ACCESS. To install the application, just copy the two files on the enclosed diskette onto any directory either on a local PC or on a network server. The application is started from "ACCESS"'s Main Menu option File/Open. Select the proper file (<directory>\ers2.mdb) and press OK. Then select "Form"-"Main"-"Open" and the first record in the "Main" database will be displayed on the screen. From here the user may enter: browse the existing records in the two databases, add new records, edit existing ones, etc. To exit this form, the user should press the "Exit" button at the bottom right of the screen. For each reply to the questionnaire, the user may browse/edit the related tunnel specific records (button "Show tunnels for this reply"). If the user wants to browse (or edit) all these records

irrespective of the current reply, he/she presses the “Show all tunnels” button and proceeds. Return to current main form is by pressing the “Exit” button at the bottom right of the screen.

Search for more tunnel-specific information throughout the countries could be undertaken in Mission 2.

A diskette containing the database application is enclosed in Appendix A to this report.

6. ARCHIVE

All the replies to the questionnaire and enclosures are compiled, systematised and stored in an archive consisting of three binders. Each reply has been given a unique number, and the replies are sorted by country. To each reply, a printout from the database is enclosed together with the original material.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Coverage

Of the 68 questionnaires sent to 24 countries, 48 replies from 22 countries were completed and returned. Greece and Luxembourg did not return completed questionnaires. Three of the replies are from countries/regions that do not have any road tunnels. The analysis is thus based on 45 completed replies from 21 countries. The rate of return on a country basis is satisfactory. Furthermore, as all the major road tunnel countries returned their completed replies, these should give a good picture of the existing regulations and rules for the transport of dangerous goods in tunnels.

7.2 Quality of answers

The quality of the answers varies significantly. Some respondents only partly filled out the questionnaire. Others completed the questionnaire without giving additional important information, e.g. stating that they have specific regulations without listing the rules or the tunnels that the rules apply to. Others returned completed questionnaire with comprehensive attachments where they elaborate their answers. In general, with some exceptions, the tunnel-specific information required (questions 8, 12, 13 and 14A) incomplete.

Throughout the analysis, the respondents were contacted to clarify their answers. It was possible to some extent to obtain the necessary additional information, but quite a few respondents were unavailable.

7.3 Recommendations for further work in Mission 2

In the countries where rules and regulations for the transport of dangerous goods in road tunnels exist, the regulations often vary within the country, depending on parameters such as traffic density, tunnel standard and available alternative routes. The questionnaire does not ask for such information for the specific tunnels; consequently, it is not possible to correlate the rules and regulations with the operational and technical parameters of the tunnels. Mission 2 should comprise collection and analysis of such data. Furthermore, it would be beneficial to collect more technical and operational data on each tunnel in the different countries during Mission 2 and hence get as complete picture as possible of the existing road tunnels in the various countries. The “tunnel-specific” database developed in Mission 1 (see Chapter 5) will serve as a good basis for this work.

So far, no information has been collected on the problems which the rules and regulations have caused the operators, the police and the governmental or regional bodies, in terms of enforcing the rules, delays in transport, need for extra manning, etc. Such information should be collected during Mission 2.

Tunnels must be considered a part of the total road system. Rules and regulations for specific tunnels on a tunnel-rich route, may impose large costs and delays on the operator and the society.

When analysing rules and regulations for specific tunnels, it is therefore important to know which other tunnels are on the route, and whether the rules and regulations are common for the entire route.

Two accidents in road tunnels involving dangerous goods appeared in the replies. Due to the wording of the questions, it is not possible to assess how many countries have implemented a system for recording accidents involving dangerous goods. Details about such systems should be investigated during Mission 2. The quality of the systems should also be checked (we are aware of accidents in tunnels involving dangerous goods that were not included in the replies).

8. REFERENCES

/1/ "Conditions actuelles de circulation dans les tunnels des véhicules routiers transportant des matières dangereuses", C.E.T.U., March 1994

/2/ PIARC Report from the XXth World Road Congress Montréal, 3-9 September 1995

/3/ "Proceedings of the International Conference on Fires in Tunnels. Borås, Sweden October 10-11 1994", Swedish National Testing and Research Institute Fire Technology, SP Report 1994:54

/4/ Microsoft ACCESS Version 2.0 User's Guide (1994)

- o0o -

APPENDIX

A
MS ACCESS DATABASE APPLICATION

- o0o -

ERS2.LDB

ERS2.MDB

APPENDIX
B
BLANK QUESTIONNAIRE

- o0o -

RESEARCH PROJECT ERS2

TRANSPORT OF DANGEROUS GOODS THROUGH ROAD TUNNELS

1. If Road Tunnels exist in your country please answer the questions below. If not, tick here ☐

2. Is a "ROAD TUNNEL" defined in your country?

☐ not defined
☐ anything underground
☐ by length (please specify)
☐ other (please specify)

3. Are there general road traffic regulations specific to road tunnels?

☐ YES (please specify)
☐ NO

4. Are there specific rules for the transport of dangerous goods in road tunnels in your country?

☐ YES
☐ NO

5. Do you define dangerous goods in road transport by using:

☐ UN Recommendations on the Transport of Dangerous Goods (Orange Book)
☐ the European Agreement on the Transport of Dangerous Goods by Road (ADR)
☐ other classification (please specify)

6. What body is responsible for specifying the rules for the transport of dangerous goods through road tunnels?

☐ national Ministry of Transport
☐ other national authority (please specify)
☐ regional or local authority
☐ tunnel operator (if different from above)
☐ other (please specify)

7. Are there general rules applying to the transport of dangerous goods through all road tunnels in your country?

☐ YES
☐ NO

7A. If yes, what are these rules based on?

☐ The United Nations Recommendations on the Transport of Dangerous Goods (which edition?)
☐ The European Agreement on the Transport of Dangerous Goods by Road (ADR) (which edition?)
☐ other national rules (please specify)
☐ no dangerous goods allowed through any road tunnels

7B. If no, in what ways do they differ?

☐ different rules in different national regions
☐ more/less restrictive for older tunnels
☐ more/less restrictive for tunnel types
☐ more/less restrictive for toll tunnels
☐ more/less restrictive for longer tunnels
☐ more/less restrictive for volume of traffic
☐ other (please specify)

8. Please list (and if possible enclose copies of) all rules for the transport of dangerous goods through specific road tunnels.

Name of tunnel	Construction, type of tunnel (cut and cover, twin bore, etc.)	Rules applicable	Rules attached
1.			
2.			
3.			
etc.			

9. Are dangerous goods in road tunnels rules determined by:

☐ general risk assessment
☐ risk assessment for each tunnel
☐ general experience
☐ availability of alternative non-tunnel routes
☐ other (please specify)

10. Are specific measures taken in tunnel design and management to permit the transport of dangerous goods through road tunnels?

☐ additional fire resistance
☐ additional ventilation equipment
☐ incident detection systems
☐ dangerous goods vehicle convoys
☐ emergency exercises
☐ others (please specify)

11. How are transport operators made aware of the rules for each tunnel?

☐ advertised at tunnel
☐ rules published nationally
☐ operators informed by trade associations
☐ up to transport operators to find out
☐ other (please specify)

12. Which body is responsible for enforcing these rules?

Name of tunnel	Police	Tunnel operator	Ministry of Transport	Other agency (please specify)
1.	☐	☐	☐	☐
2.	☐	☐	☐	☐
3.	☐	☐	☐	☐
etc.	☐	☐	☐	☐

13. How are dangerous goods rules applied and enforced at each tunnel?

Name of tunnel	vehicle tagging	spot checks	vehicle convoys	on trust	other (please specify)
1.					
2.					
3.					
etc.					

14. Is data available on incidents involving dangerous goods in road tunnels?

☐ NO ☐ YES If yes, where is this information held?

14A. Please list incidents if possible:

	Name of tunnel	Date of incident	Nature of incident
1.			
2.			
3.			
etc.			

15. Is your authority interested in the OECD research project:

☐ by seeing the results
☐ by participating
☐ by contributing funding
☐ not interested

15A. Would you be willing to cooperate with a follow-up in depth discussion with an OECD analyst?

☐ YES
☐ NO

16. Your further general comments on the transport of dangerous goods in road tunnels policy welcomed below.

PROJET DE RECHERCHE ERS2 SUR LE *TRANSPORT DE*

MARCHANDISES DANGEREUSES DANS LES TUNNELS ROUTIERS

1. S'il existe des tunnels routiers dans votre pays, veuillez répondre aux questions ci-dessous..Si non, cocher la case ☐

2. Quelle est la définition de "TUNNEL ROUTIER" dans votre pays ?

☐ pas de définition
☐ n'importe quel souterrain
☐ longueur (veuillez spécifier)
☐ autre (veuillez spécifier)

3. Existe-t-il des règles de circulation générale spécifiques aux tunnels routiers?

☐ OUI (veuillez spécifier)
☐ NON

4. Existe-t-il des règles spécifiques pour le transport de marchandises dangereuses dans les tunnels routiers de votre pays ?

☐ OUI
☐ NON

5. Quelle est l'origine de la définition dans votre pays des marchandises dangereuses transportées par route ?

☐ Recommandations de l'ONU relatives au transport de marchandises dangereuses (le "Livre Orange")
☐ Accord européen relatif au transport international des marchandises dangereuses par route (ADR)
☐ autre (veuillez spécifier)

6. Quel est l'organe responsable pour déterminer les règles pour le transport de marchandises dangereuses dans les tunnels routiers ?

☐ Ministère national des Transports
☐ autre autorité nationale (veuillez spécifier)
☐ autorité régionale ou locale
☐ direction du tunnel (si différente des catégories ci-dessus)
☐ autre (veuillez spécifier)

7. Existe-t-il des règles générales qui s'appliquent au transport de marchandises dangereuses dans tous les tunnels routiers dans votre pays ?

☐ OUI
☐ NON

7A. Si oui, quelle est l'origine de ces règles ?

☐ Recommandations de l'ONU relatives au transport des marchandises dangereuses (spécifier le numéro de l'édition)
☐ Accord européen relatif au transport international des marchandises dangereuses par route (ADR) (spécifier l'année de l'édition)
☐ autre règles nationales (veuillez spécifier)
☐ les marchandises dangereuses ne sont admises dans aucun tunnel routier

7B. Si non, quelles sont les variations ?

☐ règles différentes selon les régions
☐ règles plus/moins sévères pour les tunnels plus anciens
☐ règles plus/moins sévères selon le type de tunnel
☐ règles plus/moins sévères pour les tunnels à péage
☐ règles plus/moins sévères pour les tunnels plus longs
☐ règles plus/moins sévères selon le volume de circulation
☐ autres (veuillez spécifier)

8. Veuillez indiquer tous les règlements pour le transport des marchandises dangereuses dans des tunnels routiers déterminés. (Si possible, veuillez joindre une copie du règlement)

	Nom du tunnel	Type de construction (en tranchée, double percée, etc.)	Règlement applicable	Règlement fourni
1.				
2.				
3.				
etc.				

9. Les règles pour le transport des marchandises dangereuses dans les tunnels routiers sont-elles déterminées par :

☐ analyse générale des risques
☐ analyse des risques pour chaque tunnel en particulier
☐ pratique générale
☐ l'existence ou non d'itinéraires alternatifs en surface
☐ autres considérations (veuillez spécifier)

10. Existe-t-il des mesures spécifiques au niveau de la conception et de la gestion des tunnels routiers pour permettre le transport des marchandises dangereuses ?

☐ protection ignifuge supplémentaire
☐ ventilation supplémentaire
☐ dispositifs pour détecter les incidents
☐ circulation des vehicules de marchandises dangereuses en convoi
☐ simulations de cas d'urgence
☐ autres (veuillez spécifier)

11. Comment les règles pour chaque tunnel sont-elles portées à la connaissance des transporteurs ??

☐ affichées à l'entrée du tunnel
☐ publiées à l'échelon national
☐ communiquées aux transporteurs par leurs associations professionelles
☐ recherche de l'information laissée à l'initiative du transporteur
☐ autrement (veuillez spécifier)

12. Quel est l'organe chargé de faire respecter les règles ?

Nom du tunnel	Police	Direction du tunnel	Ministère des Transports	Autre organe (spécifier)
1.	☐	☐	☐	☐
2.	☐	☐	☐	☐
3.	☐	☐	☐	☐
etc.	☐	☐	☐	☐

13. Comment applique-t-on et fait-on respecter les règles relatives aux marchandises dangereuses pour chaque tunnel ?

Nom du tunnel	Suivi électronique des véhicules	Vérifications au hasard	Véhicules en convoi	Fait confiance au transporteur	Autre (spécifier)
1.					
2.					
3.					
etc.					

14. Existe-t-il des données sur les incidents concernant les matières dangereuses dans les tunnels routiers ?

☐ NON ☐ OUI Si oui, où peut-on trouver ces données ?

14A. Indiquer les incidents, si possible :

	Nom du tunnel	Date de l'incident	Nature de l'incident
1.			
2.			
3.			
etc.			

15. Quel est l'intérêt de votre organisation pour le projet de recherche OCDE ?

☐ voudrait voir les conclusions
☐ voudrait participer
☐ voudrait contribuer financièrement
☐ n'a pas d'intérêt

15A. Seriez-vous disposé à participer à une discussion plus approfondie avec un expert de l'OCDE ?

☐ OUI
☐ NON

16. Indiquer ci-dessous tout autre commentaire général sur le transport des marchandises dangereuses dans les tunnels routiers.

APPENDIX
C
LIST OF SUBMITTED REPLIES

Id. No.	Respondent	Signed by	Doc. date	Document specification	Date received (DNV)
1	Räddningsverket (***Sweden***)	T. Gill	28.02.96	Questionnaire + attachments	23.08.96
2	Office fédéral des routes (***Switzerland***)	D.M. Gilabert/ A. Hofer	08.03.96	Questionnaire + attachments	23.08.96
3	Ministère Wallon de l'équipement et des transports (***Belgium***)	D.de Smet	21.03.96	Questionnaire	23.08.96
4	Gouvernement Wallon (***Belgium***)	M Lebrun	18.03.96	Questionnaire	23.08.96
5	Dept. of transportation, State of California (***USA***)	J.E. Roberts	14.03.96	Questionnaire + attachments	23.08.96
6	Ministry of transport, road & traffic legislation dept. (***Denmark***)	J. Nielsen	01.04.96	Questionnaire	23.08.96
7 38 39 40	Associazione internazionale permanente dei congressi della strada, comitato nazionale Italiano (***Italy***)	E. Scotto	21.03.96	Questionnaire	23.08.96
8	Ministerie van de Vlaamse Gemeenschap, dienst West-Vlaanderen (***Belgium***)	M. Casier	28.03.96	Questionnaire + attachments	23.08.96
9	Rep. of Turkey, Ministry of Public works and settlement, gen dir. of highways (***Turkey***)	D. Yigit	29.03.96	Questionnaire	23.08.96
10	Dept. of transport, Energy and Comm. (***Ireland***)	M. O'Brien	04.04.96	Questionnaire	23.08.96
11	Ministère de l'équipement, du logement, des transports et du tourisme, direction des routes (***France***)	D. Lacroix	22.04.96	Questionnaire + attachments	23.08.96
12	Gouvernement Wallon (***Belgium***)	M Lebrun	01.04.96	Questionnaire	23.08.96
13	Dept. of transportation, State of Connecticut (***USA***)	E.R. Munroe	14.03.96	Letter	23.08.96
14	Ministersvo Dopravy Ceske Republiky (***Czech Republic***)	P. Pospisil	23.04.96	Questionnaire	02.09.96
15	Ministry of Construction, Publ. Works Res. Inst., Tunnel Division (***Japan***)	H. Mashimo	08.04.96	Questionnaire	02.09.96
16	Circulacao e Seguranca Rodoviaria (***Portugal***)	P. Roberto	11.04.96	Questionnaire + attachment	02.09.96
17	Statens Vegvesen, Vegdirektoratet (***Norway***)	J.A. Myhre	29.03.96	Questionnaire + attachment	02.09.96
18 41 42 43	Transport Canada, Safety and Security, Transport Dangerous Goods Directorate (***Canada***)	K. O' Grady	15.05.96	Questionnaire +attachment	02.09.96
19	Turkish Road Association (***Turkey***)	A. Cavusoglu	06.06.96	Questionnaire + attachment	02.09.96

Id. No.	Respondent	Signed by	Doc. date	Document specification	Date received (DNV)
20	Dept. of transportation, State of Tennessee (***USA***)	C.E. Cobble	07.06.96	Letter	02.09.96
21	The Department of Transport (***United Kingdom***)	J. Harrison	09.05.96	Questionnaire + attachments	02.09.96
22 44 45 46	Transport and Regional Development, Road Transport Branch (***Australia***)	E. Wheeler	02.04.96	Questionnaire + letter + attachments	02.09.96
23	Dartford River Crossings Ltd. (***United Kingdom***)	R. Jones	16.01.96	Questionnaire + attachment	02.09.96
24	The Port Authority of NY&NJ. Interstate Transportation Dept. (***USA***)	R.M. Brown	?	Questionnaire	02.09.96
25	Rep. Österreich, Bundesministerium für Wirtsch. angelegenheiten (***Austria***)	D.I. Hörhan	?	Questionnaire+ attachments	02.09.96
26	Rep. Österreich, Bundesministerium für Wirtsch. angelegenheiten (***Austria***)	Dr. Prager	?	Questionnaire	02.09.96
27	Directoraat-Generaal Rijkswaterstaat (***Netherlands***)	G.L. Tan	02.02.96	Questionnaire + attachments	02.09.96
28	? (***Spain***)	?	?	Questionnaire	02.09.96
29	Gouvernement du Québec, Ministère des Transports (***Canada***)	J. Croisetière	01.03.96	Questionnaire + attachments	02.09.96
30	Rep. Österreich, Bundesministerium für öffentliche Wirtschaft und Verkehr (***Austria***)	Dr. Kafka	?	Questionnaire + attachments	02.09.96
31	Maryland Transportation Authority (***USA***)	H.W. Moore	20.02.96	Questionnaire + attachments	02.09.96
32	Bundesministerium für Verkehr (***Germany***)	Mr. Deffke	?	Questionnaire + attachments	02.09.96
33	Ministry of Transport and Communications(***Finland***)	M. Rajamäki	28.02.96	Questionnaire	02.09.96
34	Dept. of Transportation, Div. of highways, State of North Carolina (***USA***)	L.F. Pace	21.02.96	Questionnaire	02.09.96
35	Illinois Department of Transportation (***USA***)	G. Koehler	07.02.96	Questionnaire	02.09.96
36	Ministerie van de Vlaamse Gemeenschap, dienst Oost-Vlaanderen (***Belgium***)	J.P. Matthijs	23.02.96	Questionnaire	02.09.96
37	? (Antwerpen, ***Belgium***)	?	?	Questionnaire	02.09.96
47	Ministerio del Interior, Relaciones Internacionales, Dirrección de Tràfico (***Spain***)	César Lozano	16.10.96	Questionnaire	16.10.96
48	Institute for Transport Sciences Limited Liability Company (***Hungary***)	Boldizsár Vásárhelyi	16.10.96	Letter	17.10.96

Specification of attachments

1. Sweden

- "Present Swedish road tunnels with restrictions for the transport of dangerous goods"
- "Map of Sweden, with recommended routes for the transport of dangerous goods"

2. Switzerland

- "Liste des tronçons de route pour lesquels sont prescrites des limitations de passage avec certaines marchandises dangereuses, art. 23"

5. USA, State of California

- "Vehicle code 1990. State of California"

8. Belgium

- "Belgium road code, articles 47-49"

11. France

- "Circulaire no. 76-44 du 12 mars 1976, relative à la réglementation de la circulation dans les tunnels des véhicules routiers transportant des matières dangereuses"
- "Caractéristiques et conditions de transport des matières dangereuses dans les tunnels français de plus 800 m"
- "Réglementation de la circulation routière dans le tunnel sous le Mont-Blanc. Arrêté préf. No. 95-1247 du 3 juillet 1995"
- "Règlement de circulation du tunnel routier du Fréjus (31 décembre 1992, modifié le 8 juin 1994)"
- "Arrêté du 11 décembre 1986 relatif à la réglementation de la circulation à l'intérieur du tunnel de Chamoise sur l'autoroute A 40"
- "Arrêté du 11 décembre 1986 relatif à la réglementation de la circulation à l'intérieur du tunnel de Vuache sur l'autoroute A 40"
- "Arrêté du 15 septembre 1971 relatif à la réglementation de la circulation à l'intérieur du tunnel de Chat"
- État récapitulatif du nombre et des longueurs cumulées de tubes de tunnels en exploitation classés par itinéraire"

17. Norway

- "Transport of dangerous goods in road tunnels in Norway"

19. Turkey

- "Highway tunnels in Turkey"

21, 23. United Kingdom

- "The transport of dangerous goods through road tunnels in the UK". WS Atkins, July 1993
- "Blackwall tunnel - by-laws 1968"
- "Rotherhithe tunnel - by-laws"
- "Transport of dangerous goods through the Dartford tunnel". Paper by Rodney Jones, 1993
- "1995 No. 2060. Highways, England and Wales. The Dartford-Thurrock crossing (amendment) Regulations 1995"
- "1994 No. 2031. Highways, England and Wales. The Dartford-Thurrock crossing (amendment) Regulations 1994"
- "British toll tunnels. Dangerous traffic. List of restrictions - 8th edition (1995). Mersey, Tyne and Dartford tunnels". Booklet.

25, 30. Austria

- "Bundesgesetzblatt für die Republik Österreich, 12 Jänner 1990. 22. Verordnung - Verordnung des Bundesministers für öffentliche Wirtschaft und Verkehr vom 19 Dezember 1989, mit der die Verordnung über de Beförderung gefährlicher Güter auf bestimmten Strassenstrecken"
- "Strassentunnelverordnung, 17 Juni 1987"

27. Netherlands

- "List of tunnel types in Dutch National Highways, and extract of the Dutch regulation for transport of hazardous materials". Note, no title.

29, 43. Canada

- "Guide sur le transport des matières dangereuses"
- "Règlement sur la circulation, le dépannage et les remorquages sur certaines voies de communication de la région de Montréal". November 1993.
- "Règlement sur le transport des matières dangereuses". February 1994.
- "B.C. Reg. 174/70. British Columbia Highway Act Regulations". March 1991

31. USA, State of Maryland

- "Maryland vehicle laws and regulations". An extract.
- "DoT. Subtitle 07, Maryland Transportation Authority, Chapter 01 Transportation of hazardous materials"

32. Germany

- "Budesgesetzblatt, Jahrgang 1995, Teil 1. Gefahr gutverordnung Strasse-GGVS, incl. Rn. 280 000, -001, -002"
- "Regelungen zum Transport gefährlicher Güter (Stand 31.12.1995". Note.
- "Richtlinien für die Ausstattung und den Betrieb von Straßentunneln". RABT 1994

44, 45, 46. Australia

- "Precautions during use of road vehicles". Section 8.3.11.2.
- "Carriage of dangerous goods. Regulation 119A". Gathered from page 154 of 1935-06.REG.
- "Schedule M streets and tunnels for the purposes of regulation 119A". Gathered from page 930 of 1935-06.REG.
- "City Northern Bypass Project. Analysis of the risk of accidents involving hazardous liquids & associated fire events in the tunnel". Report, 11 May 1995

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